DRAFT

Programmatic Environmental Assessment

for

Fisheries and Ecosystem Research Conducted and Funded

by the

Pacific Islands Fisheries Science Center

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LIST OF ACRONYMS AND ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
ARMS	Autonomous Reef Monitoring Structures
ASARA	American Samoa Archipelago Research Area
CFMP	Community-Based Fishery Management Program
CFR	Code of Federal Regulations
CNMI	Commonwealth of the Northern Mariana Islands
CTD	Conductivity, Temperature, Depth instrument
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
HARP	High-frequency Acoustic Recording Packages
PEA	Programmatic Environmental Assessment
ENSO	El Nino-Southern Oscillation
ESA	Endangered Species Act
EO	Executive Order
FEP	Fishery Ecosystem Plan
FMA	Fisheries Management Area
FMP	Fishery Management Plan
FSC	Fisheries Science Center
HAPC	Habitat Areas of Particular Concern
HARA	Hawaiian Archipelago Research Area
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
IATTC	Inter-American Tropical Tuna Commission
km	Kilometer
LME	Large Marine Ecosystem
LOA	Letters of Authorization
MARA	Mariana Archipelago Research Area
MHI	Main Hawaiian Islands
MNM	Marine National Monument
MPA	Marine Protected Area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MUS	Management Unit Species
NAR	National Area Reserve
NDSA	Naval Defensive Sea Areas
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NWHI	Northwestern Hawaiian Islands
NWR	National Wildlife Refuge

OPR	NMFS Headquarters Office of Protected Resources
PBR	Potential Biological Removal
PIFSC	Pacific Islands Fisheries Science Center
PFMC	Pacific Fisheries Management Council
SARA	Samoa Archipelago Research Area
SMA	Special Management Area
UAS	Unmanned Aerial Systems
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
WCPFC	Western and Central Pacific Fisheries Commission
WCPRA	Western and Central Pacific Research Area
WPRFMC	Western Pacific Regional Fisheries Management Council

EXECUTIVE SUMMARY

CHAPTER 1 – INTRODUCTION AND PURPOSE AND NEED

The Federal government has a responsibility to protect living marine resources in waters of the United States of America (U.S.), also referred to as federal waters. These waters generally lie 3 to 200 nautical miles (nm) from the shoreline, and comprise the Exclusive Economic Zone (EEZ)[1]. The National Oceanic and Atmospheric Administration (NOAA) has the primary responsibility for protecting marine finfish and invertebrate species and their habitats. Within NOAA, the National Marine Fisheries Service (NMFS) has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources within the U.S. EEZ.

NMFS is fundamentally a science-based agency, with its primary mission being the stewardship of living marine resources through science-based conservation and management. So central is science-based management to NMFS fishery management efforts, it is listed among the ten National Standards set forth in the Magnuson-Stevens Fishery Conservation and Management Act (MSA): "(2) Conservation and management measures shall be based upon the best scientific information available." (16 U.S.C. §§ 1801-1884).

This Draft Programmatic Environmental Assessment (DPEA) evaluates both a primary and a secondary federal action under the National Environmental Policy Act (NEPA). The primary action is the proposed implementation of Pacific Islands Fisheries Science Center (PIFSC) fisheries and ecosystem research activities for the next five years (as described above and in Section 2.2), or longer if the activities continue to be implemented as described in this document and the analysis of the environmental effects remains consistent and applicable with those activities. The purpose of this action is to produce scientific information necessary for the management and conservation of domestic and international living marine resources in a manner that promotes both the recovery and long-term sustainability of certain species and generates social and economic benefits from their use. The information derived from these research activities is necessary for the development of a broad array of management actions for fisheries, marine mammal, and ecosystem management actions taken not only by NMFS, but also by other federal, state, and international authorities. The secondary action is the issuance of proposed regulations and subsequent Letters of Authorization (LOA) under Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) of 1972, as amended (MMPA; 16 United States Code [U.S.C.] 1361 et seq.) that would govern the unintentional taking[2] of small numbers of marine mammals incidental to PIFSC fisheries and ecosystem research activities.

Fisheries Science Centers

In order to direct and coordinate the collection of scientific information needed to make informed fishery conservation and management decisions, NMFS established six regional Fisheries Science Centers[3], each a distinct organizational entity and the scientific focal point within NMFS for region-based federal fisheries-related research in the United States.

The Fisheries Science Centers conduct primarily fisheries-independent research studies[4] but may also participate in fisheries-dependent and cooperative research studies. This research is aimed at monitoring

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[1] An area over which a nation has special rights over the exploration and use of marine resources.

[2] The term "take" under the MMPA means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption or behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment)." (16 U.S.C. Sec 1361 *et seq*.)

[3] The six regional Fisheries Science Centers are: Northeast FSC, Southeast FSC, Southwest FSC, Northwest FSC, Alaska FSC, and Pacific Islands FSC.

[4] Fisheries-independent research is designed and conducted independent of commercial fishing activity to meet specific research goals, and includes research directed by PIFSC scientists and conducted on board NOAA-owned and operated vessels or NOAA-chartered vessels. Fisheries-dependent research is research that is carried out in partnership with commercial fishing vessels. The vessel activity is not directed

target species stock recruitment, survival and biological rates, abundance and geographic distribution of species and stocks, and providing other scientific information needed to improve our understanding of complex marine ecological processes and promote NMFS strategic goal of ecosystem-based fisheries management.

Pacific Islands Fisheries Science Center Research Activities

PIFSC is the research arm of NMFS in the Pacific Islands Region. Headquartered in Honolulu, Hawai'i, PIFSC has taken a leading role in marine research on ecosystems, both in the insular and pelagic environments. Originally called the Honolulu Laboratory and part of the Southwest Fisheries Science Center for over 40 years, PIFSC became its own science center when the NOAA Fisheries Pacific Islands Region was established in 2003. PIFSC implements a multidisciplinary research strategy including scientific analysis and an ecosystem observation system to support an ecosystem-based approach to the conservation, management, and restoration of living marine resources. PIFSC conducts a wide range of activities including resource surveys and stock assessments, fisheries monitoring, oceanographic research and monitoring, critical habitat evaluation, life history and ecology studies, advanced oceanographic and ecosystem modeling and simulations, and economic and sociological studies.

PIFSC conducts research and provides scientific advice to managers of fisheries and protected resources for the State of Hawai'i, Territory of American Samoa, Territory of Guam, the Commonwealth of the Northern Mariana Islands and the Pacific Remote Island Areas. This DPEA assesses the impacts of research activities conducted by PIFSC in four different research areas (Figure 1.1-2): 1) Hawaiian Archipelago Research Area (HARA); 2) Mariana Archipelago Research Area (MARA); 3) American Samoa Archipelago Research Area (ASARA); and 4) Western and Central Pacific including the Pacific Remote Islands Research Area (WCPRA). The HARA, MARA, and ASARA extend approximately 24 nm from the baseline of the respective archipelagos (i.e., to approximately the outer limit of the contiguous zone[5]). The fourth research area, the WCPRA, includes the remainder of the archipelagic U.S. EEZs, the Central and Western Pacific Ocean between the archipelagos, and the waters around the Pacific remote islands. These research areas and related Large Marine Ecosystems (LMEs) are described in detail in Section 3.1.1.

NMFS has prepared this DPEA to evaluate several alternatives for conducting and funding these fisheries and ecosystem research activities as the primary federal action. NMFS is also evaluating a number of mitigation measures that may be implemented to reduce potential impacts on marine mammals as part of the analysis concerning the secondary action, compliance with the MMPA. Additionally, because the proposed fisheries and ecological research activities occur in areas inhabited by a number of marine mammals, birds, sea turtles, corals, and fishes listed under the Endangered Species Act (ESA) as threatened or endangered, this DPEA evaluates activities that could result in unintentional impacts on ESA-listed species. In addition, because the proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as Essential Fish Habitat (EFH), this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the MSA respectively.

CHAPTER 2 – ALTERNATIVES

The National Environmental Policy Act requires federal agencies to consider alternatives to a proposed federal action. The evaluation of alternatives under NEPA assists the decision maker in ensuring that any

by the PIFSC, but researchers collect data on the commercial catch. Cooperative research programs are those where PIFSC scientists play a significant role in some aspect of study design, administration, or assessment of results but which are carried out by cooperating scientists (other agencies, academic institutions, commercial fishing-associated groups, or independent researchers) on board non-NOAA vessels.

[5] Presidential Proclamation 7219 extended the U.S. contiguous zone from 12 to 24 nautical miles on September 2, 1999.

unnecessary impacts are avoided through an assessment of alternative ways to achieve the underlying purpose of the proposed action that may result in less environmental harm.

To warrant detailed evaluation under NEPA, an alternative must be reasonable and meet the stated purpose and need for the proposed actions (see Section 1.3). Additionally, NEPA requires consideration of a "no action" alternative, which is Alternative 1 in this DPEA. For this DPEA, NMFS has applied the following screening criteria to a range of alternatives to identify which ones should be brought forward for detailed analysis:

Screening Criteria

To be considered "reasonable" for purposes of this DPEA, an alternative must meet the following criteria:

- The action must not violate any federal statute or regulation.
- The action must be consistent with reasonably foreseeable funding levels.
- The action must be consistent with long-term research commitments and goals to maintain the utility of scientific research efforts, or consider no federal funding availability for fisheries research.

To maintain the utility of scientific research efforts, fisheries and marine ecosystem scientific research should address at least some of the following goals related to fisheries management:

- Methods and techniques must provide standardized, objective, and unbiased data consistent with past data sets (time series) in order to facilitate long-term trend analyses.
- Collected data must adequately characterize living marine resource and fishery populations and the condition of their habitats.
- The surveys must enable assessment of population status and provide predictive capabilities required to respond to changing ecosystem conditions and manage future fisheries.
- Research on new methodologies to collect fisheries and ecosystem information (e.g., active and passive acoustic instruments and video surveys of benthic habitats in lieu of dredge gear or bottom trawls), and research oriented toward modifications of fishing gear to address bycatch or other inefficiencies must be conducted with experimental controls sufficient to allow statistically valid comparisons with relevant alternatives.

NMFS evaluated each potential alternative against these criteria. Based on this evaluation, the No-Action/Status Quo Alternative and two other action alternatives have been identified as reasonable and are being carried forward for more detailed evaluation in this DPEA. NMFS will also evaluate a second type of no-action alternative that considers no federal funding for fisheries research activities. This will be called the No Research Alternative to distinguish it from the No-Action/Status Quo Alternative. The No-Action/Status Quo Alternative will be used as the baseline to compare all of the other alternatives.

Three of the alternatives include a program of fisheries and ecosystem research projects conducted or funded by PIFSC as the primary federal action. Because this primary action is connected to a secondary federal action (also called a connected action under NEPA), for NMFS to consider promulgation of regulations and subsequent issuance of LOAs under Section 101(a)(5)(A) of the MMPA for the incidental, but not intentional, taking of marine mammals, NMFS must identify as part of this evaluation under the MMPA "(t)he means of effecting the least practicable adverse impact on the species or stock and its habitat". As a result, NMFS will identify and evaluate a reasonable range of mitigation measures to minimize impacts to marine mammals that occur in PIFSC research areas. In addition, because this NEPA document will be used to initiate section 7 consultation under the ESA and for compliance with other conservation laws, each of which may recommend or require mitigation measures, the consideration of mitigation measures is extended to all protected species. These mitigation measures are considered as

part of the identified alternatives in order to evaluate their effectiveness to minimize potential adverse environmental impacts. Protected species include all marine mammals, which are covered under the MMPA, all species listed under the ESA, and bird species protected under the Migratory Bird Treaty Act.

PIFSC fisheries and ecosystem research activities also include several international fisheries technology research programs, including bycatch reduction research projects that take place outside of U.S. jurisdiction, in foreign territorial seas. Under EO 12114, Environmental Effects Abroad of Major Federal Actions, Department of Commerce DAO 216-12, and NAO 216-6 Section 7, NMFS is required to consider the environmental effects of federal actions outside of the U.S. Because these international fisheries technology research programs, including bycatch reduction research projects, are not being evaluated under NEPA, they will be considered separately from the NEPA alternatives in this DPEA, and are described in Section 2.7 at the end of this chapter. In compliance with EO 12114, this DPEA will describe and analyze the potential effects of the proposed action and alternatives on the environment outside of the U.S. Federal actions may be exempt from this EO if the action will not have a significant effect on the environment outside of the U.S. as determined by the agency (EO 12114, Section 2-5), or if the action is carried out with participation from the foreign nation (EO 12114, Section 2-3(b)).

Alternative 1 – No-Action/Status Quo Alternative - Conduct Federal Fisheries and Ecosystem Research with Scope and Protocols Similar to Past Effort

The No-Action/Status Quo Alternative (Status Quo Alternative) includes fisheries and ecosystem research using the same protocols as were implemented in the recent past (considered to be from 2008 through 2014 for the purposes of this DPEA). These federal research activities are necessary to fulfill NMFS mission to provide science-based management, conservation, and protection of living marine resources in four different research areas: 1) HARA; 2) MARA; 3) ASARA; and 4) WCPRA. Under the Status Quo Alternative, PIFSC would conduct the same scope of research as in recent years and use the current mitigation measures for protected species.

Under the Status Quo Alternative, PIFSC would administer and conduct a wide range of fishery-independent and industry-associated research and survey programs, as summarized in Table 2.2-1. These surveys utilize a wide range of research equipment and fishing gear to capture fish and invertebrates for stock assessment or other research purposes, collect plankton and larval life stages of organisms to facilitate ecosystem studies, and gather oceanographic and acoustic data to characterize the marine environment. The main gear types of concern for potential interactions with protected species include pelagic trawls (surface and midwater), various hook-and-line gears, and instruments deployed on lines from vessels or moorings that may result in entanglement. In addition, the use of active acoustic instruments and the presence of researchers may lead to behavioral harassment of marine mammals. The scope of past research activities is considered as the basis for analysis of future activities under the Status Quo Alternative.

The Status Quo Alternative research activities include a suite of mitigation measures that were developed to minimize the risk of ship strikes and entanglements/captures/hookings of protected species in fishing gear (i.e., marine mammal monitoring and the "move-on" rule). The following mitigation measures have been implemented on all PIFSC surveys since at least the end of 2014, although many surveys implemented them earlier:

- Visual monitoring for protected species prior to deployment of gear;
- Use of the "move-on" rule if marine mammals are sighted from the vessel prior to deployment of trawl, longline, or any other fishing gear that may pose a risk of interactions with protected species and if the animals appear to be at risk of interaction with the gear as determined by the professional judgment of the Chief Scientist or officer on watch; and
- Short tow times and set times to reduce exposure of protected species to research gear.

However, these mitigation measures may not be sufficient to reduce the effects of PIFSC fisheries and ecosystem research activities on marine mammals to the level of least practicable adverse impact, as required under the MMPA (see Alternative 2). Other mitigation measures may be required under the MMPA and ESA processes for the specified research activities conducted by PIFSC.

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

The Preferred Alternative is comprised of a combination of research activities continued from the past and additional, new research surveys and projects. The Preferred Alternative would not include several of the projects described under the Status Quo Alternative, including:

- The Northwestern Hawaiian Islands Lobster Survey
- The Northwestern Hawaiian Islands Bottomfish Survey
- Pelagic Longline Hook Trials
- Longline Gear Research Surveys
- Marlin Longline Surveys

Under the Preferred Alternative, the Cetacean Ecological Assessment surveys would include increased levels of effort relative to the Status Quo Alternative, and would be expanded to include all four of the research areas within the Pacific Islands Region. Several new research surveys and projects that were not included in the Status Quo Alternative would occur under the Preferred Alternative, and other existing research projects would be modified; these new projects and changes in existing projects are summarized in Table 2.3-1.

Under this alternative, PIFSC would apply to NMFS Office of Protected Resources (OPR)[6] to promulgate regulations governing the issuance of LOAs for incidental take of marine mammals under the MMPA. OPR would consider these activities and mitigation measures and determine whether it should promulgate regulations and issue LOAs as appropriate to PIFSC. If regulations are promulgated and LOAs are issued, they would prescribe the permissible methods of taking; a suite of mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals and their habitats during the specified research activities; and require monitoring and reporting that will result in increased knowledge of the species and of the level of taking.

In addition, PIFSC would engage in ESA section 7 consultations with NMFS Pacific Islands Regional Office (and U.S. Fish and Wildlife Service, as appropriate) for species that are listed as threatened or endangered. These consultations may result in the development of one or more Biological Opinions (BiOps) that state the opinions of the agencies as to whether or not the primary and secondary federal actions are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The BiOps may contain incidental take statements that may include reasonable and prudent measures along with implementing terms and conditions intended to minimize the impact of incidental take of ESA-listed species during PIFSC research activities.

The Preferred Alternative includes the same suite of mitigation measures as the Status Quo Alternative to reduce the risk of adverse interactions with protected species. In addition, under the Preferred Alternative PIFSC would make changes to their gear configurations for instrument deployment, specifically altering the ratio of sinking and floating lines to reduce the risk of entanglements in lines at the surface of the water. PIFSC would also establish a new program for enhanced protected species training for its scientists and crew that would likely be involved in protected species monitoring or decisions related to avoidance

[6] Permits and Conservation Division, Incidental Take Program

of protected species interactions. This program would include opportunities for Chief Scientists and Captains to share information on protected species avoidance practices and to help standardize such decision-making protocols. Under the Preferred Alternative, these mitigation measures would be implemented during the the LOA authorization period and would be intended to reduce the effects of PIFSC fisheries research activities on marine mammals to the level of least practicable adverse impact, as required under the MMPA.

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

Under the Modified Research Alternative, PIFSC would conduct and fund the same scope of fisheries research as described for the Preferred Alternative and would include all of the same mitigation measures considered under the Preferred Alternative. Under this alternative, PIFSC would also apply for authorizations under the MMPA for incidental take of protected species during these research activities and initiate section 7 consultations regarding ESA-listed species. The key difference between the Modified Research Alternative and the Preferred Alternative is that the Modified Research Alternative includes a number of additional mitigation measures derived from a variety of sources including: (1) comments submitted from the public on potential mitigation of commercial fisheries impacts, (2) discussions within NMFS OPR as part of the proposed rulemaking process under the MMPA, and (3) a literature review of past and current research into potential mitigation measures. These measures include changes to visual monitoring methods for protected species (e.g., dedicated Protected Species Observers and technological methods to improve detection under poor visibility conditions), operational restrictions on where and when research may be conducted, and adoption of alternative methodologies and equipment for sampling.

PIFSC periodically reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluating new mitigation measures includes assessing their effectiveness in reducing risk to protected species, but measures must also pass safety and practicability considerations, meet survey objectives, allow survey protocols to remain compatible with previous data sets, and be consistent with the purpose and need for PIFSC research activities. Some of the mitigation measures considered under the Modified Research Alternative (e.g., no night fishing or broad spatial/temporal restrictions on research activities) would not allow survey protocols to remain consistent with previous data sets and would essentially prevent PIFSC from collecting data required to provide for fisheries management purposes under the MSA. Some research surveys necessarily target fish species that are preyed upon by protected species with an inherent risk of interactions during these surveys. PIFSC acknowledges the inherent risk of these, and it has implemented a variety of measures to mitigate that risk. PIFSC currently has no viable alternatives to collecting the data derived from these surveys and does not propose to implement potential mitigation measures that would preclude continuation of these surveys, such as the elimination of night surveys or elimination of pelagic trawl gear use. An analysis of the potential efficacy and practicability of the additional mitigation measures considered in this alternative is presented in Section 4.4.

The secondary federal action covered under this DPEA is the promulgation of requested regulations and subsequent LOAs under Section 101(a)(5)(A) of the MMPA, which requires NMFS to identify and evaluate a reasonable range of mitigation measures that may reduce impacts to marine mammals among other factors. As described above, some mitigation measures could prevent PIFSC from maintaining the utility of ongoing scientific research efforts, and those mitigation measures would normally be excluded from consideration in the DPEA under screening criteria 3 (Section 2.1). However, such mitigation measures would likely be considered during the MMPA rulemaking process and/or ESA section 7 consultation and are therefore considered in this DPEA under the Modified Research Alternative.

Alternative 4 – No Research Alternative - No Fieldwork for Federal Fisheries and Ecosystem Research Conducted or Funded by PIFSC

Under the No Research Alternative PIFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered in the scope of this DPEA in marine waters of the HARA, MARA, ASARA, and WCPRA. This moratorium on fieldwork would not extend to directed research on marine mammals and ESA-listed species that is authorized under separate research permits (i.e., MMPA section 10 permits) and NEPA documents, although these research activities may not be authorized to continue use of active acoustic equipment or fishing gears that could result in incidental takes of marine mammals. NMFS would need to rely on other data sources, such as fishery-dependent data (e.g., harvest data) and state or privately supported fishery-independent data collection surveys or programs to fulfill its responsibility to manage, conserve and protect living marine resources in the U.S. Under this alternative, organizations that have participated in joint research programs may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding. Any non-federal fisheries research would occur without PIFSC funding, direct control of program design, or operational oversight. It is unlikely that these non-NMFS fisheries research surveys would be consistent with the time series data NMFS has collected over many years, which is the core information supporting NMFS science and management missions and vital to fishery management decisions made by the Fishery Management Councils, NMFS, and other marine resource management institutions, leading to greater uncertainty for fishery and other natural resource management decisions.

CHAPTER 3 – AFFECTED ENVIRONMENT

Chapter 3 presents baseline information on the marine environment affected by PIFSC research activities. This information is not intended to be encyclopedic but to provide a foundation for the analysis of environmental impacts of the alternatives and the cumulative effects analysis. Sources of additional information are incorporated by reference.

The geographic areas and physical environments potentially affected by PIFSC research surveys are located throughout the Pacific Ocean. PIFSC's fisheries research activities take place in four primary research areas: the HARA, MARA, ASARA, and the WCPRA, which are described in detail in Chapter 3. PIFSC research surveys occur both inside and outside the United States (U.S.) Exclusive Economic Zone (EEZ) and sometimes in foreign territorial seas. Often, the surveys span across multiple ecological, physical, and political boundaries. PIFSC research areas encompass many areas with special designations to protect various resources, serve as relatively undisturbed reference research sites, and are subject to various levels of conservation and management under a variety of authorities. Classifications of these special resource areas include Essential Fish Habitat (and component Habitat Areas of Particular Concern), fisheries closure areas, and designated Marine Protected Areas (MPAs) including U.S. Marine National Monuments, National Marine Sanctuaries, National Parks, and Fish and Wildlife Refuges, as well as Department of Defense Naval Defensive Sea Areas, and State and Territorial MPAs.

Thousands of finfish species occur within the PIFSC research areas. Descriptions of ESA-listed species/stocks are provided, including listed Distinct Population Segments of scalloped hammerhead shark. Species targeted by commercial fisheries and subject to PIFSC stock assessment research and other species caught frequently in PIFSC surveys are also described.

Marine mammal species that occur in the PIFSC research areas are listed in Table 3.2-3, including 26 species of cetaceans (whales, dolphins, and porpoise) and one pinniped (Hawaiian monk seal). All of these species are federally protected under the MMPA regardless of where they occur. Six large whale species are listed as endangered under the ESA. Information is presented on marine mammal acoustics and functional hearing ranges for several groups of marine mammals. Marine mammals rely on sound production and reception for social interactions (e.g., reproduction and communication), to find food, to navigate, and to respond to predators.

Three ESA-listed seabird species occur in the PIFSC research areas that may interact with PIFSC fisheries and ecosystem research. There are many other ESA-listed bird species in the region that are primarily terrestrial and would be unlikely to interact with marine research activities. There are many other seabird species that occur in the PIFSC fisheries research areas that may potentially interact with research vessels and gear. However, birds have never been caught incidentally in PIFSC fisheries surveys. All species likely to occur in the U.S. EEZ are protected by the Migratory Bird Treaty Act.

Five species of sea turtles occur within the PIFSC research areas, all of which are listed as endangered or threatened under the ESA. Sea turtles are susceptible to damage of onshore nesting habitat, exploitation of eggs, small boat strikes, and interactions with commercial and non-commercial fisheries.

Invertebrates found within the PIFSC research areas include numerous species of cnidarians (particularly corals), crustaceans, mollusks, echinoderms, porifera (sponges), and bivalves. NMFS published a final rule in September 2014 to list 20 species of corals as threatened under the ESA (79 FR 53852, 10 September 2014). Fifteen of the 20 ESA-listed coral species may occur within PIFSC research areas. Brief descriptions are given for each of these species including habitat, distribution, and threats. Other listed coral species may also occur in these research areas but have not yet been reported so the record of species in each area may change as more reliable information becomes available.

Several components of the social and economic environment within the PIFSC research areas are described in Section 3.3. Cultural resources may be defined as historic properties, landscapes, cultural items, archaeological resources, sacred sites, traditional knowledge, or collections of materials subject to protection under federal regulations. Section 3.3 provides an overview of cultural resources found within each of the designated PIFSC research areas. Section 3.3 also provides an overview of the social and economic aspects of commercial and non-commercial fisheries, fishing communities, and the economies that would be potentially affected by fisheries and ecosystem research activities conducted or funded by PIFSC.

CHAPTER 4 – ENVIRONMENTAL EFFECTS

As indicated earlier, NMFS is fundamentally a science-based agency, with its primary mission being the stewardship of living marine resources through science-based conservation and management. Of the four alternatives evaluated in this DPEA, three alternatives maintain an active research program (Status Quo, Preferred, and Modified Research Alternatives) that clearly enables collection and development of additional scientific information, and one alternative (No Research) does not. In NMFS' view, the inability to acquire scientific information essential to developing robust fisheries management measures that prevent overfishing and rebuild overfished stocks would ultimately imperil the agency's ability to meet its mandate to promote healthy fish stocks and restore the nation's fishery resources. The scientific information provided by fisheries and ecosystem research programs also allows NMFS to address potential effects of climate change and ocean acidification. Long-term, consistent fisheries and ecosystem research programs contribute substantially to developing effective and timely fisheries management actions and assists in meeting U.S. trust responsibilities and international treaty obligations.

The following discussion summarizes the direct and indirect impacts by resource component associated with the alternatives evaluated in Chapter 4 of this DPEA. The effects of the alternatives on each resource component were assessed using an impact assessment criteria table to distinguish between major, moderate, and minor effects within the context of each resource component. The analysis shows that the potential direct and indirect impacts on the physical and biological environments under the three research alternatives are similar and would have minor adverse effects. The three research alternatives would also have minor to moderate beneficial effects on the social and economic environment of fishing communities by providing the scientific information needed for sustainable fisheries management and by providing funding, employment, and services. The similarity of impacts among the three research alternatives is due to the fact that the research activities proposed under these alternatives are similar; the

alternatives also differ in the type of mitigation measures included for protected species. The No Research Alternative, in contrast, would eliminate direct adverse effects of the research alternatives on the marine environment but would have minor to moderate adverse indirect effects on several biological resources due to increasing uncertainty in future resource management decisions caused by the loss of scientific information on the marine environment from PIFSC, as well as indirect adverse impacts from not removing marine debris from the marine environment. The No Research Alternative was also considered to have minor to moderate adverse effects on the social and economic environment of fishing communities through impacts on various communities as well as long-term and widespread adverse impacts on sustainable fisheries management. Table ES-1 provides a summary of impact determinations for each resource component by alternative.

Table ES-1 Summary of Environmental Effect Conclusions for Each Alternative

Resource Component	Alternative 1 (Status Quo)	Alternative 2 (Preferred)	Alternative 3 (Modified Research)	Alternative 4 (No Research)
Physical Environment	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Special Resource Areas and EFH	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Fish	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Marine Mammals	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Birds	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Sea Turtles	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Invertebrates	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Social and Economic Environment	Minor to moderate *beneficial*	Minor to moderate *beneficial*	Minor to moderate *beneficial*	Minor to moderate *adverse*

Physical Environment

Under the three research alternatives, direct impacts to benthic habitats would occur through the use of several types of bottom-contact equipment. Bottom-contact fishing gear used in PIFSC fishery research activities under the three research alternatives would include bottomfishing bottom traps, stereo-video recording instruments [Bottom Camera (BotCam), Modular Optical Underwater Survey System (MOUSS), Baited Remote Underwater Video Systems (BRUVS)] that rest or anchor directly on the seafloor, as well as Autonomous Reef Monitoring Structures (ARMS), Acoustic Doppler Current Profilers (ADCPs), Bioerosion Monitoring Units (BMUs), Calcium Acidification Units (CAUs), Sea Bird Electronics SBE56 Temperature Recorders (STRs), water sampling devices (PUCs and RAS), pH/pCO_2 instruments (SEAFET/SAMI), High-frequency Acoustic Recording Packages (HARPs), and Ecological Acoustic Recorders (EARs) that are either fixed or anchored to the benthic substrate (Table 2.2-1; also see Appendix A for description of gear types). Due to the small areas affected by stationary bottom-contact fishing gear, the geographic extent of impacts would be limited to much less than 1 percent of the project area and would therefore be considered localized according to the criteria for determining effects levels, provided in Table 4.1-1. PIFSC does not use bottom trawl or dredge equipment for any of its

research programs, and therefore, the impacts to physical habitat that could result from the use of bottom trawl or dredge equipment would not occur in the PIFSC research areas as a result of activities proposed under any of the research alternatives.

Most disturbances to benthic habitats would be expected to recover within several months due to the action of ocean currents, depositional processes, and natural growth. Water quality could be affected through disturbance of bottom sediments, causing temporary and localized increases in turbidity. The potential for accidental fuel spills or other contamination from research vessels is considered small and any incidents would be rare due to the training and spill response equipment required for work on all research vessels, and adherence to Coast Guard regulations regarding safety and pollution prevention, and the experience of NOAA Corps and charter captains and crew. The overall effects on benthic habitat and water quality are considered minor to moderate in magnitude, small areas of impact (much less than one percent of each research area) would be impacted, and the areas of impact would be dispersed over a large geographic area. Low intensity impacts resulting from the disturbance of organisms that produce structure could persist for months, however impacts resulting in measureable changes to the physical environment would be temporary. In general, any measureable alterations to benthic habitat would recover within several months through the action of water currents, depositional processes, and natural growth. Overall impacts would therefore be considered minor adverse under all three of the research alternatives, as they would all have similar impacts on the physical environment.

Under the No Research Alternative, there would be no direct impacts on the physical environment from PIFSC-affiliated fisheries and ecological research. However, the loss of scientific information generated by PIFSC research would contribute to greater uncertainty about the effects of climate change, ocean acidification, commercial fisheries impacts, and other external factors on benthic ecosystems. Indirect effects could occur through less scientifically informed decisions by resource management agencies and persistence of marine debris that otherwise would have been removed. The loss of information from PIFSC would likely affect a large geographic area but would be minor in magnitude given other potential sources of scientific research data. Impacts to the physical environment would therefore be considered minor adverse under the No Research Alternative.

Special Resource Areas and EFH

Under the three research alternatives, PIFSC would conduct some fisheries and ecosystem research activities in monuments, sanctuaries, refuges, and EFH; however, the research activities would be minimally invasive, and extractive sampling would be limited. The potential effects on special resource areas and EFH resulting from PIFSC research under the Status Quo Alternative are similar or the same as those discussed for physical, biological, and socioeconomic resources elsewhere in this DPEA. These effects primarily involve potential adverse impacts to wildlife, and the risk of accidental spills or contamination from vessel operation. Near-surface and midwater trawl gear, as well as various plankton nets, water sampling devices, and acoustic survey equipment could result in temporary impacts to pelagic habitat within special resource areas and EFH. Presence of pelagic sampling equipment may result in short-term disturbance or displacement of pelagic species, but the duration of impacts to pelagic habitats within special resource areas and EFH would generally not extend beyond the duration of the research activity. While survey activities may occur within special resource areas, these activities would have *de minimus* impacts on benthic habitats within sanctuaries, EFH, or other special resource areas because they would be small in magnitude, short-term in duration, and localized in geographic scope. PIFSC does not use bottom-contact trawl equipment or other mobile bottom-contact research equipment for any fisheries and ecosystem research programs proposed under the three research alternatives. Stationary bottom-contact equipment that could potentially influence benthic habitat and EFH within special resource areas is described in section 4.2.1, Physical Environment Impacts.

One PIFSC survey likely to be conducted within the special resource areas and EFH would include the Reef Assessment and Monitoring Program (RAMP) surveys in nearshore areas using non-invasive survey

techniques. RAMP survey locations are selected randomly, and can potentially occur within MPAs and other special resource areas. Under all of the three research alternatives such activities would be minimally extractive, and would occur infrequently. Any research activities occurring within special resource areas and EFH would meet established conservation measures and restrictions for the location.

Impacts to special resource areas and EFH under the Preferred Alternative would be very similar to the impacts under the Status Quo Alternative. The Modified Research Alternative includes the potential for spatial/temporal restrictions on PIFSC fisheries research as a means to reduce impacts on protected species. This provision may reduce impacts on certain areas if such closures were determined to be effective mitigation measures. However, specific determinations about potential research restrictions have not been made and it is assumed that impacts to special resource areas and EFH would be similar under all three research alternatives.

Under the No Research Alternative, there would be no direct impacts on special resource areas and EFH from PIFSC fisheries or ecosystem research activities. However, the indirect effects on resource management agencies and conservation plans for protected areas due to the loss of scientific information would be similar to that described for the physical environment and would be considered minor adverse.

Fish

Under all of the three research alternatives, potential effects of research vessels, survey gear, and other associated equipment on fish species found in the research areas would include mortality from fisheries and ecosystem research activities, contamination from discharges, and potential disturbance and changes in behavior due to sound sources. The only fish species in the project area listed as threatened or endangered under the ESA is the scalloped hammerhead shark. Historically, only four scalloped hammerhead sharks have been captured as a result of PIFSC fisheries and ecosystem research, all of which belonged to the non ESA-listed Central Pacific DPS. Furthermore, all four of these captures were released alive with no resulting mortality. Given the lack of historical takes of ESA-listed fish species, the potential for future takes is considered small and unlikely to affect any ESA-listed population of scalloped hammerhead sharks. For most species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to research surveys and projects is much less than one percent of annual catch limits (ACLs) or commercial harvest and is considered to be minor in magnitude for all species. For species which exceed one percent of ACLs or commercial harvest, catch is still small relative to the population of each species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities. Disturbance of fish from research activities would be temporary and minor in magnitude for all species. As described in Section 4.2.3.6, the potential for accidental contamination of fish habitat is considered minor in magnitude and temporary or short-term in duration. The overall effects of any of the three research alternatives on target fish would be minor in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse.

In contrast to these adverse effects, PIFSC research also provides long-term beneficial effects on managed fish species throughout the Pacific Islands Region through its contribution to sustainable fisheries management. Data from PIFSC fisheries and ecosystem research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks. The beneficial effects of the time-series data provided by PIFSC research programs are especially valuable for long-term trend analysis for commercially harvested fish and, combined with other oceanographic data collected during fisheries and ecosystem research, provide the basis for monitoring changes to the marine environment important to fish populations.

Under the No Research Alternative, there would be no direct effects of PIFSC research on fish because PIFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research. The lack of at-sea research activities would eliminate the risk of mortality from fisheries research activities, disturbance

and changes in behavior due to the presence of vessels and research gear, and potential contamination from vessel discharges. However, the loss of scientific information about fish populations and their habitats, especially commercially valuable species (e.g., bottomfish, reef fish, tuna, and billfishes), would make it increasingly difficult for fisheries managers to effectively monitor stock status, set commercial harvest limits, or develop fishery regulations to recover depleted stocks or protect vulnerable stocks, especially as information used in stock assessments gets older and less reliable. For non-commercial species, the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular fish species is unknown. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on fish stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact of the No Research Alternative on commercially important fish stocks would be considered moderate adverse for the areas surveyed by PIFSC.

Marine Mammals

The primary direct effects of the three research alternatives on ESA-listed and non-listed marine mammals include behavioral responses to sound produced through the use of active acoustic sources (Level B harassment under the MMPA), Level B harassment of monk seals on haulouts by the physical presence of researchers, incidental capture, entanglement, or hooking in fishing gear but released without serious injury (Level A harassment), and incidental capture, entanglement, or hooking resulting in serious injury or mortality. The potential for effects from ship strikes, contamination of the marine environment, and removal of marine mammal prey species was considered minor for all alternatives and research areas. The MMPA requires applicants for LOAs to estimate the number of each species of marine mammal that may be incidentally taken by harassment or serious injury/mortality during the proposed action. The PIFSC LOA application (attached to the DPEA as Appendix C) includes estimates of takes in all four research areas using the scope of research and mitigation measures described in the Preferred Alternative but it is assumed that these levels of take could occur under all three research alternatives.

The potential direct and indirect effects of PIFSC research activities on marine mammals have been considered for each of the four PIFSC research areas (HARA, MARA, ASARA, and WCPRA) and for all gear types used in research under each of the three research alternatives. All species may be exposed to sounds from active acoustic equipment used in PIFSC research in the four research areas, although several acoustic sources are not likely audible to many species (i.e., operated at a frequency above or below the animal's hearing range). For the marine mammals affected, those effects would likely be temporary and minor changes in behavior for nearby animals as the ships pass through any given area. The potential for temporary threshold shift (TTS) in hearing is low for high-frequency cetaceans (beaked whales and dwarf and pygmy sperm whales) and very low to zero for other species. The potential for hearing loss or injury to any marine mammal is essentially zero. Because of the minor magnitude of effects and the short-term duration of acoustic disturbance, the overall effects of acoustic disturbance are considered minor adverse for all species under all of the three research alternatives.

PIFSC has never caught, hooked, or had marine mammals entangled in fisheries research gear. However, incidental takes of marine mammals have occurred in commercial and non-commercial fisheries in the same areas as PIFSC research occurs and using gears similar to those used in research. PIFSC has used information on these analogous fisheries to make precautionary estimates of marine mammals that may be incidentally taken during future fisheries and ecosystem research. These Level A harassment and mortality and serious injury takes include three ESA-listed species and 13 non-listed cetacean species,

primarily by research using longline gear but also including research with midwater trawl gear and instrument deployments (potential entanglement in mooring lines or other lines). For almost all species and stocks with determined potential biological removal (PBR) values, the requested takes, if they occurred, would represent less than ten percent of PBR and would be considered minor in magnitude. The exception is for spinner dolphins. If all of the requested takes for spinner dolphin occurred on the Oahu/4-Islands stock, the takes would be 12.1 percent of PBR for this stock and would be considered moderate in magnitude. Given the mitigation measures implemented under the Status Quo Alternative, the relatively small amount of fishing effort involved in PIFSC research, and the lack of takes in the past, PIFSC does not anticipate that the level of requested takes will actually occur in the future. The overall impact of the potential takes of these species, if they occurred, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

PIFSC also uses other hook-and-line gear, bongo nets, baited traps, SCUBA gear, and other scientific instruments in the course of conducting fisheries and ecosystem research (Table 2.2-1) that are not considered to present reasonable risks of incidental takes of marine mammals and for which no take requests have been made.

In addition to Level B harassment takes for many species through acoustic disturbance, PIFSC is requesting Level B harassment takes for Hawaiian monk seals due to the physical presence of researchers in nearshore waters and along beaches. Given the protocols for monitoring and avoiding interactions with monk seals, these potential takes would likely result in only temporary disturbance of small numbers of monk seals and adverse impacts would be minor. Given the very small amounts of fish and invertebrates removed from the ecosystem during scientific sampling, the dispersal of those sampling efforts over large geographic areas, and the short duration of sampling efforts, the overall risk of causing changes in food availability for marine mammals is considered minor adverse for all research areas under each of the three research alternatives. Also, given the crew training, required emergency equipment, and adherence to environmental safety protocols on NOAA research vessels and NOAA chartered vessels, the risk of altering marine mammal habitat through contamination from accidental discharges into the marine environment is considered minor adverse for all three research alternatives.

The overall impacts to marine mammals would be similar among the three research alternatives, and would be minor to moderate in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

Under the No Research Alternative, PIFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters of the HARA, MARA, ASARA, or WCPRA. Directed-take research by PIFSC on protected species would continue under the existing respective ESA and MMPA directed-take research permits, but the use of gear or instruments not expressly permitted under those authorizations would not be conducted under the No Research Alternative (e.g., the sampling of prey species using a midwater trawl net by the Cetacean Research Program). This would eliminate the potential for direct and indirect effects on marine mammals through disturbance, entanglement in gear, changes to prey availability, and contamination of the marine environment in all four research areas and for all species of marine mammals. However, many of the PIFSC projects that would be eliminated under this alternative include opportunistic observations made from the deck of the vessels (transects while vessels are underway) which provide information on the abundance and distribution of marine mammals in these four research areas. Oceanographic and fisheries data collected by PIFSC is also important for monitoring the ecological status of the environment important to marine mammals. While there would be no direct effects on marine mammals due to adverse interactions with ships and scientific gear, the loss of observational and ecological information important to marine mammals would indirectly affect resource management decisions concerning the conservation of marine mammals.

There are too many unknown variables to estimate the magnitude of effects this lack of information would mean to any particular stock of marine mammal but they would likely be minor in the near future. The overall impact to marine mammals would be adverse and minor for all four PIFSC research areas under the No Research Alternative.

Birds

All three of the research alternatives include the use of fishing gear (e.g., trawls, longlines) that have had substantial incidental catch of seabirds in commercial fisheries. However, research gear is generally smaller than commercial gear in both scope and scale, and research protocols are quite different than commercial fishing practices. In particular, fisheries research uses shorter duration sets and less effort than commercial fisheries and no bait or offal is thrown overboard while research gear is in the water, thereby greatly reducing the attraction of seabirds to research vessels. Based on the historical lack of interactions between seabirds and research gear used for PIFSC fisheries and ecosystem research, incidental take of seabirds in research gear is unlikely. This DPEA also considers the potential for fisheries and ecosystem research to affect the habitat quality of seabirds through removal of prey and contamination of seabird habitat and, as described above for marine mammals, concludes that these effects would be minor adverse for all species. The overall effects on seabirds are therefore considered minor adverse under all three research alternatives. One potential mitigation measure under the Modified Research Alternative would be for PIFSC to deploy streamer lines on longline gear to reduce the risk of catching seabirds. If seabird interactions with longline gear are documented in the future, PIFSC will evaluate whether use of streamer lines is warranted given the tradeoffs between the potential conservation benefit and changes to research protocols that might affect time-series data.

Some PIFSC surveys sometimes take bird biologists on board when there is bunk space available to conduct transect surveys for bird distribution and abundance in the PIFSC research areas. This information is used by NMFS, the U.S. Fish and Wildlife Service, and other international resource management agencies to help with bird conservation issues and is considered to have indirect beneficial effects on birds.

Under the No Research Alternative, the risk of direct adverse effects on seabirds from PIFSC research would be eliminated, but there could be potential long-term minor adverse indirect impacts to seabirds because resource management authorities would lose ecological information about the marine environment important to seabird conservation.

Sea Turtles

The DPEA analyzes the same direct and indirect effects of PIFSC fisheries research on sea turtles as described for marine mammals. The potential for ship or small boat strikes, removal of prey, entanglement in line used during research activities, entanglement in derelict fishing gear, and contamination of marine habitat would be similar to the risks described for marine mammals; these effects are considered minor adverse for all sea turtle species under all three research alternatives. Sea turtles hearing range is apparently well below the frequencies of acoustic instruments used in fisheries research so turtles are unlikely to detect these sounds or be affected by them. PIFSC has no history of interactions with sea turtles in research gear and the potential for injury or mortality under all of the research alternatives is very small. The overall effects of the research alternatives would therefore be considered minor adverse on all species of sea turtles.

As with marine mammals and seabirds, the No Research Alternative would eliminate the risk of direct adverse effects on sea turtles from PIFSC research. However, there could be minor adverse indirect impacts due to the loss of PIFSC-affiliated research on bycatch reduction, the removal of marine debris, and ecological information important to sea turtle conservation.

Invertebrates

PIFSC fisheries and ecosystem research conducted under the three research alternatives could have direct and indirect effects on many invertebrate species through physical damage to infauna and epifauna, collection in midwater and surface trawl nets, incidental and directed take of coral specimens, mortality, changes in species composition, and contamination or degradation of habitat.

For all invertebrate species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to PIFSC fisheries and ecosystem research surveys and projects is less than two percent of commercial and non-commercial harvest and is considered to be minor in magnitude for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities and the risk of altering benthic community structure would be minimal. Disturbance of invertebrates and benthic habitats from research activities would be temporary and minor in magnitude for all species. The overall direct and indirect effects of the Status Quo Alternative on invertebrates would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse.

Under the Preferred Alternative, the Northwestern Hawaiian Islands Lobster Survey is not carried forward. The elimination of this survey would substantially reduce the total mortality of lobsters from PIFSC research activities. Modified surveys include a midwater trawl added to the Cetacean Ecology Assessment Survey and increased geographic scope of the Insular Fish Abundance Estimation Comparison Surveys (deploys a BotCam, BRUVS, and MOUSS) to include the MARA, ASARA, and WCPRA. These stationary bottom-contact gears have very small footprints and therefore the potential to crush, bury, remove, or expose invertebrates is also very small. The overall effects of the Preferred Alternative on invertebrates would likely be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse.

The Modified Research Alternative includes potential spatial and temporal restrictions on where and when PIFSC research could occur. Spatial and temporal restrictions may reduce impacts on invertebrates in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. Such restrictions could also reduce overall research fishing effort in important habitats and limit the ability of PIFSC to sample invertebrate species as prescribed in their research plans. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Preferred Alternative. Overall effects on invertebrates would therefore be similar even if research was conducted in somewhat different places and times. Thus, overall impacts to invertebrates under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse.

In addition to these minor adverse effects, each of the three research alternatives would contribute to long-term beneficial effects on invertebrate species throughout the Pacific Islands Region through the contribution of PIFSC fisheries research. Specifically, the RAMP surveys support numerous management objectives, including monitoring ecosystem health, understanding the effects of climate change and ocean acidification, assessing ecological effects of fishing, prioritizing and planning conservation strategies, and detecting ecosystem shifts.

Under the No Research Alternative, there would be no direct effects of PIFSC fisheries and ecosystem research on invertebrates through physical damage, directed take of coral, mortality, changes in species composition, and contamination. However, the loss of scientific information about invertebrates would impede the ability of fisheries managers to effectively assess and monitor stocks, set harvest limits, or develop necessary regulations to protect vulnerable stocks. For non-commercial species (e.g. various corals), the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean

acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers. Although other data are available to support resource management decisions, the interruption or cessation of long-term data series on commercially valuable invertebrate stocks could lead to increased uncertainty and changes in some management scenarios. Management authorities would lose important information needed to establish sustainable harvest limits and help conserve and restore benthic habitats. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on invertebrate stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact of the No Research Alternative on commercially important invertebrate stocks would be considered moderate adverse.

Social and Economic Environment

The effects of PIFSC fisheries and ecosystem research on the social and economic environment are expected to be very similar under all three research alternatives. All three research alternatives include avoidance of known historic cultural resource sites, such as shipwrecks, burial sites, fish ponds, and avoidance of locations were contemporary cultural resources are known to occur. Each of these alternatives would include important scientific contributions to sustainable fisheries management for some of the most diverse and important commercial and non-commercial fisheries throughout the Pacific Island region, which benefits the fisheries and the communities that support them. These industries have regionally large economic footprints, generate millions of dollars' worth of sales and thousands of commercial fishing-related jobs, and provide millions of people across the country with highly valued seafood. Millions of non-commercial fishers also participate and support fishing service industries. PIFSC fisheries research activities would also have minor to moderate beneficial impacts to the economies of fishing communities through direct employment, purchase of fuel, vessel charters, and supplies. Continued PIFSC fisheries research is important to build trust and cooperation between the fishing industry and NMFS scientists and fisheries managers. PIFSC fisheries research also informs management decisions which help to sustain traditional, cultural, and subsistence fishing communities. The overall effects of PIFSC-affiliated research would be long-term, distributed widely across the Pacific Island region, and would be considered minor to moderately beneficial to the social and economic environment for all three research alternatives.

The impacts of the No Research Alternative would be the inverse of the three research alternatives. It would likely have minor to moderate adverse impacts on the social and economic environment through greater uncertainty in fisheries management, which could lead to more conservative fishing quotas (i.e., underutilized stocks and lost opportunity) or an increased risk of overfishing, followed by reductions in commercial and recreational fisheries harvests. The lack of scientific information would also compromise efforts to rebuild overfished stocks and monitor the effectiveness of no-fishing conservation areas. These impacts would adversely affect the ability of NMFS to comply with its obligations under the MSA. It would also eliminate research-associated federal spending on charter vessels, fuel, supplies, and support services in various communities. The No Research Alternative would also have long-term adverse impacts on the scientific information PIFSC contributes to meet U.S. obligations for living marine resource management under international treaties.

CHAPTER 5 – CUMULATIVE EFFECTS

Cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions on the human environment over time. An individual action may have only minor or moderate impacts, but the cumulative effects of all actions may be major. NEPA requires an analysis of cumulative effects in order

to alert decision makers to the full environmental consequences of a proposed action and its alternatives on resource areas of concern. This analysis looks at the overall cumulative impact and the contribution of PIFSC fisheries and ecosystem research activities to the overall cumulative impact.

In terms of fisheries, understanding how the cumulative impacts from human activities and trends in the natural environment have influenced the marine environment over time is key to understanding the importance of NMFS role in fisheries management. The need for scientific information from PIFSC research activities is in large part the result of past actions that contributed to major adverse impacts on fish stocks from overfishing, pollution of coastal and ocean areas from accidental and intentional discharges, runoff of agricultural and industrial waste, and degradation of habitat. Federal efforts within the last 40 years to reduce pollution, restore degraded habitats, and effectively manage commercial and recreational fishery harvests have reversed some of these trends. A number of important fish stocks have been restored to healthy levels and others are in the rebuilding process.

Similarly, cumulative impacts from human activities and trends in the natural environment over time have contributed major adverse impacts to some populations of marine mammals, sea turtles, and other marine species. As a result, the MMPA and ESA were enacted to help address specific conservation concerns and many human activities are subject to federal management measures to protect marine species and promote recovery of impacted populations.

Climate change and ocean acidification have the potential to impact populations and distributions of many marine species. Fisheries and ecosystem research activities make a minimal contribution to these long-term, global environmental processes through the burning of fossil fuels. However, long-term, systematic marine research provides important scientific information on the changes and trends in marine ecosystems brought about by climate change and ocean acidification.

In addition to PIFSC research efforts, there are many current and reasonably foreseeable activities that may contribute to cumulative impacts on the marine environment, including: conservation efforts, commercial shipping, commercial and recreational fisheries, energy development, military activities, coastal development projects, marine research activities by other agencies and institutions, and other human activities that contribute to global climate change. These actions can produce both adverse and beneficial impacts that directly and indirectly affect ocean resources managed by NMFS and the social and economic environment of fishing communities that rely on them.

This DPEA generally considers the contribution of the three research alternatives to the cumulative effects on given resources to be very similar and they are often discussed together. The contribution of the No Research Alternative to the cumulative effects on resources is quite different and is discussed separately.

As described in the Chapter 4 summary above, PIFSC research activities would have minor adverse effects on the various resource components of the physical and biological environments. Because PIFSC research activities involve such a small number of vessels compared to other vessel traffic and collect relatively small amounts of biomass compared to commercial and non-commercial fisheries, the contribution of the three research alternatives to cumulative adverse effects on fish, marine mammal, and other species and resource areas would be small. PIFSC scientific research activities will also have beneficial contributions to the cumulative effects on physical, biological, and socioeconomic resources. The research alternatives contribute substantially to the science that feeds into federal fishery management measures aimed at rebuilding and managing fish stocks in a sustainable manner. It also contributes to understanding the nature of changes in the marine environment and adjusting resource management plans accordingly, and it helps meet co-management and international treaty research obligations. The research activities under the three research alternatives help alleviate adverse cumulative impacts on the biological and socioeconomic environments, resulting in long-term beneficial contributions to cumulative effects.

The No Research Alternative would not contribute to direct adverse effects on the marine environment (e.g., research catch of fish and incidental take of marine mammals) but would contribute indirect adverse effects on both the biological and socioeconomic environments based on the lack of scientific information to inform future resource management decisions and the lost opportunity to remove marine debris.

OTHER SECTIONS

In addition to the chapters summarized above, the DPEA includes a description of the laws applicable to PIFSC research activities in Chapter 6, cited references in Chapter 7, and a list of persons and agencies consulted during development of the DPEA in Chapter 8. Appendix A provides a description of the fishing gear, other scientific instruments, and vessels used during PIFSC research activities. Appendix B includes tables and figures showing the spatial distribution of research effort within the PIFSC research areas. Appendix C is PIFSC's application for promulgating regulations and issuing LOAs for incidental take of marine mammals under the MMPA from NMFS OPR.

CONCLUSION

Based on the analysis in this DPEA, NMFS has not identified any potential adverse environmental impacts that would rise to the level of "significant" under NEPA, thus triggering the requirement for an EIS. NMFS will not make a final determination about significance until the close of the 60-day public comment period on the draft DPEA and it has received all the public comments. A final determination on whether potential impacts of the proposed action are significant will be made with consideration of public comments and will be published in the Federal Register.

1.1 NOAA'S RESOURCE RESPONSIBILITIES AND ROLE IN FISHERIES RESEARCH

The Federal government has a responsibility to protect living marine resources in waters of the United States of America (U.S.), also referred to as federal waters. These waters generally lie 3 to 200 nautical miles (nm) from the shoreline, and comprise the Exclusive Economic Zone (EEZ). The U.S. government has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside of the U.S. EEZ. To carry out its responsibilities over federal and international waters, Congress has enacted several statutes authorizing certain federal agencies to administer programs to manage and protect living marine resources. Among these federal agencies, the National Oceanic and Atmospheric Administration (NOAA) has the primary responsibility for protecting marine finfish and shellfish species and their habitats. Within NOAA, the National Marine Fisheries Service (NMFS) has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources.

Within the area covered by this Draft Environmental Assessment (DPEA), NMFS manages fisheries for finfish, shellfish, corals, catch of non-target, associated, and dependent species, fishery ecosystems, and habitats, under the provisions of several major statutes, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA)[7], the Tuna Conventions Act, the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the Migratory Bird Treaty Act (MBTA). Fulfilling the requirements of these statutes requires the close interaction of numerous entities in a sometimes complex fishery management process. In the NMFS Pacific Islands Region, the entities involved include the Pacific Islands Fisheries Science Center (PIFSC), the University of Hawaiʻi and NOAA's Joint Institute for Marine and Atmospheric Research (JIMAR, a cooperative institute between the University of Hawaiʿi and PIFSC), the Pacific Islands Regional Office (PIRO), the West Coast Regional Office, the Western Pacific Regional Fisheries Management Council (WPRFMC), state and territorial fisheries agencies, the U.S. Fish and Wildlife Service (USFWS), and a number of international fisheries management organizations and commissions (see Section 1.1.3).

1.1.1 Fisheries Science Centers

Six Regional Fisheries Science Centers[8] direct and coordinate the collection of scientific information on living marine resources and their ecosystems to assist resource managers in making sound decisions that build sustainable fisheries, facilitate the protection and recovery of threatened and endangered species, and sustain healthy ecosystems. Each Fisheries Science Center is a distinct entity and provides the primary scientific support for a particular NMFS fisheries region (Figure 1.1-1).

PIFSC conducts research and provides scientific advice to managers of fisheries and protected resources for the State of Hawaiʻi, Territory of American Samoa, Territory of Guam, the Commonwealth of the Northern Mariana Islands and the Pacific Remote Island Areas. This DPEA assess the impacts of research activities conducted by PIFSC in four different research areas (Figure 1.1-2): 1) Hawaiian Archipelago Research Area (HARA); 2) Mariana Archipelago Research Area (MARA); 3) American Samoa Archipelago Research Area (ASARA); and 4) Western and Central Pacific including the Pacific Remote Islands Research Area (WCPRA). These research areas and related Large Marine Ecosystems (LMEs) are described in detail in Section 3.1.1.

[7] 16 U.S.C. §§ 1801-1884, (MSA 2007).

[8] The NMFS Fisheries Science Centers are: 1) Northeast, 2) Southeast, 3) Southwest, 4) Northwest, 5) Alaska, and 6) Pacific Islands.

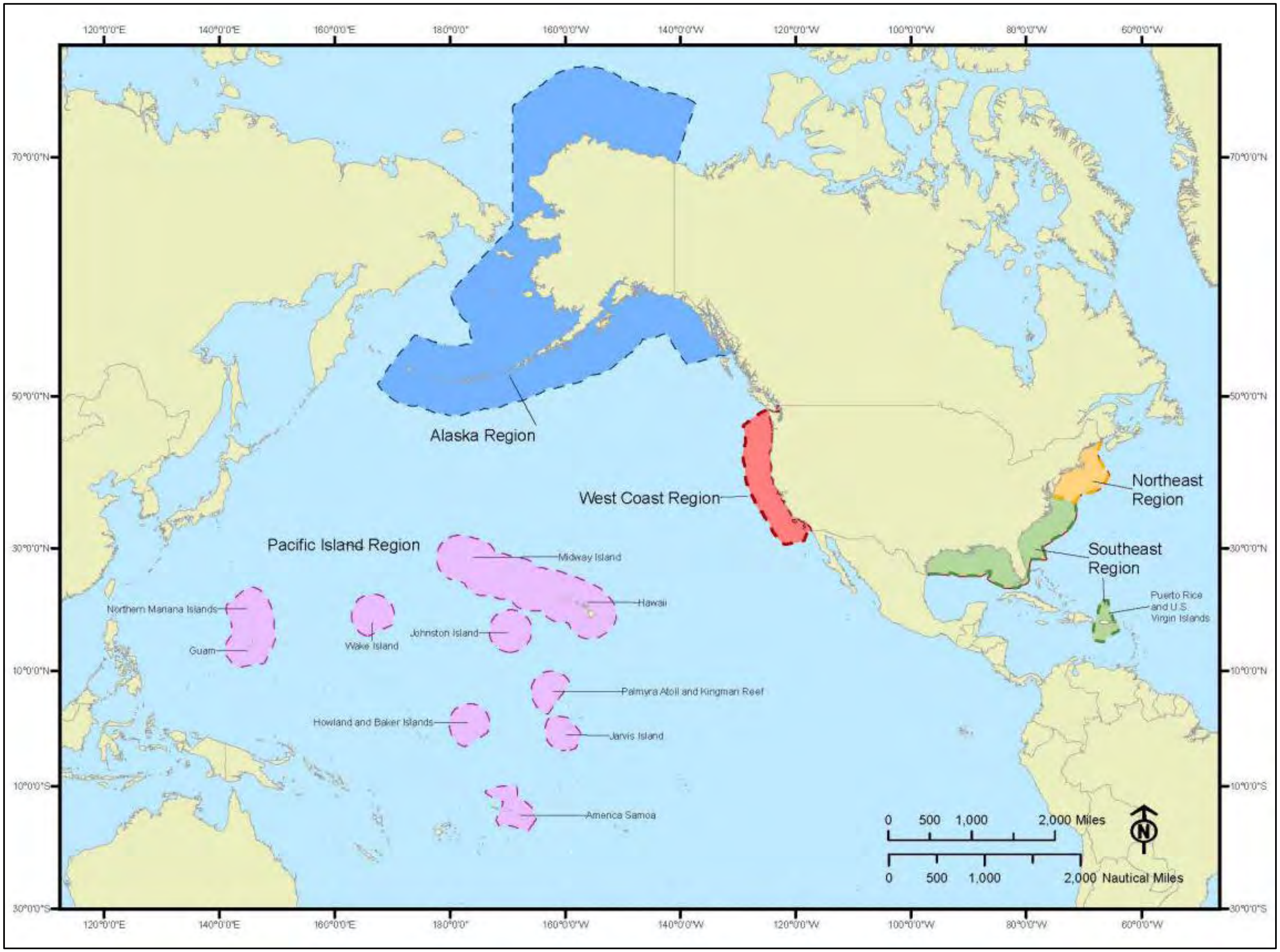

Figure 1.1-1 NMFS Fisheries Regions

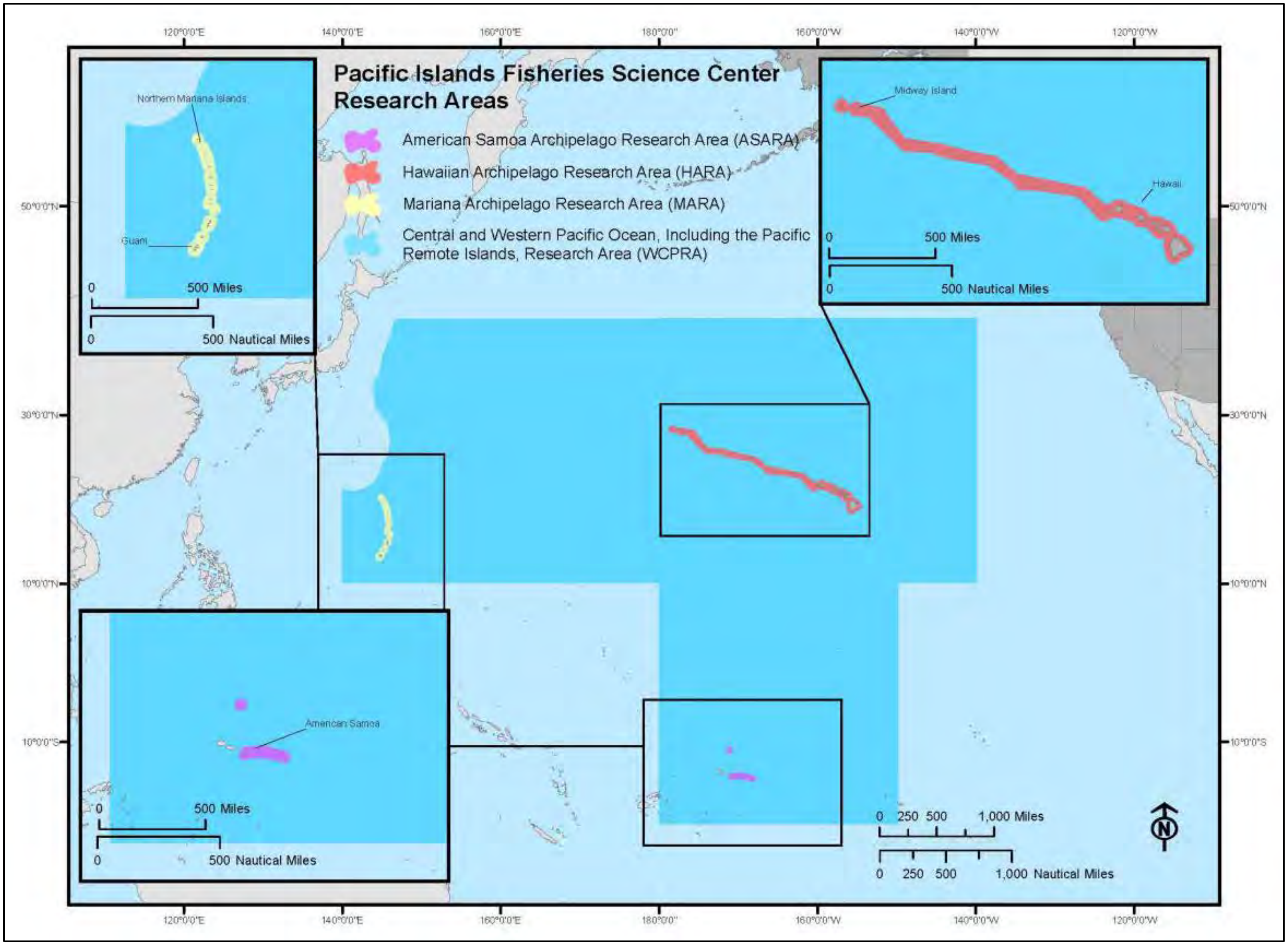

Figure 1.1-2 PIFSC Research Areas

1.1.2 Fisheries Management Councils

In order to encourage a collaborative approach to fisheries management, the MSA established the nation's eight Regional Fishery Management Councils. Five Councils are convened for the Atlantic Ocean (New England, Mid-Atlantic, South Atlantic, Gulf, and Caribbean), incorporating members of their respective states and territories. In the Pacific, the Pacific Fisheries Management Council (PFMC) includes Washington, Oregon, California, and Idaho. The North Pacific Fisheries Management Council (NPFMC) is concerned with the waters around Alaska. And in the west, the Western Pacific Regional Fishery Management Council (WPRFMC) covers federal waters across the Central and Western Pacific Ocean including the Hawaiian Archipelago, Samoa Archipelago, the Mariana Archipelago, and U.S. Pacific Remote Islands (including Johnston Atoll, Kingman Reef, Palmyra Atoll, Jarvis Island, Howland Island, Baker Island, and Wake Atoll).

The councils, which include fishing industry representatives, fishers, scientists, government agency representatives, federal appointees, and others, are designed to provide all resource users and managers a voice in the fisheries management process. Under the MSA, the councils are charged with developing Fishery Management Plans (FMPs) – or Fishery Ecosystem Plans (FEPs) in the case of the WPRFMC – and management measures for the fisheries occurring within the EEZ adjacent to their constituent states. These fishery management or ecosystem plans also develop measures to manage U.S. fishing operations beyond the U.S. EEZ (i.e., the U.S. longline fishery), particularly with regard to the bycatch of protected species, or when the fishery lands its catch in the U.S. Data collected by fisheries science centers are often used to inform FMPs, as well as to inform other policies and decisions promulgated by the Fisheries Management Councils. Such policies and decisions sometimes affect areas that span the jurisdictions of several Fisheries Management Councils, and make use of data provided by multiple fisheries science centers.

1.1.3 International Fisheries Management Organizations

In addition to providing information to domestic fisheries management councils, PIFSC provides scientific advice to support numerous international fisheries councils, commissions, and conventions, which are discussed in detail below.

The need for international cooperation in fisheries management is driven by the trans-boundary distribution and movements of many of the targeted and bycatch species and the exploitation of common resources outside areas of national jurisdiction, on the high seas.

Pelagic species, such as tuna and billfishes, have a wide geographic distribution, both on the high seas and inside the Exclusive Economic Zones (EEZ) of many nations and undertake trans-boundary movements of significant, but variable distances. Pelagic species are harvested by domestic and foreign fishing fleets; however, the U.S. accounts for a relatively small fraction of the pelagic species caught in the western and central Pacific Ocean (Secretariat of the Pacific Community 2013). The primary international regional fisheries management organization (RFMO) for pelagic species in this region is the Western and Central Pacific Fisheries Commission (WCPFC).

1.1.3.1 Western and Central Pacific Fisheries Commission

The WCPFC is an international organization that aims to ensure the long-term conservation and sustainable use of pelagic fish stocks (i.e., tunas, billfishes, and associated species) in the western and central Pacific Ocean. The WCPFC was established by the Convention for the Conservation and Management of Pelagic Fish Stocks in the western and central Pacific Ocean (WCPFC Convention) which was enacted in 2004. The WCPFC is made up of 26 member nations (including the European Union), plus several participating territories and cooperating non-member nations, who have an interest in the management of high seas fisheries in the western Pacific Ocean. The Convention applies to waters of

the Pacific Ocean including areas around Hawai'i, Territory of American Samoa, Territory of Guam, the Commonwealth of the Northern Marianas Islands, and U.S. Pacific remote island areas, and therefore encompasses much of the operational area of significant U.S. purse seine, longline, and distant-water albacore troll fisheries, as well as local small-scale fisheries for pelagic species Figure 1.1-3. Through the WCPFC, the U.S. is directly engaged in the development of fisheries management measures to manage and conserve bigeye, yellowfin, albacore, other tunas, billfishes, and sharks, and to minimize impacts on other species, including sea turtles and seabirds. PIFSC scientists lead or serve on, and provide scientific advice to, the WCPFC Science Committee and its Scientific Working Groups.

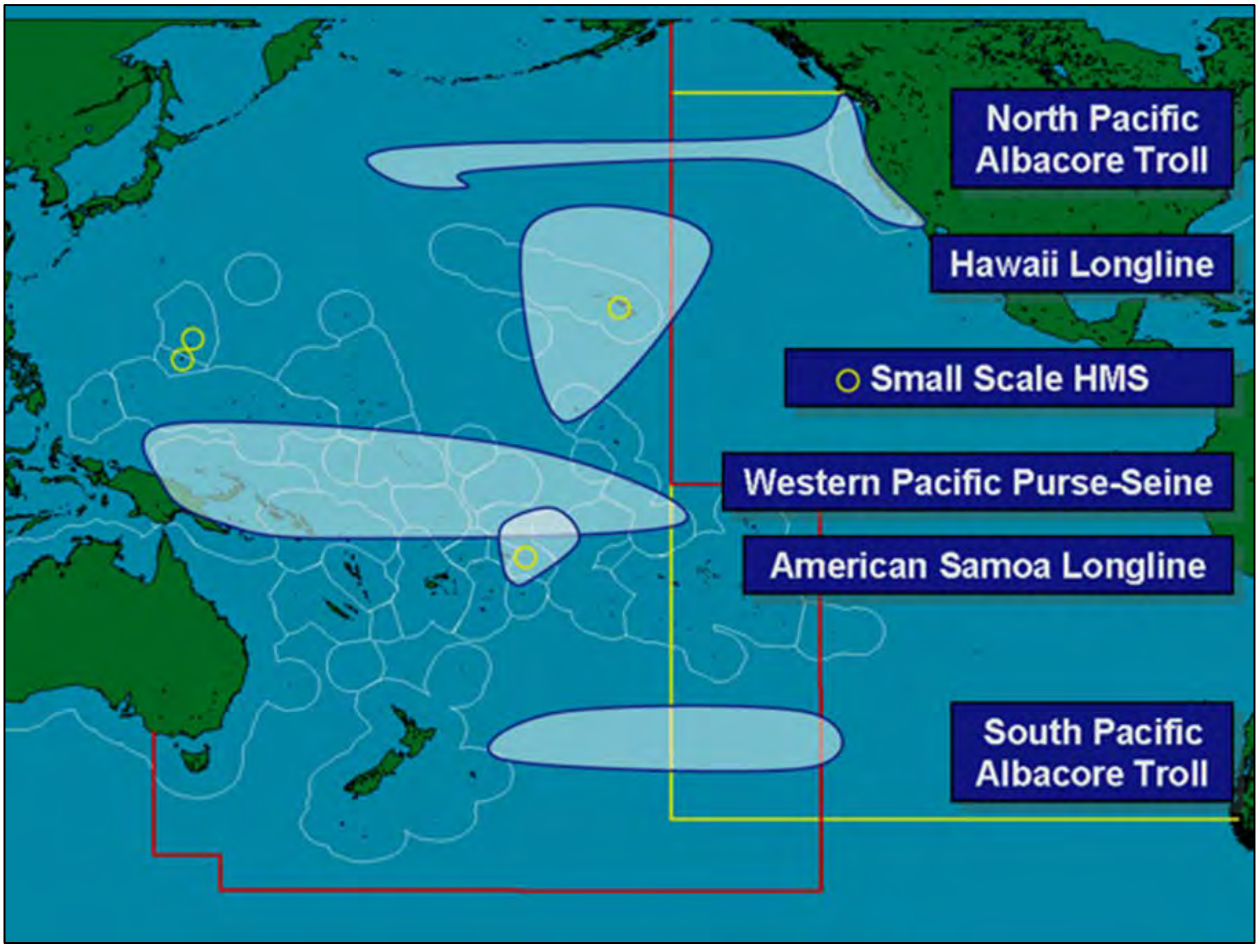

Figure 1.1-3 United States Western and Central Pacific Fisheries in relation to the WCPFC Area (red boundary) and the Inter-American Tropical Tuna Commission Area (yellow boundary, overlapping the red boundary in the central Pacific, see IATTC, below)

1.1.3.2 International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

The primary source of scientific advice to the Northern Committee of the WCPFC is the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The ISC was established in 1995 to develop better information on stocks of tuna and tuna-like species in the North Pacific Ocean in cooperation with relevant fisheries organizations, to enhance scientific knowledge of these stocks throughout their entire range. The organization has seven voting members and a variety of non-voting members and cooperating non-members. PIFSC scientists serve as the Chair of the ISC

Plenary, chair several of its Working Groups, provide fisheries data and scientific advice, and collaborate extensively in conducting stock assessments (ISC 2014).

1.1.3.3 South Pacific Tuna Treaty

The South Pacific Tuna Treaty (SPTT) is a Multilateral Fisheries Treaty which is a vital component of the political and economic relationship between the U.S. and the Pacific Island Parties (Figure 1.1-4). The SPTT was entered into force in 1987 for an initial period of 5 years and since that time; it has been extended twice, most recently through 2013. The Treaty sets the operational terms and conditions for the U.S. tuna purse seine fleet to fish, primarily for skipjack and yellowfin tunas, in a vast portion of the WCPFC Area. Other measures related to conservation and management of this fishery, including non-target, associated and dependent species are also developed and implemented by the WCPFC. Under an Economic Assistance Agreement related to the SPTT, the U.S. provides economic assistance to the Pacific Island Parties to support public education, health care programs, responsible utilization of natural resources, and general economic and social welfare in the Pacific Islands (DOS 2012).

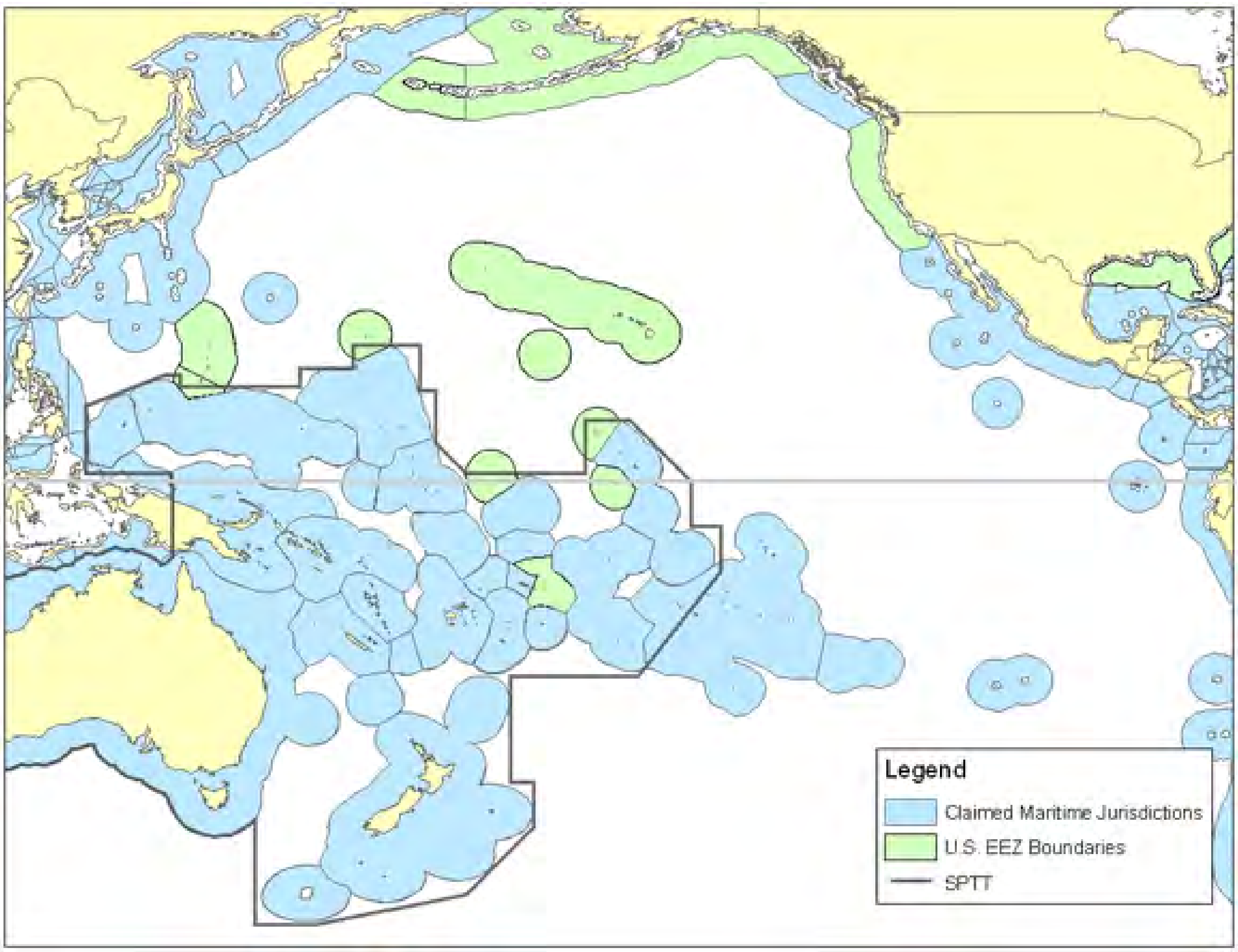

Figure 1.1-4 South Pacific Tuna Treaty Boundary

1.1.3.4 South Pacific Regional Fisheries Management Organization

Overfishing and habitat damage particularly from deep-sea trawling on high seas seamounts is prompting the initiation of multilateral agreements to address this problem in the North and South Pacific Ocean. The South Pacific Regional Fisheries Management Organization (SPRFMO) was created to manage

resources in the South Pacific and adopted the Convention on the Conservation and Management of the High Seas Fishery Resources of the South Pacific Ocean in Auckland, New Zealand (SPRFMO 2014; Figure 1.1-5).

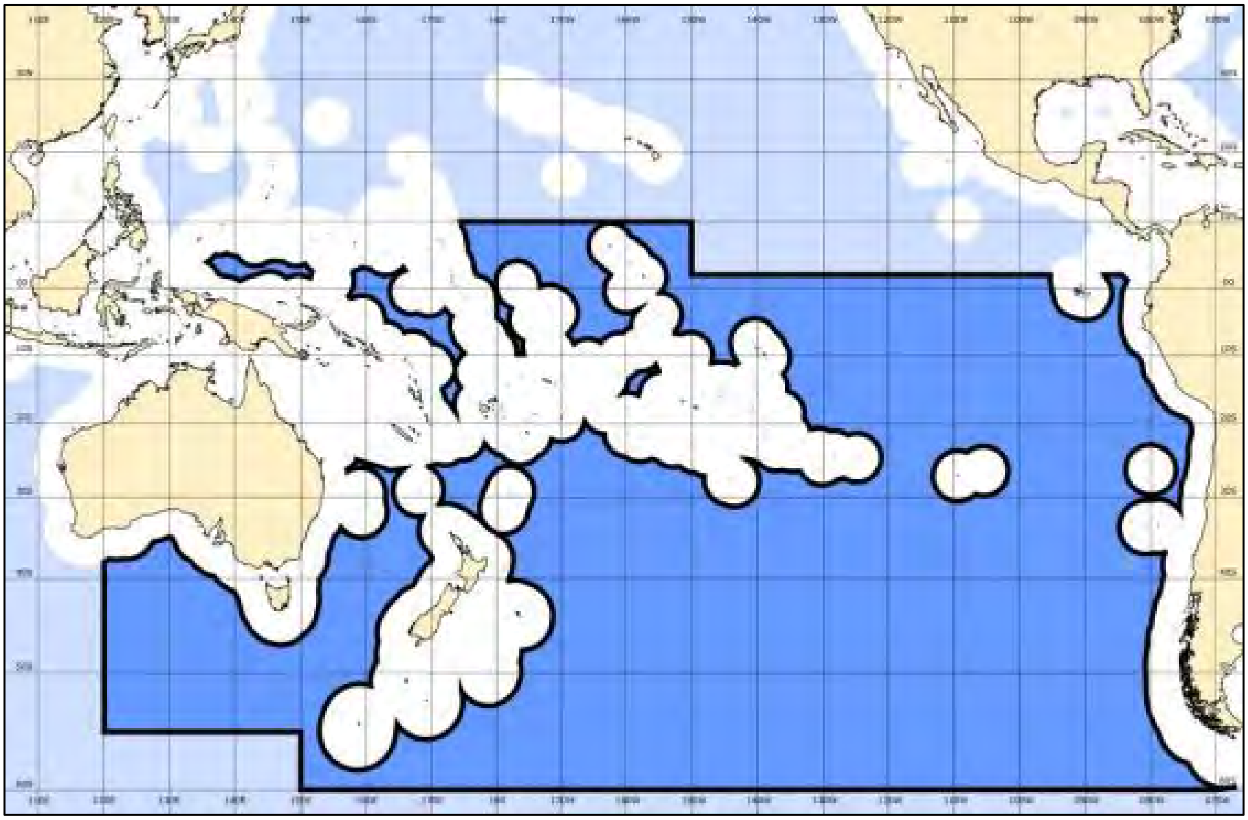

Figure 1.1-5 South Pacific Regional Fisheries Management Organization boundary map

1.1.3.5 Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean

In response to a growing concern of the international community over possible negative impacts of bottom fisheries activities on vulnerable marine ecosystems (VMEs) in the high seas, Japan, the Republic of Korea, the Russian Federation, and the U.S. began discussions regarding the management of the north western Pacific Ocean high seas bottom trawl fisheries. This area includes the Emperor Seamounts and Northern Hawaiian Ridge, which are proven fishing grounds for seamount groundfish (NPFC 2012; Figure 1.1-6).

In 2009, revised interim measures of the northwest Pacific Ocean were adopted. The objectives of the interim measures are the sustainable management of fish stocks and the protection of vulnerable marine ecosystems. While working on a long-term agreement to achieve the identified objectives the parties decided to limit fishing effort to the existing level and not to expand bottom fish fisheries into new areas (NPFC 2012).

In 2011, the 10th multilateral meeting to discuss the long-term agreement included Canada, China, Japan, Korea, Russia, the U.S., and Chinese Taipei. The meeting resulted in the adoption of interim management measures for the northeast Pacific Ocean and a completed draft of the English text of the Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean (NPFC 2012).

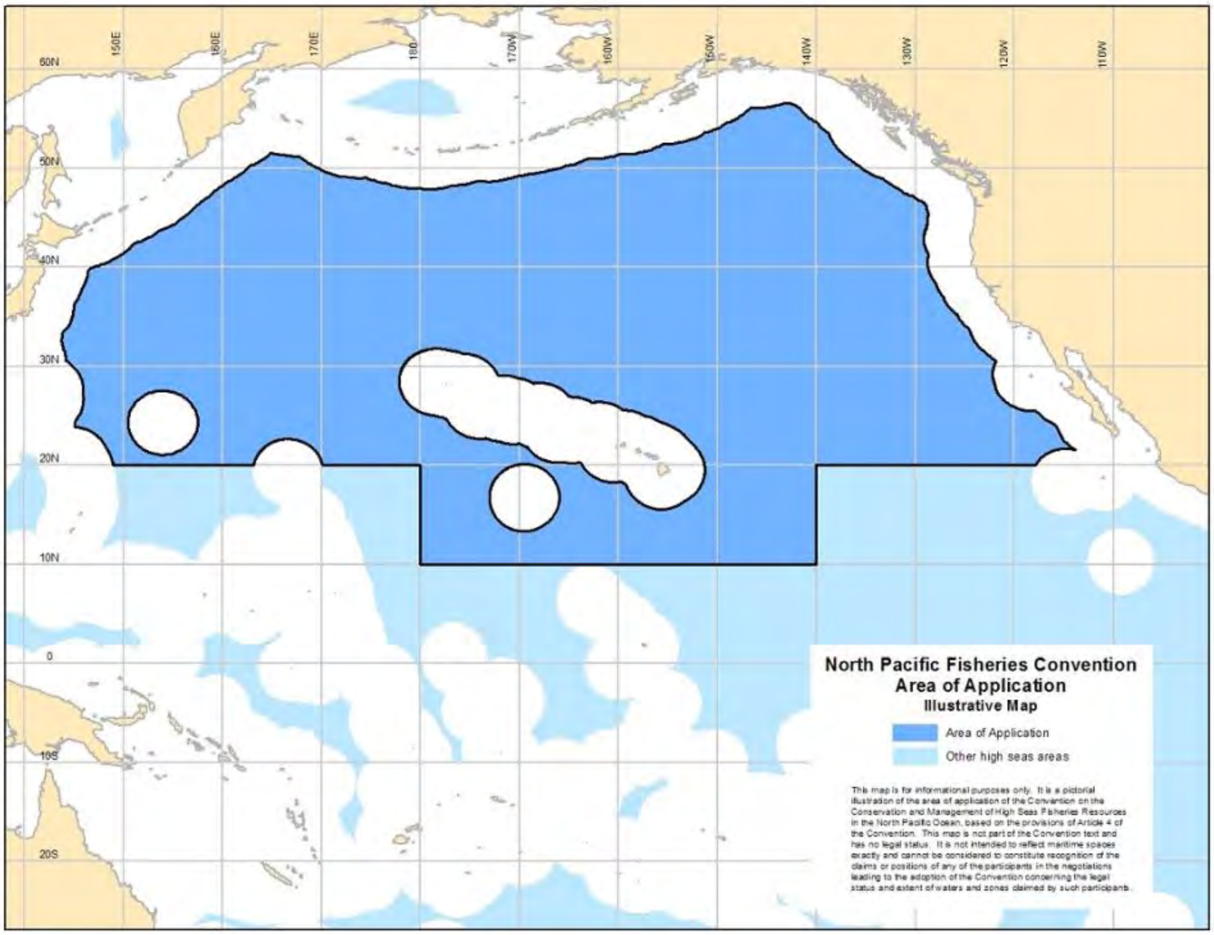

Figure 1.1-6 North Pacific Fisheries Convention Boundary Map

1.1.3.6 Inter-American Convention for the Protection and Conservation of Sea Turtles

The Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles is an intergovernmental treaty that provides the legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles.

The IAC was entered into force in May of 2001 and promotes the protection, conservation and recovery of sea turtles and those habitats on which they depend, on the basis of the best available data and taking into consideration the environmental, socioeconomic, and cultural characteristics of the Parties (NOAA 2012a).

The Convention represents a binding commitment by these parties to implement domestic measures to reduce threats to sea turtles. These measures include:

- Prohibition of deliberate take of sea turtles or their eggs
- Compliance with the Convention on International Trade in Endangered Species (CITES)
- Implementation of appropriate fishing practices and gear technology to reduce incidental take (bycatch) of turtles in all relevant fisheries
- Use of Turtle Excluder Devices (TEDs) on shrimp trawl vessels

- Designation of protected areas for critical turtle habitat
- Restriction of human activities that could harm turtles
- Promotion of sea turtle research and education

The treaty applies to all territorial waters of the contracting parties, encompassing the Pacific and Atlantic Oceans, including the Caribbean Sea and Gulf of Mexico. Of the six sea turtle species protected under the IAC, five occur in the Pacific Islands Region: Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), and the olive ridley turtle (*Lepidochelys olivacea*) (NOAA 2012a).

1.1.3.7 Inter-American Tropical Tuna Commission (IATTC)

The IATTC is an international organization that seeks to ensure the long-term conservation and sustainable use of all stocks of tunas and tuna-like species and other species of fish taken by vessels fishing for tunas and tuna-like species in the IATTC Area. The IATTC was first established under a 1949 Convention, and in 2003 a new Convention - the Convention for the Strengthening of the Inter-American Tropical Tuna Commission (commonly known as the "Antigua Convention") - was adopted by the parties to the IATTC, entering into force in 2010, to reflect modern developments in fisheries management including the UN Fish Stocks Agreement. The IATTC includes 20 nations (including the European Union), plus several cooperating non-parties. Its area includes most of the Pacific Ocean east of 150° W Longitude (Figure 1.1-7), including waters off the west coast states of California, Oregon and Washington, and encompasses significant U.S. fisheries, such as the troll fishery targeting albacore, and the Hawai‘i-based longline fishery which expends a portion of its effort within this Area. Through the IATTC, the United States is directly engaged in the development of management arrangements for the fisheries for which the IATTC is responsible, including measures to manage and conserve bigeye tuna and albacore. Through the West Coast Regional Office, PIFSC provides the ISC with data and advice on U.S. fisheries in the IATTC area, including catch of target, non-target, associated, and dependent species (NMFS 2012b).

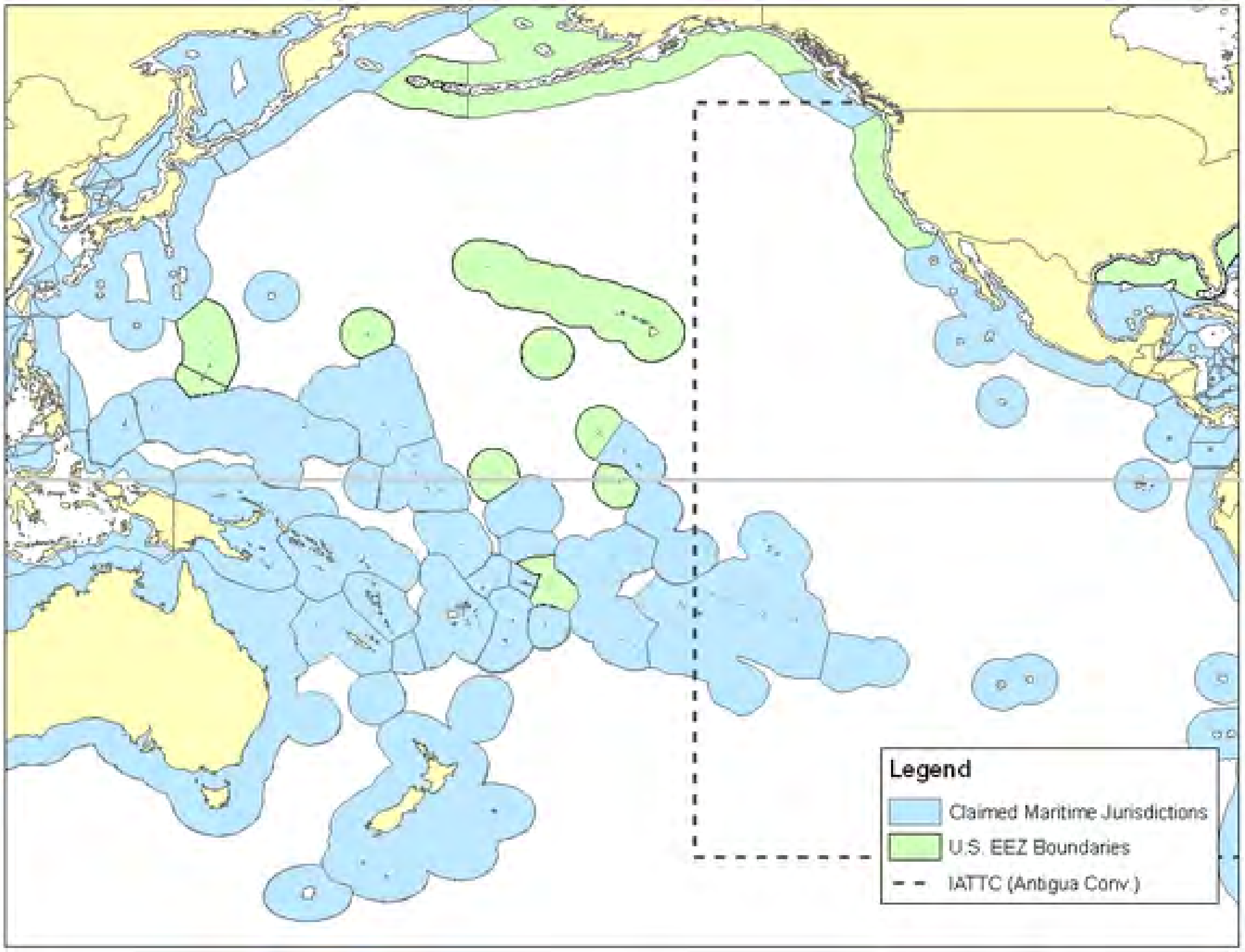

Figure 1.1-7 IATTC map

1.1.4 Role of Fisheries Research in Federal Fisheries Management

Domestic fisheries managers use a variety of techniques to manage fishery resources, a principal method being the development of FMPs or FEPs. These plans articulate fishery goals as well as the methods that will be used to achieve those goals, and their development is specifically mandated under the MSA. PIFSC provides scientific information and advice to assist with the development of FMPs or FEPs prepared by the WPRFMC, NPFMC, PFMC, and other agencies.

Through its Regional Fisheries Science Centers, NMFS conducts research on the status of living marine resources and associated habitats. More than most Science Centers, PIFSC conducts a great deal of fishery-dependent research and evaluation of fishery-dependent data to provide analyses of fishery dynamics and to understand factors affecting catch of non-target, associated, and dependent species (e.g. bycatch, and take of protected species). PIFSC also conducts fisheries-independent research designed and conducted independent of commercial fishing activity to meet specific research goals, including research directed by PIFSC scientists and conducted on board NOAA-owned and operated vessels or NOAA-chartered vessels. PIFSC also collaborates on fisheries-independent research with cooperating agencies and scientists conducted on board non-NOAA vessels.

PIFSC fisheries-dependent research includes research conducted on-board commercial or contracted fishing vessels during their fishing operations (e.g., cooperative research with the bottomfish fishery).

Fishery-independent research activities by PIFSC on commercial or contracted fishing vessels, which are not part of a FMP, FEP, or EFP whereby marine mammal and ESA-listed species take has been exempted or that complies with MMPA section 118 or an ESA incidental take statement, are evaluated within this DPEA (see Section 1.4).

Fishery-dependent research activities occurring on U.S. commercial fishing vessels associated with a fishery that has a valid FMP or EFP whereby marine mammal and ESA-listed species take has been exempted or that complies with MMPA section 118 or an ESA incidental take statement, as applicable, are not evaluated within this DPEA.

1.2 PIFSC FISHERIES RESEARCH AREAS AND FACILITIES

PIFSC is the research arm of NMFS in the Pacific Islands Region. Headquartered in Honolulu, Hawai‘i, PIFSC has taken a leading role in marine research on ecosystems, both in the insular and pelagic environments. Originally called the Honolulu Laboratory and part of the Southwest Fisheries Science Center for over 40 years, PIFSC became its own science center when the NOAA Fisheries Pacific Islands Region was established in 2003. PIFSC implements a multidisciplinary research strategy including scientific analysis and an ecosystem observation system to support an ecosystem based approach to the conservation management, and restoration of living marine resources. PIFSC conducts a wide range of activities including resource surveys and stock assessments, fisheries monitoring, oceanographic research and monitoring, critical habitat evaluation, life history and ecology studies, advanced oceanographic and ecosystem modeling and simulations, and economic and sociological studies (NOAA 2012c).

Effective May 3, 2015, PIFSC underwent a reorganization of its division structure to better represent the future research mission and more closely align with other NMFS offices. The new structure includes the Director’s Office, three research divisions (Ecosystem Sciences; Fisheries Research and Management; and Protected Species), and two administrative divisions (Operations, Management, and Information; and Science Operations). The former Coral Reef Ecosystem Divison, Ecosystem and Oceanography Division, and Socioeconomics Program were combined to form the Ecosystem Sciences Division. The Director’s Office is responsible for overall scientific leadership and research direction, program management, and operational policy.

1.2.1 Ecosystem Sciences Division

The Ecosystem Sciences Division (ESD) conducts multidisciplinary research, monitoring, and analysis of integrated environmental and living resource systems in coastal and offshore waters of the Pacific Ocean. Field research activities cover from near-shore island-associated ecosystems such as coral reefs, to open ocean ecosystems on the high seas. Research focus includes: oceanography, coral reef ecosystem assessment and monitoring, benthic habitat mapping, and marine debris research and removal. Analysis of the current structure and dynamics of marine environments, as well as examination of potential projections of future conditions such as those resulting from climate change impacts are assessed with use of numerical ecosystem models. Because humans are a key part of the ecosystem, the ESD includes research of the social and economic aspects of fishery and resource management decisions. The ESD also provides scientific and capacity building support to international organizations.

1.2.2 Fisheries Research and Monitoring Division

The Fisheries Research and Monitoring Division (FRMD) provides fisheries research and monitoring science to support fisheries management in the Pacific Islands Region. The Division's fisheries research activities include: investigations into target fish species' life history; production of assessments of population size and characteristics for target and non-target species; and research into methods to reduce bycatch of non-target species, including modifications to fishing gear and use of deterrent devices. The Division also monitors fishing activity in federal fisheries via logbook and compiles reports of these data,

as well as works with State of Hawaiʻi Hawaiʻi and Pacific Territorial agencies to enhance their fisheries monitoring efforts. The Division provides information about and findings from its fisheries research and monitoring activities to a variety of stakeholders, including the Western Pacific Regional Fishery Management Council (WPRFMC), RFMOs (conventions that govern catch of highly migratory species throughout the central and western Pacific), and participates in collaborations and fishing gear technology transfer with foreign nations and with non-governmental organizations.

1.2.3 Protected Species Division

The Protected Species Division (PSD) conducts scientific investigations which serve a basis for management decisions and actions to enhance the conservation and recovery of endangered Hawaiian monk seals, endangered and threatened sea turtles, whales, and dolphins. The Division is comprised of three programs: the Hawaiian Monk Seal Research Program, the Turtle Research Program, and the Cetacean Research Program. Research objectives for all three programs address species-specific topics designed to assess and monitor population trends, characterize biology and natural history, understand foraging ecology and movement patterns at sea, identify and investigate impediments to population growth, and build research capacities with other stakeholders. The Division also conducts community outreach and education activities to share information with stakeholders and promote the stewardship of protected species.

1.2.4 Science Operations Division

The Science Operations Division (SOD) provides the technical and logistical support necessary to carry out the PIFSC science mission in the field and the lab. SOD is composed of three complementary units: Program Coordination, Survey, and Technical Services. The Program Coordination unit is responsible for communicating science needs and plans in the Marine National Monuments of the Pacific. This includes working closely with research and management partners located in Hawaiʻi, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands. The Survey unit provides the hands-on operational and scientific support for field research using advanced sampling technologies while on ships and small boats. The Technical Services unit facilitates compliance of research activities with applicable environmental statutes and regulations, including NEPA and permits. Technical Services also facilitates document preparation for publication and maintains the research library facilities.

1.2.5 Operations, Management, and Information Division

The Operations, Management, and Information Division (OMID) provides support for strategic and annual operations planning; budget allocation and execution; FTE and human resources management (including EEO and diversity); administrative processes, data and information management information technology, e-mail and telecommunications systems; environmental compliance, safety and facilities management. Other functions include travel services, acquisition and grants, and all other administrative services in support of Center scientists.

1.3 PURPOSE AND NEED

Primary Action: This DPEA evaluates both a primary and a secondary action under the National Environmental Policy Act (NEPA). The primary action is the proposed implementation of PIFSC fisheries and ecosystem research activities for the next five years (as described above and in Section 2.2), or longer if the activities continue to be implemented as described in this document and the analysis of the environmental effects remains consistent and applicable with those activities. The purpose of this action is to produce scientific information necessary for the management and conservation of domestic and international living marine resources in a manner that promotes both the recovery and long-term sustainability of certain species and generates social and economic benefits from their use. The information derived from these research activities is necessary for the development of a broad array of

management actions for fisheries, marine mammal, and ecosystem management actions taken not only by NMFS, but also by other federal, state, and international authorities.

The ultimate goal of PIFSC fisheries and ecosystem research activities is to inform management of the region's fisheries to ensure that the exploited marine fish and invertebrate populations, and the associated fish, protected species, habitats, and ecosystems remain sustainable and healthy. In order to achieve this, PIFSC needs to continue its research activities through a suite of programs that generate the scientific information necessary for the conservation and management of the region's living marine resources.

Secondary Action: A secondary, related action - also called a "connected action" under NEPA (Sec. 1508.25) - is the issuance of proposed regulations and subsequent Letters of Authorization (LOA) under Section 101(a)(5)(A) of the MMPA of 1972, as amended (MMPA; 16 United States Code [U.S.C.] 1361 *et seq*.) that would govern the unintentional taking of small numbers of marine mammals incidental to PIFSC's research activities.

Under the MMPA, any activities resulting in the take of marine mammals must be authorized by NMFS; this includes research programs conducted by the NMFS science centers. Because PIFSC's research activities have the potential to take marine mammals by Level A and B harassment, serious injury or mortality, PIFSC is applying to NMFS for an incidental take authorization (ITA) for its research programs.

Section 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review. Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

Take, under the MMPA is defined as, "To harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines harassment as, "Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment]."

The purpose of issuing an ITA is to provide an exemption to the take prohibition in the MMPA and to ensure that the action complies with the MMPA and NMFS implementing regulations. ITAs may be issued as either: (1) regulations and associated LOAs under Section 101(a)(5)(A) of the MMPA; or (2) an Incidental Harassment Authorizations (IHAs) under Section 101(a)(5)(D) of the MMPA. An IHA can only be issued when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. In this specific action, because there is a potential for lethal takes and takes that may result in serious injury that could lead to mortality, PIFSC is requesting rulemaking and the issuance of LOAs for this action.

Pursuant to Section 101(a)(5)(A) of the MMPA, NMFS, upon application from PIFSC, may propose regulations to govern the unintentional taking of marine mammals incidental to the proposed fisheries research activities by PIFSC in the Pacific Island Region for the next five years. Because the issuance of MMPA incidental take regulations and associated LOAs to PIFSC are federal actions, NMFS is required to analyze the effects of the actions on the human environment pursuant to NEPA and NMFS NEPA procedures. As a result, one branch of NMFS (the Office of Protected Resources, Permits and

Conservation Division [NMFS PR1]) will evaluate the effects of issuing regulations and an ITA to another branch of NMFS (i.e. PIFSC).

This DPEA analyzes the environmental impacts associated with the requested authorization of the take of marine mammals, incidental to PIFSC's conduct of fisheries research activities in the Pacific Islands Region. It also analyzes a reasonable range of mitigation measures that may be required if NMFS issues an MMPA authorization. The analysis of mitigation measures includes a consideration of benefits to the affected species or stocks and their habitat, and an analysis of the practicability and efficacy of each measure. This analysis of mitigation measures could potentially be used to support requirements pertaining to mitigation, monitoring, and reporting specified in MMPA regulations and subsequent LOAs, if issued.

Further, because the proposed research activities occur in known habitat areas of species that are listed as threatened or endangered under the ESA[9], this DPEA evaluates potential impacts to ESA-listed species that may result from either the primary or secondary action. Likewise, because the proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as Essential Fish Habitat (EFH), this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the Magnuson-Stevens Act. PIFSC intends to use this DPEA as the basis for consultations with the appropriate offices and agencies in compliance with these and other applicable laws (Table 1.6-1).

1.4 SCOPE AND ORGANIZATION OF THIS DPEA

In considering the proposed action, NMFS is responsible for complying with a number of federal statutes, regulations, and executive orders, including NEPA. As such, the purpose of the DPEA is to provide an environmental analysis to support the NMFS proposal to continue the research activities under the requirements of a LOA and to encourage and facilitate public involvement in the environmental review process.

Under NEPA, a DPEA is prepared to describe the impacts that are likely to be caused by a proposed action on the human environment. If no potentially significant impacts are identified during preparation of the DPEA, a Finding of No Significant Impact (FONSI) is prepared to document the decision maker's determination and to approve the proposed action. If at any time during preparation of the DPEA it appears that significant impacts would result from the proposed action, the agency would halt development of the DPEA and begin preparing an Environmental Impact Statement (EIS) to more thoroughly evaluate the potential impacts and potential ways to reduce or mitigate those impacts. Thus, while the DPEA objectively evaluates the full extent of potential impacts of a proposed action (from minor to major, adverse or beneficial, short-term to long-term – see discussion below), the FONSI provides the decision maker's rationale with regard to the significance of those impacts.

This DPEA provides a programmatic-level assessment of the potential impacts on the biological and human environments associated with the proposed PIFSC research programs. A programmatic approach is used when initiating or reevaluating a federal program for NEPA compliance. It evaluates many issues, activities, and alternatives (compared to documents for a specific project or action), and provides a baseline for future management actions. The intent of this DPEA is to describe in sufficient detail all of PIFSC project-specific fisheries and fisheries-related ecosystem research activities (i.e., surveys) for the next five years. Programmatic documents are often intended to provide NEPA compliance for management and other activities over a fixed period before a formal review is again initiated.

This DPEA assesses not only the potential direct and indirect impacts of the alternatives presented to the physical, biological, and socioeconomic systems in PIFSC's area of responsibility, but also the potential impacts of the management processes that are used to monitor the health of the resources, develop plans

[9] 16 U.S.C. §1531 *et seq*.

to manage the resources to balance recovery goals and socioeconomic goals, and ensure the sustainability of the resources and affected fishing communities.

The chapters that follow describe the proposed research activities and potential alternatives considered (Chapter 2), the affected environment as it currently exists (Chapter 3), the probable direct and indirect consequences on the human environment that may result from the implementation of the proposed research activities and their alternatives (Chapter 4), and the potential contribution to cumulative impacts from the proposed activities and their alternatives (Chapter 5).

The scope of this DPEA covers research activities conducted by PIFSC or its partners that:

- Contribute to fishery management and ecosystem management responsibilities of NMFS under U.S. law and international agreements.
- Take place in marine waters in the Hawaiian Archipelago Research Area, the Mariana Archipelago Research Area, the American Samoa Archipelago Research Area, and the Western and Central Pacific including the Pacific Remote Islands Research Area (see Figure 1.1-2).
- Involve the transiting of these waters in research vessels, observational surveys made from the deck of those vessels (e.g., marine mammal and seabird transects), the deployment of fishing gear and scientific instruments into the water in order to sample, collect specimens, and monitor living marine resources and their environmental conditions, or use active acoustic devices for navigation or remote sensing purposes.
- Have the potential to interact adversely with marine mammals and protected species of fish, sea turtles, birds, and invertebrates. However, the research activities covered under this DPEA involve only *incidental* interactions with protected species, not *intentional* interactions with those species.
- The primary focus of this DPEA is on fisheries research but also includes fisheries-related ecosystem research (i.e., collection of data necessary to understand the habitats and ecosystem processes that affect fisheries). These other types of surveys are also included because they deploy gear and instruments similar to those used in fisheries research, from similar research platforms (e.g., vessels), and in the same areas.

This DPEA does NOT cover:

- Directed research on protected species, such as studies involving intentional capture of marine mammals for tagging and tissue sampling, which require directed scientific research permits. Directed research on protected species is covered by other environmental review processes and consultations under applicable regulations. However, this DPEA does include some research activities that have associated ESA section 10 permits for research involving ESA-listed species. Such directed research permits may not cover unintentional effects on other protected species, e.g., marine mammals, which is a focus of this DPEA.
- The potential effects of research conducted by scientists in other NMFS Science Centers.
- Other activities of PIFSC that do not involve the deployment of vessels or gear in marine waters, such as evaluations of socioeconomic impacts related to fisheries management decisions, taxonomic research in laboratories, fisheries enhancements such as hatchery programs, and educational outreach programs.
- Other fisheries research programs conducted and funded by other agencies, academic institutions, non-governmental organizations, and commercial fishing industry research groups without material support from PIFSC.

In the future, additional research activities may propose to use methods that were not considered in the evaluation of impacts in this DPEA. Some of these proposed projects may require further environmental impact assessment or satisfaction of other consultation, approval, or permitting requirements before being allowed to proceed (see also Section 2.3.2). In particular, proposed projects that may impact protected species and require permits under the ESA or the MMPA may require individual NEPA analyses and decisions tiered off this DPEA. Under NEPA, tiering refers to development of subsequent NEPA analyses that incorporate by reference and build on prior NEPA analyses. A programmatic NEPA approach is especially conducive to NEPA tiering. As the details of any such studies are presently unavailable, they cannot be assessed here. After new projects are sufficiently well defined and their potential environmental consequences are better understood, specific impacts will be evaluated as necessary. If the proposed new research activities are not within or similar to the range of alternatives addressed in the programmatic document and may have adverse environmental impacts that are not within the scope of the analysis in this DPEA, additional NEPA review would be required.

In developing this DPEA, NMFS adhered to the procedural requirements of NEPA; the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508)[10], and NOAA's procedures for implementing NEPA[11].

The following definitions will be used to characterize the nature of the various impacts evaluated with this DPEA:

- Short-term or long-term impacts. These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.
- Direct or indirect impacts. A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a stream might include sediment-laden waters in the vicinity of the action, whereas an indirect impact of the same erosion might lead to lack of spawning and result in lowered reproduction rates of indigenous fish downstream.
- Minor, moderate, or major impacts. These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in CEQ regulations (40 CFR 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.
- Adverse or beneficial impacts. An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the manmade or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.
- Cumulative impacts. CEQ regulations implementing NEPA define cumulative impacts as, "Impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency

[10] See Reference (CEQ 1969).

[11] NOAA Administrative Order (NAO) 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act.

(federal or non-federal) or person undertakes such other actions." (40 CFR 1508.7) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

PIFSC has initiated discussions with Native Hawaiian Organizations and the State Historic Preservation Offices (SHPOs) in Hawaiʻi, Guam, American Samoa, and American Samoa in order to identify historic sites that may be affected by the proposed fisheries research activities (Appendix X [copy of letter requesting to initiate discussions).

The proposed PIFSC research activities are not expected to result in impacts to public health or safety because the research activities would be conducted in accordance with NOAA safe work environment standards (29 CFR 1960). These issues are not considered further in this assessment.

1.5 PUBLIC REVIEW

Public participation is a cornerstone of the NEPA process. In preparing EAs, federal agencies must involve environmental agencies, applicants, and the public to the extent practicable (40 CFR Sec. 1501.4 [b]). Following guidance for public review of EAs in NOAA Administrative Order 216-6 (Sections 5.02b.1 and 5.03e.2), this DPEA and the associated LOA application will be available for public review on the PIFSC web site, and notice of the availability of the DPEA will be published in the *Federal Register*. Public comments received on this draft DPEA will be addressed in the Final PEA.

1.6 REGULATORY REQUIREMENTS

NMFS is the lead federal agency for the proposed research activities evaluated in this DPEA. These activities trigger a broad range of regulatory compliance processes because they may cause both adverse impacts to public resources regulated by various statutes, and contribute to reducing impacts caused by other activities, such as fishing, that are also regulated by those same statutes. Chapters 4 and 5 assess the impacts of the research activities on protected species and habitat. Because the research activities are essential for NMFS to carry out its regulatory mandates, Chapters 4 and 5 also describe potential impacts to NMFS' ability to effectively monitor and manage fishery resources under the alternatives evaluated. Descriptions of the relevant statutory requirements are provided in Chapter 6, "Applicable Laws."

Table 1.6-1, below, presents a brief summary of some of these laws. This information is provided to aid the reader in understanding the material presented later in the DPEA and is not intended to be a complete listing of all applicable statues, orders or regulations applicable to the proposed action and alternatives.

Table 1.6-1 Applicable Laws and Treaties

Law	Description
National Environmental Policy Act (NEPA)	Requires federal agencies to evaluate potential environmental effects of any major planned federal action and promotes public awareness of potential impacts by requiring federal agencies to prepare an environmental evaluation for any major federal action affecting the human environment.
Magnuson-Stevens Fishery Conservation and Management Act (MSA)	Authorizes the U.S. to manage fishery resources in an area from a state's territorial sea (extending 3 nm from shore) to 200 nm off its coast (termed as the EEZ). Includes 10 national standards to promote domestic commercial and recreational fishing under sound conservation and management principles, and provide for the preparation and implementation of fishery management plans (FMPs).
Marine Mammal Protection Act (MMPA)	Prohibits the take of marine mammals in U.S waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the U.S. Allows, upon request, the "incidental," but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing).

Law	Description
International Dolphin Conservation Program Act (IDCPA)	The International Dolphin Conservation Program Act (IDCPA) was a 1997 amendment to the U.S. MMPA. It provides for the U.S. implementation of the international Agreement on the International Dolphin Conservation Program (IDCP), to which the U.S. is a signatory.
Endangered Species Act (ESA)	Provides for the conservation of endangered and threatened species of fish, wildlife, and plants throughout all or a significant portion of their range, and the conservation of the ecosystems upon which they depend. Administered jointly by NMFS and the USFWS.
Migratory Bird Treaty Act (MBTA)	Protects approximately 836 species of migratory birds from any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof, unless permitted by regulations.
Fish and Wildlife Coordination Act (FWCA)	Requires USFWS and NMFS to consult with other state and federal agencies in a broad range of situations to help conserve fish and wildlife populations and habitats in cases where federal actions affect natural water bodies.
National Marine Sanctuaries Act (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, archeological, educational, or esthetic qualities as national marine sanctuaries. Section 304(d) of the NMSA requires interagency consultation between the NOAA Office of National Marine Sanctuaries (ONMS) and federal agencies taking actions that are “likely to destroy, cause the loss of, or injure a sanctuary resource.”
Tuna Conventions Act Of 1950	Provides for U.S. representation on the Inter-American Tropical Tuna Convention (IATTC). The principal duties of the IATTC are (1) to study the biology of the tropical tunas, tuna baitfish, and other kinds of fish taken by tuna vessels in the eastern Pacific Ocean and the effects of fishing and natural factors upon them, and (2) to recommend appropriate conservation measures, when necessary, so that these stocks of fish can be maintained at levels which will afford the maximum sustained catches.
National Historic Preservation Act (NHPA)	Section 106 requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties.
Executive Order (EO) 12989, Environmental Justice	Directs federal agencies to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law.
Coastal Zone Management Act (CZMA)	Encourages and assists states in developing coastal management programs. Requires any federal activity affecting the land or water use or natural resources of a state's coastal zone to be consistent with that state's approved coastal management program.
Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean	The convention establishes an international commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, now more commonly referred to as the Western and Central Pacific Fishery Commission (WCPFC). A noteworthy aspect of the convention is the fact that it will exercise management control into the high seas zones outside national EEZs in contrast to some other regional fishery management organizations.
High Seas Fishing Compliance Act	The United Nations Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas establishes the responsibility of each nation for the actions of vessels fishing under that nation’s flag on the high seas. The High Seas Fishing Compliance Act (HSFCA) is the domestic legislation enacted in 1995 to provide authority to the Secretary of Commerce to implement this agreement.
South Pacific Tuna Treaty (SPTT)	The 1987 Multilateral Fisheries Treaty with the U.S. in the Forum Fisheries Agency is a vital component of the political and economic relationship between the U.S. and the Pacific Island Parties. The treaty entered into force in 1987 for an initial period of five years. It has since been extended twice; the most recent extension is for 2003 through 2013. The treaty sets the operational terms and conditions for the U.S. tuna purse seine fleet to fish in a vast area of the central and western Pacific Ocean, including waters under the jurisdiction of the Pacific Island Parties.

Law	Description
The Antiquities Act of 1906	The Antiquities Act of 1906 authorizes the President to proclaim national monuments on federal lands that contain "historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest." The President is to reserve "the smallest area compatible with the proper care and management of the objects to be protected." (16 U.S.C. § 43)
Executive Order (EO) 12114, Environmental effects aboard of major Federal Actions	EO 12114, Environmental Effects Abroad of Major Federal Actions, requires federal agencies to assess whether federal actions have the potential to "significantly affect" the environment of the global commons or the environment of a foreign nation not participating with the United States or "otherwise involved in the action."
Western and Central Pacific Fisheries Commission (WCPFC)	The WCPFC is an international organization that aims to ensure the long-term conservation and sustainable use of highly migratory fish stocks (i.e., tunas, billfishes, and associated species) in the western and central Pacific Ocean. The WCPFC Convention seeks to address problems in the management of high seas fisheries resulting from unregulated fishing, over-capitalization, excessive fleet capacity, vessel re-flagging to escape controls, insufficiently selective gear, unreliable databases and insufficient multilateral cooperation in respect to conservation and management of highly migratory fish stocks.
International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)	The ISC was established in 1995 to develop better information on stocks of tuna and tuna-like species in the North Pacific Ocean in cooperation with relevant fisheries organizations, to enhance scientific knowledge of these stocks throughout their entire range.
South Pacific Regional Fisheries Management Organization (SPRFMO)	The South Pacific Regional Fisheries Management Organization is an inter-governmental organization that is committed to the long-term conservation and sustainable use of the fishery resources of the South Pacific Ocean and in so doing safeguarding the marine ecosystems in which the resources occur.
Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles	The IAC for the Protection and Conservation of Sea Turtles is an intergovernmental treaty that provides the legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles. The IAC was entered into force in May of 2001 and promotes the protection, conservation and recovery of sea turtles and those habitats on which they depend, on the basis of the best available data and taking into consideration the environmental, socioeconomic, and cultural characteristics of the Parties.

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2.1 INTRODUCTION

The Council on Environmental Quality (CEQ) is responsible for the development and oversight of regulations and procedures implementing the National Environmental Policy Act (NEPA). The CEQ regulations provide guidance for federal agencies regarding NEPA's requirements (40 Code of Federal Regulations [CFR] Part 1500). National Oceanic and Atmospheric Administration (NOAA) has also prepared environmental review procedures for implementing NEPA, NOAA Administrative Order 216-6 (NAO 216-6). Section 5.03b of NAO 216-6 states: "An Environmental Assessment [EA] must consider all reasonable alternatives, including the preferred action and the no action alternative." To warrant detailed evaluation by the National Marine Fisheries Service (NMFS), an alternative must be reasonable[12] and meet the purpose and need (see Section 1.3). Screening criteria are used to determine whether an alternative is reasonable and should be considered further or whether it is not reasonable to consider in detail in the EA. Section 2.6 describes potential alternatives that were considered but rejected because they do not meet the purpose and need of the proposed action.

Screening Criteria – To be considered 'reasonable' for the purposes of this Draft Programmatic Environmental Assessment (DPEA), an alternative must meet the following criteria:

1. The action must not violate any federal statute or regulation.
2. The action must be consistent with reasonably foreseeable funding levels.
3. The action must be consistent with long-term research commitments and goals to maintain the utility of scientific research efforts, or consider no federal funding availability for fisheries research.

To maintain the utility of scientific research efforts, fisheries and marine ecosystem scientific research should fulfill the following requirements:

1. Methods and techniques must provide standardized, objective, and unbiased data consistent with past data sets (time series) in order to facilitate long-term trend analyses.
2. Collected data must adequately characterize living marine resource and fishery populations and the health of their habitats.
3. The surveys must enable assessment of population status and provide predictive capabilities required to respond to changing ecosystem conditions and manage future fisheries.
4. Research on new methodologies to collect fisheries and ecosystem information (e.g., active and passive acoustic instruments and video surveys of benthic habitats in lieu of dredge gear or bottom trawls), and research oriented toward modifications of fishing gear to address bycatch or other inefficiencies must be conducted with experimental controls sufficient to allow statistically valid comparisons with relevant alternatives.

NMFS evaluated each potential alternative against these criteria and requirements. Based on this evaluation, the No-Action/Status Quo alternative and two other action alternatives were identified as reasonable and are carried forward for more detailed evaluation in this DPEA. NMFS also evaluates a second type of no-action alternative that considers no federal funding for fisheries research activities. This alternative is called the No Research Alternative to distinguish it from the No-Action/Status Quo alternative.

[12] "Section 1502.14 (NEPA) requires the EA/Environmental Impact Statement (EIS) to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are *practical or feasible from the technical and economic standpoint and using common sense*, rather than simply desirable from the standpoint of the applicant." (40 Questions) (emphasis added)

The No-Action/Status Quo Alternative is used as the baseline for comparison of the other alternatives. Three of the alternatives include fisheries and ecosystem research projects conducted or funded by the Pacific Islands Fisheries Science Center (PIFSC) as the primary federal action. These three alternatives also include suites of mitigation measures intended to avoid and minimize potentially adverse interactions with protected species. Protected species include all marine mammals, which are covered under the Marine Mammal Protection Act (MMPA), all species listed under the Endangered Species Act (ESA), and bird species protected under the Migratory Bird Treaty Act (MBTA).

The three alternatives involving research activities in the marine environment trigger marine mammal protection requirements under the MMPA. For this reason, NMFS must evaluate the alternatives to ensure that they would fulfill the purpose and need of NMFS issuing regulations and subsequent Letters of Authorization (LOA) under Section 101(a)(5)(A) of the MMPA to PIFSC, which is the secondary federal action considered in this DPEA. The LOA, if issued, would provide an exception to PIFSC from the take prohibitions for marine mammals under the MMPA, incidental to the conduct of PIFSC's research activities, namely: (1) the issuance of an LOA for the take of marine mammals by Level A and Level B harassment, and by serious injury or mortality incidental to the PIFSC's conduct of research activities for a five-year-long period of time; and (2) compliance with the MMPA which sets forth specific findings (e.g., no unmitigable adverse impact on the availability of a species or stock for subsistence uses, negligible impact on a species or stock, reporting, monitoring, and mitigation requirements) that must be made in order for NMFS to issue an LOA. In order to authorize incidental take of marine mammals under the MMPA, NMFS must identify and evaluate a reasonable range of mitigation measures to minimize impacts to marine mammals to the level of least practicable adverse impact. This range of mitigation measures has been incorporated as part of the identified alternatives in order to evaluate their ability to minimize potential adverse environmental impacts. The efficacy and practicability of all potential mitigation measures are assessed in Chapter 4.

Further, because the proposed research activities occur in known habitat areas of species that are listed as threatened or endangered under the ESA, this DPEA evaluates potential impacts to ESA-listed species that may result from either the primary or secondary action. Likewise, because the proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as Essential Fish Habitat (EFH), this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the Magnuson-Stevens Act.

Additionally, PIFSC research activities include several international fisheries technology research programs, including bycatch reduction research projects, that take place outside of U.S. jurisdiction, in foreign territorial seas. Under EO 12114, Environmental Effects Abroad of Major Federal Actions, Department of Commerce DAO 216-12, and NAO 216-6 Section 7, NMFS is required to consider the environmental effects of federal action outside of the U.S. Because these international fisheries technology research programs, including bycatch reduction research projects, are not being evaluated under NEPA, they will be considered separately from the NEPA alternatives in this DPEA, and are described in Section 2.7 at the end of this chapter. In compliance with EO 12114, this Draft Programmatic Environmental Assessment will describe and analyze the potential effects of the proposed action and alternatives on the environment outside of the U.S. Federal actions may be exempt from this EO if the action will not have a significant effect on the environment outside of the U.S. as determined by the agency (EO 12114, Section 2-5), or if the action is carried out with participation from the foreign nation (EO 12114, Section 2-3(b)).

2.2 ALTERNATIVE 1 – NO-ACTION/STATUS QUO ALTERNATIVE - CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH WITH SCOPE AND PROTOCOLS SIMILAR TO PAST EFFORT

As discussed in Chapter 1, PIFSC collects a wide array of research data necessary to evaluate the status of fishery resources and the marine environment. PIFSC scientists conduct fishery-independent research onboard NOAA owned and operated vessels or on chartered vessels in four geographic research areas. The Hawaiian Archipelago Research Area (HARA), the Mariana Archipelago Research Area (MARA), and the American Samoa Archipelago Research Area (ASARA) extend approximately 24 nm from the baseline of the respective archipelagos (i.e., to approximately the outer limit of the contiguous zone[13]). The fourth research area, the Central and Western Pacific Ocean, including the Pacific Remote Island Areas, Research Area (WCPRA), includes the remainder of the archipelagic U.S. EEZs, the Central and Western Pacific Ocean between the archipelagos and certain political boundaries (e.g., regional fisheries management organizations), and the waters around the Pacific remote islands. Figure 1.1-2 shows the latitude and longitude boundaries of these research areas.

PIFSC also designs and executes a limited number of surveys onboard commercial fishing vessels (activities occurring on U.S. commercial fishing vessels associated with a fishery that has a valid FMP or EFP whereby marine mammal and ESA-listed species take has been exempted or that comply with MMPA section 118 or an ESA incidental take statement, as applicable, would be outside the scope of this DPEA). In those instances, PIFSC scientists contract commercial vessels to conduct a research project in the context of the existing fishery. Under the Status Quo Alternative, PIFSC would administer and conduct 20 survey programs over the next five year period, as described in Table 2.2-1. Unless specifically noted under the survey descriptions in Table 2.2-1, the status quo research described below is also included in the Preferred Alternative (Table 2.3-1).

Table 2.2-1 is a summary of regularly occurring PIFSC surveys conducted on NOAA, University of Hawaiʻi, and chartered vessels. These surveys are likely to continue during the next five years, although not necessarily every year. The Pacific Islands Region is a vast geographic area, several times the size of the continental U.S. Consequently, it is impossible to carry-out all of the research surveys in all of the research areas every year. As a result, research surveys are generally focused on one research area every year and that research area is visited every second, third, or fourth year. Over the course of five years, this research cycle could be presented as HARA-ASARA-MARA-WCPRA-HARA. This cycle inherently includes some overlap of any one research area (e.g., Wake Atoll in the WCPRA is usually visited when the ship is transiting to MARA because it is on the way and makes for the most cost-efficient model). Furthermore, a specific survey may be prioritized every year, for several years in a row, in one research area because of a defined management need. Because the ships and headquarters for PIFSC are based in Hawaiʻi, the HARA is visited more frequently than the other research areas. In addition, for any particular year only some of the surveys are funded and carried out. The sum of all the proposed Days-at-Sea (DAS) for the all the surveys listed in Table 2.2-1 is over 700 days. The projected DAS numbers in the table represent a best case scenario and are often carried out in fewer days. Furthermore, many of these surveys are overlapping (e.g., RAMP and Benthic Habitat Mapping can occur at the same time on the same ship), are specific to one research area (e.g., Mariana Resource Survey) and therefore carried out every third year, alternate with another survey (e.g., Kona IEA and Pelagic Oceanographic Survey), can occur independent of the NOAA white ships (e.g., small boat-based surveys that launch from land), and every survey is subject to available funding. In recent years the DAS was funded at approximately 150 DAS for the *Oscar Elton Sette* and 130 DAS for the *Hiʻialakai*. These DAS numbers include transit times and gear testing, which are not days in which research surveys are usually conducted.

[13] Presidential Proclamation 7219 extended the U.S. contiguous zone from 12 to 24 nautical miles on September 2, 1999.

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Table 2.2-1 Summary Description of PIFSC Research Activities Conducted or Funded under the Status Quo Alternative

See Appendix A for descriptions of the different gear types and vessels used. Equivalent research vessels may be used in the future for specific research activities depending on availability. Appendix B includes figures showing the spatial coverage of each survey by season. Mitigation measures are described in Section 2.2.1. Units of measurement are presented in the format data was collected.

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Sampling Pelagic Stages of Insular Fish Species	Results of sampling inform life history and stock structure studies for pelagic larval and juvenile stage specimens of insular fish. Additional habitat information is also collected. Target species are snapper, grouper, and coral reef fish species within the 0-175 m depth range. Pelagic stages sampling is conducted both at midwater depths using a “Stauffer” modified Cobb trawl (Cobb trawl) or a 10-foot Isaacs-Kidd trawl, and at the surface using a 6-foot Isaacs-Kidd trawl. Surveys may occur every year in the HARA, but approximately once every three years in the MARA, ASARA, and WCPRA.	HARA MARA ASARA WCPRA 3-200 nautical miles (nm) from shore	Year-round HARA: up to 20 Days at Sea (DAS) MARA, ASARA, WCPRA: up to 30 DAS approximately once in research area every three years Midwater Research trawls are conducted at night, Surface trawls are conducted day and night	NOAA Ship *Oscar Elton Sette* or equivalent vessel	Cobb trawl (midwater trawl) with OES Netmind or Isaacs-Kidd 10-foot (ft) midwater trawl	Tow speed: 2.5-3.5 knots (kts) Duration: 60-240 minutes (min) Depth: Deployed at various depths during same tow to target fish at different water depths, usually to 250 meters (m)	40 tows per survey per year
					Isaacs-Kidd 6-ft trawl (surface atrawl) Dip net (surface)	Tow speed: 2.5-3.5 kts Duration: 60 min Depth: Surface	40 tows per survey per year
Spawning Dynamics of Highly Migratory Species	Early life history studies provide larval stages for population genetic studies and include the characterization of habitat for early life stages of pelagic species. Egg and larval collections are taken in surface waters using a variety of plankton gear, primarily Isaacs-Kidd 6-foot surface trawl, but also sometimes including 1-meter ring net and surface neuston net.	HARA MARA ASARA WCPRA 1-25 nm from shore	Year-round HARA: up to 25 DAS MARA, ASARA, WCPRA: up to 25 DAS approximately once in research area every three years Surface trawls are conducted day and night	*Oscar Elton Sette* or equivalent vessel, Small boats	Isaacs-Kidd 6-foot (surface)	Tow speed: 2.5-3.5 kts Duration: 60 min Depth: Surface	140 tows per survey per year
					Neuston tows (surface) 1-m ring net (surface)	Tow Speed: 2.5-3.5 kts Duration: 30-60 min Depth: 0-3 m	140 tows per survey per year
Cetacean Ecology Assessment *(Under the Preferred Alternative this survey would include midwater trawling with the Cobb net)*	Survey transects conducted in conjunction with cetacean visual and acoustic surveys within the Hawai‘i EEZ to develop ecosystem models for cetaceans. Sampling includes active acoustics to determine relative biomass density of sound scattering layers; trawls to sample within the scattering layers; cetacean observations; surface and water column oceanographic measurements and water sample collection.	HARA MARA ASARA WCPRA	Variable timing, depending on ship availability, up to 90 DAS Usually conducted in non-winter months Midwater trawls are conducted at night, Surface trawls are conducted day and night All other gear and instruments are conducted day and night	*Oscar Elton Sette*, small boats, contract fishing vessels	Small-mesh towed net (surface trawl)	Tow Speed: 2.5-3.5 kts Duration: 30-60 min	180 tows total per year
					Active acoustics (splitbeam Simrad EK60)	38-200 kHz	Intermittent continuous during surveys
					Acoustic Doppler Current Profiler (ADCP) (RD Instruments Ocean Surveyor 75)	75 kHz	Intermittent continuous during surveys
					Conductivity, temperature, depth (CTD) profiler	90 min. Profiles from surface down to 1000 m depth	Up to 180 per survey per year)
					Expendable bathythermograph (XBT)	10 min. duration. Profiles from surface down to1000 m depth	Maximum 900 per survey per year
	<u>*Passive Acoustics Calibration*</u> - Transmit sound (synthetic pings, dolphin whistles or echolocation clicks, etc.) to passive acoustic recording devices for purposes of in-situ calibration, needed to understand detection distances and received level or frequency-dependent variation in the device performance.	HARA MARA ASARA WCPRA			Underwater sound playback system (Lubell LL916 piezoelectric underwater speaker)	Includes underwater projector and amplifier suspended from small boat or ship. Projection depth may vary from near surface to 100 m.	Intermittent

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
	Stationary Passive Acoustic Recording - Placement of long-term acoustic listening devices for the purposes of recording cetacean occurrence and distribution, ambient and anthropogenic noise levels, and presence of other natural sounds. Recorders are typically deployed and retrieved once or twice per year at each monitoring location.	HARA MARA ASARA WCPRA			High-frequency acoustic recording package (HARP), ecological acoustic recorder (EAR), or similar device	Deployed in seafloor package or mooring configuration consisting of recorder, acoustic releases, anchor and flotation	Up to ten long-term monitoring sites
	Passive Acoustic Monitoring - Deployment of passive acoustic monitoring devices in conjunction with other sampling measures, such as on fishing gear or free-floating.	HARA MARA ASARA WCPRA			Miniature HARPs, sonobuoys, or similar platforms	Autonomous recorder package modified for attachment to longline gear, oceanographic mooring, or free-floating. Various configurations may have surface buoys with recorder up to 1000 ft below, or may have smaller form factor with entire package not exceeding 1m length.	Continuous
	Passive Acoustic or Oceanographic Gliders - Autonomous underwater vehicles used for sub-surface profiling and other sampling over broad areas and long time periods. Passive acoustic device integrated into the vehicle provide measure of cetacean occurrence and background noise. CTD, pH, fluorometer, and other sensors provide oceanographic measures over several months duration.	HARA MARA ASARA WCPRA			Seaglider; WaveGlider; or similar platform	Autonomous underwater vehicle. Buoyancy driven glider profile from surface to pilot-controlled depth (up to 1000 m), Inertial vehicles driven by wave-action have surface float with solar panels and communication antennas with sub-surface sled carrying sensors 5-20 m below surface.	Continuous
Marine Debris Research and Removal *(Preferred Alternative expanded to include net tows and Unmanned Aerial Systems (UAS) gear, and to include all research areas)*	These surveys: (1) identify and assess the types and locations of marine debris (e.g., derelict fishing gear) in the marine environment and along the shoreline; and (2) conduct targeted removals at high-priority sites. Team members systematically survey reefs using shoreline walks, swim surveys, and towed-diver surveys to locate submerged derelict fishing gear in shallow water. Debris type, size, fouling level, water depth, GPS coordinates, and substrate of the adjacent habitat are recorded. Nets are evaluated before removal actions to determine appropriate removal strategies. Attempts to remove marine debris encountered at sea are variable and can be unfeasible because of operational, vessel, or safety constraints. However, by attaching a satellite-tracked marker to debris, it will be possible to locate that debris in the future and to track and analyze its drifting patterns.	HARA ASARA	HARA: annually or on an as needed basis, up to 30 DAS ASARA: Occurred once in 2009 after a tsunami Surface trawls are conducted day and night UAS are conducted during the day or night In-water and beach activities are conducted during the day	NOAA Ship *Hi'ialakai,* *Oscar Elton Sette*, or equivalent vessel Small boats	Knives, lift bags, scissors, shovels, cargo nets Helicopters (Main Hawaiian Islands only)	Gear used to a depth of 30 m in around islands and atolls.	HARA: average of 48 metric tons per survey per year 1996 - 2013 ASARA: 4 metric tons per survey per year
Coral Reef Benthic Habitat Mapping	Produces comprehensive digital maps of coral reef ecosystems using multibeam sonar surveys and optical validation data collected using towed vehicles and AUVs.	HARA MARA ASARA WCPRA	Year-round, up to 30 DAS Day and night	*Oscar Elton Sette*, *Hi'ialakai*, or equivalent vessel Small boats	Active acoustics (will vary by vessel): Multibeam Simrad EM3002 D and EM300, multibeam Reson 8101 ER, Imagenex 837 DeltaT, split-beam Simrad EK60	18-300 kilohertz (kHz)	Continuous

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Deep Coral and Sponge Research	Research includes opportunistic surveys on distribution, life history, ecology, abundance, and size structure of deep corals and sponges using ROV, divers, and submersibles. Besides visual surveys, sampling protocols include collection of coral and sponges for genetic, growth and reproductive work and an array of data loggers (temperature, currents, particulate load) placed on the bottom for recovery in future years.	HARA MARA ASARA WCPRA	Opportunistically, depending on ship availability Year-round, 50 DAS	NOAA Ship *Okeanos Explorer*, *Oscar Elton Sette*, *Hiʻialakai*, University of Hawaiʻi research vessel *Kaʻimikai-o-Kanaloa*, or equivalent vessel	Remotely operated vehicle (ROV), divers, submersibles, autonomous underwater vehicle (AUV), landers, instrument packages, Ship-based multibeam echosounders (SeaBeam 3012 multibeam, EK-60 18kHz, Knudsen 3260 sub-bottom profiler 3.5 kHz)	ROVs include the Super Phantom S2 ROV system operated by the Undersea Vehicles Program at the University of North Carolina at Wilmington. Subs include Pices V and Pices IV and similar Human occupied vehicles (HOV) AUV includes Seabed and other unmanned systems Hull-mounted 3.5-30 kHz multibeam	HARA: 200 MARA: 200 ASARA: 200 WCPRA: 200 DNA specimens N=100, mean weight (wt) = 10 grams (g) Voucher specimens N=60 wt = 10-500 g Paleo-specimens N=40, wt=500-2000 g
Insular Fish Life History Survey and Studies	Provide size ranges of deepwater eteline snappers, groupers, and large carangids to determine sex-specific length-at-age growth curves, longevity estimates, length and age at 50% reproductive maturity within the Bottomfish Management Unit Species (BMUS) in Hawaiʻi and the other Pacific Islands Regions. Specimens are collected in the field and sampled at markets.	HARA: (0.2 -5 nm from shore) every year. MARA ASARA WCPRA	HARA: July-September, up to 15 DAS/yr. Other areas: Year-round, up to 30 DAS for each research area once every three years Day and night	*Oscar Elton Sette* or equivalent vessel, Contracted fishing vessels, small boats	Hook-and-line	Hand line, Electric or hydraulic Reel: Each operation involves 1-3 lines with.4-6 hooks per line; soaked 1-30 min. Squid bait on circle hooks (typically 10/0 to 12/0).	HARA: 350 operations per survey per year Other areas: 240 operations per survey per year for each research area
Pacific Reef Assessment and Monitoring Program (RAMP) *(Preferred Alternative to include additional gear and fish collections)*	Ecosystem surveys that include rapid ecological assessments; towed-diver surveys; coral disease, invertebrates, fish, and algae surveys; and oceanographic characterization of coral reef ecosystems. Surveys also include training to conduct surveys which occur between 0-3nm from shore, year-round, using small boats, SCUBA or closed circuit rebreathers (CCR) diver surveys, sampling, and deployment of various equipment. Samples and specimens collected in the field would be analyzed in the laboratory.	HARA MARA ASARA WCPRA; 0-20 nm from shore	Year-round; Annual (each research area is surveyed triennially) 30-120 DAS depending on which area is surveyed In-water activities with divers are conducted during the day, all other activities are conducted day and night	*Oscar Elton Sette*, *Hiʻialakai*, Small boats	Hand gear used by SCUBA and free divers	Spear gun, slurp gun (a clear plastic tube designed to catch small fish by sliding a plunger backwards out of the tube), hand net, including small boat operations with SCUBA Hammer, chisel, bone cutter, shears, scissors, clippers, scraping, syringe, core-punch, hand snipping Temporary transect line, surface marker buoy, 1 m long plastic spacer pole with camera	MARA: Ad hoc fish collections from 2009, less than 20 specimens. Up to 500 samples per year including corals, coral products, algae and algal products, and sessile invertebrates (size range from fragments to entire individuals/colonies, although the smallest possible sample will be taken - typically only a few centimeters (cm) in diameter but perhaps occasionally larger X transects per year with 30 pole contacts on the substrate for each photo-transect site
					Pneumatic/hydraulic drill for coral coring	Approximately 4 cm diameter and ≤ 100 cm long masonry drill bit used to extract a 2.5 x 5-70 cm coral sample	30 coral cores per survey per year
					Active acoustics: will vary by vessel (Multi-beam: Reson8101 ER; split-beam: Simrad EK60)	38-200 kHz	Continuous
					Bioerosion monitoring units (BMUs)	1 x 2 x 5 cm pieces of relic calcium carbonate, placed next to the reef and deployed at 0-40 m	150 deployments per survey per year Deployed for approximately 1-3 years
					Autonomous reef monitoring structures (ARMS)	36 x 46 x 20 cm structure placed on pavement or rubble (secured to bottom by stainless steel stakes and weights) in proximity to coral reef structures	150 deployments for a duration of typically1-3 yr each

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
					Sea Bird Electronics SBE56 temperature recorders	Instrument and mounting brackets are 10 x 5 x 30 cm, anchored to a dead portion of the reef with two coated 3lb dive weights and cable ties, typically deployed at 5-25 m, but may reach 30 m	Typically deployed for 1-3 yr
					ADCP	Nortek Aquadopp Sideseeing Profiler, 2 MHz down to 30m	Continuous during transects
					Conductivity, temperature, depth (CTD) profiler (shallow-water and deep-water)	Shallow-water CTDs will be conducted from small boats to a depth of 30 meters Deep-water CTDs will be conducted from larger vessels to a maximum depth of 500 m.	Hundreds to thousands of casts per survey per year
					Baited remote underwater video system (BRUVS)	35 kg system weight with 1 kilogram (kg) of bait Deployed down to100 m to the seafloor	Up to 600 deployments per survey per year Deployed for approximately 1 hour
					Calcification acidification units (CAUs)	Each CAU consists of 2 PVC plates (10 x 10cm) separated by a 1 cm spacer and mounted on a stainless steel rod which is installed by divers into the bottom (avoiding corals) down to 30 m	150 deployments per survey per year Deployed for approximately 1-3 years
Surface Night-Light Sampling	Conducted opportunistically for decades aboard PIFSC research vessels. Sampling goals: collect larval or juvenile stages of pelagic or reef fish species that accumulate within surface slicks during daylight hours and those attracted to surface and submerged lights from research vessels at night.	HARA; primarily 1-25 nm from shore; adjacent to the Kona coast, but also out to 200 nm and beyond in the WCPRA	Year-round Up to 30 DAS Along with scheduled NOAA research cruises or opportunistically aboard other vessels. Conducted during the night	*Oscar Elton Sette* or equivalent fisheries research vessel, or other vessels.	Net (dip)	Scoop nets (0.5 m diameter sometimes attached to 3-4 m long poles) used while vessel is drifting	30 night-light operations on all vessels combined. Total catch (all species) ≤ 1500 specimens of larval or juvenile fish per yr
Kona Integrated Ecosystem Assessment Cruise *(Under the Preferred Alternative hook-and-line fishing component is added)*	Survey transects conducted off the Kona coast and Kohala Shelf area to develop ecosystem models for coral reefs, socioeconomic indicators, circulation patterns, larval fish transport and settlement. Sampling includes active acoustics to determine relative biomass density of sound scattering layers; trawls to sample within the scattering layers; cetacean observations; surface and water column oceanographic measurements and water sample collection. This survey is usually performed along with passive acoustic surveys as described under the Cetacean Ecological Surveys	HARA; 2-10 nm from shore	Variable timing, depending on ship availability, up to 10 DAS Day and night	*Oscar Elton Sette*, or equivalent vessel	Large-mesh midwater Cobb trawl	Tow speed: 3 kts Duration: 60-240 min Depths: Deployed at various depths during same tow to target fish at different water depths, usually to 200 m	15-20 tows per survey per year (these tow samples would usually be limited to either Kona IEA or Oceanography Cruise in any one year)
					Small-mesh surface and midwater trawl nets (Isaacs-Kidd 6-ft and 10-ft, neuston, ring, bongo nets, 1-meter plankton drop net)	Tow speed: 3 kts Duration: up to 60 min Depth: 0-200 m	15-20 tows per survey per year (any combination of the nets described)
					Active acoustics (split-beam: Simrad EK60; trawl mounted OES Netmind; Didson 303)	Hull mounted: 38-200 kHz Surveys typically from surface to 1000 m depth Didson is usually operated between 400 m and 700 m depth. Range is 30 m	Intermittent continuous during surveys Up to 12 Didson casts for up to 120 min per survey.
					ADCP (RD Instruments Ocean Surveyor 75)	75 kHz	Intermittent continuous during surveys
					CTD profiler	90 min/cast	50 tows per survey per year, alternating with Oceanography Cruise

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Barbless Hook Donation	Donations of barbless circle hooks are made primarily at shore-based fishing tournaments or other outreach events to encourage replacement of barbed hooks in normal (legal) use. PIFSC has no control over the use of the hooks after the donation.	HARA	Year round, no DAS Conducted during the day	None	Barbless circle hooks	Hooks have the barbs crimped flat (barbs effectively removed)	Up to 35 events (days of donating hooks) per year. Up to 35,000 hooks donated per yr
Northwestern Hawaiian Islands Bottomfish Surveys *(Survey not continued in the Preferred Alternative)*	Conduct bottomfishing and collect biological data, including length measurements and otoliths and gonads. Genetic sampling of opakapaka and butaguchi.	HARA: Northwestern Hawaiian Islands	Year-round, Up to 16 DAS	*Oscar Elton Sette*	Hook-and-line	Electric or hydraulic reel: each operation involves 1-3 lines with 4-6 hooks per line; soaked 1-30 min	256 operations per survey per year. 400 BMUS per year
Insular fish Abundance Estimation Comparison Surveys *(Survey to be expanded to all research areas under Preferred Alternative)*	Comparison of Fishery-Independent Methods to Survey Bottomfish Assemblages in the Main Hawaiian Islands: Coordinated research between PIFSC EOD and FRMD, State of Hawaiʻi Department of Land and Natural Resources, University of Hawaiʻi at Manoa, University of Miami. Day and night* surveys are used to develop fishery-independent methods to assess stocks of economically important insular fish. Methods include: active acoustics, stereo baited underwater video camera systems (BotCam, Modular Optical Underwater Survey System [MOUSS], BRUVS), autonomous underwater vehicle (AUV) equipped with stereo video cameras, towed optical assessment device (TOAD), and hook-and-line fishing. * night surveys were conducted only once in 2011	Main Hawaiian Islands; 2-10 nm from shore	Variable, up to 30 DAS	*Oscar Elton Sette* or equivalent vessel, Contracted research vessels	Hook-and-line	Hand, electric, and/or hydraulic reels. Each vessel fishes 2 lines per operation. Each line is baited with 4 hooks. Soak time ≤30 min per fishing operation .	≤ 540 operations (each ≤30 min soak time) per survey per year
					Active acoustics (split multi-beam: Reson8101 ER; deep water: Simrad EK60; trawl mounted OES Netmind), various fish finder devices	38-240 kHz	Intermittent continuous during surveys
					Underwater Video Camera (BotCam)	Duration: deployed 30-60 min. Depth: 350m	380 deployments per survey per year
					AUV	Speed: 0.5 kts Duration: 3 hours/deployment	40 deployments per survey per year
					ROV	Duration: 1 hr	40 deployments per survey per year
					Towed optical assessment device (TOAD)	Tow speed: 6 kts Duration: 1 hr	40 tows per survey per year
Gear and Instrument Development and Field Trials	Field trials to test the functionality of the gear prior to the field season, or to test new gear or instruments described elsewhere in this table, but outside the geographic scope specified for other surveys.	HARA (Primarily in the waters south of Pearl Harbor on the Island of Oʻahu)	Year-round, up to 15 DAS Day and night	*Oscar Elton Sette*, *Hiʻialakai*, or equivalent vessel Small boats	Nets, lines, instruments Calibration of Simrad EK60	38-200 kHz	Intermittent for 24-48 hrs
Northwestern Hawaiian Islands Lobster Surveys *(Survey not continued in the Preferred Alternative)*	Collect data on abundance and species composition, length-frequency data of trap-captured lobsters at two banks in the NWHI to compare with results of previously collected data. Record and release any tagged lobsters.	HARA	Year-round, up to 30 DAS	*Oscar Elton Sette* or equivalent, contract fishing vessel(s)	Lobster traps	One string per site, 8 or 20 traps per string, separated by 20 fathoms of ground line; two depth regimes: 10-20 or 20-35 fathoms. Up to 15 sites (15 strings) per night	Up to 360 strings set per survey per year Total catch ≤ 5,500 spiny lobsters and ≤ 6,500 slipper lobsters per yr

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Mariana Resource Survey	Sampling activity to quantify baseline bottomfish and reef fish resources in the Mariana Archipelago Research Area. Various artificial habitat designs, Cobb trawl and IK trawls will be developed, enclosed in mesh used to retain captures, and evaluated collect pelagic-stage specimens of reef fish and bottomfish species. Large fish traps (1m x 1m x2m) deployed along or perpendicular to determine bottom contour overnight to access adult reef and bottomfish composition relative to hook-and-line fishing. Traps will be primarily set in mesophotic habitats (50-200 m depths) and in the quality of each habitat for recent recruits. deep-slope bottomfish habitats (200-500m depths).	MARA 0-25 nmi from shore	May - August Up to 102 DAS (once every three years) Midwater trawls are conducted at night, surface trawls are conducted day and night In-water activities are conducted during the day All other activities are day or night	*Oscar Elton Sette*	Large-mesh midwater Cobb trawl	Tow speed: 3 kts Duration: 60-240 min trawls; 2 tows per night Depth(s): Deployed at various depths during same tow to target fish at different water depths, usually between 100 m and 200m	15-20 tows per survey per year
					Small-mesh surface and midwater trawl nets (Isaacs-Kidd, neuston, ring, bongo nets)	Tow speed: 3 kts Duration: up to 60 min. Depth: 0-200 m	15-20 tows (any combination of the nets described) per survey per year
					Traps (Kona crab, enclosure)	Kona crab nets are nylon, with meshing spaced 2 1/2 inches apart attached to a wire ring with squid or fish bait set in the middle. Up to ten nets can be tied together with a buoy on the end net for retrieval. They are left for approximately 20 min. Enclosure traps are Fathoms Plus shellfish "lobster" traps or similar. These traps are dome-shaped, single-chambered, two entrance cones (with dimensions of 980 millimeter (mm) x 770mm x 295mm, with inside mesh dimensions of 45mm x 45mm). The traps are weighted and baited with the remains of life history samples from trolling and bottomfishing operations, and attached to two surface floats. Two strings of six traps each would be deployed at night on sand, rubble and pavement (i.e. not coral) substrate, and retrieved the next morning. Up to 20 traps per string, separated by 20 fathoms of ground line; two depths 10-35 fathoms. Up to 2 strings per DAS. Trap dimensions up to 1m high, 1 m wide, and 2 m long. Traps have outer mesh covering from 0.5-3.0 inch mesh and 1-2 funnel entrances. Trap is baited with fish using an inside baiter. Trap door swings open to retrieve catch and baiter.	25 gear sets per cruise Up to 400 strings set per survey per year
					Simrad split-beam EK60, OES Netmind	38-200 kHz	Intermittent continuous during surveys
				Small boats	Hook-and-line	Electric or hydraulic reel: Each operation involves 1-3 lines, with squid lures, soaked 10-60 min at depths between 200 m to 600 m.	1000 sets per survey per year
					Divers (spear)	Speargun	1000 reef fish
Pelagic Longline Hook Trials *(Survey not continued in the Preferred Alternative)*	Investigate effectiveness of various types of circle and tuna hooks at reducing the bycatch of non-target species in longline fisheries. Fishery observers or NOAA scientists conduct on-board documentation of catch and survival. Data collected on catch efficacy, fish size, species selectivity, and survival upon haul-back as based on hook type (e.g., J, tuna, and circle hooks). Opportunistic trolling may also be conducted to collect pelagic fish specimens for genetic, physiological, and ecological studies.	HARA, WCPRA outside prohibited longline fishing areas and up to 500 nm from shore	Variable 0-130 DAS	Contracted longline fishing vessels or fishery research vessel.	Pelagic longline and trolling	Mainline length: up to 60 miles Number of hooks: 600-3500 Gangion length (up to 30+ m), and spacing (up to 70+ m) are as required by regulations in each area: Hook size and type: size 6/0 to 9/0 J hooks, size 3.2 to 3.8 Tuna hooks, size 12/0 to 18/0 Circle hooks as restricted by changing bycatch mitigation regulations. All hooks used are allowed by regulations at the time and place used. Soak time: 600-1800 min. Troll fishing with up to 4 troll lines each with 1-2 baited hooks or 1-2 hook troll lures at 4-6 kts	Sum of all three surveys using longline gear (this and 2 below) total up to 130 longline operations per year with up to 130 trolling operations between longline operations.

Survey Name	Survey Description	General Area of Operation	Season, Frequency& Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Longline Gear Research *(Survey not continued in the Preferred Alternative)*	Research analyzes the vertical distribution of pelagic species catch rates and time of capture. Time-depth recorders (TDRs) and hook-timers on longlines deployed to document capture depth and habitat of pelagic species and time of capture. Opportunistic trolling may also be conducted to collect pelagic fish specimens for genetic, physiological, and ecological studies.	HARA, ASARA, WCPRA outside prohibited longline fishing areas and up to 500 nm from shore	Variable Opportunistic, subset of 0-130 DAS listed above under Pelagic Longline Hook Trials	*Oscar Elton Sette* or equivalent fishery research vessel, contracted longline fishing vessels.	Pelagic longline with TDRs	Same as above	Operations are a subset of operations per yr listed above under Pelagic Longline Hook Trials
Marlin Longline *(Survey not continued in the Preferred Alternative)*	Uses different setting techniques in order to eliminate shallow hooks and maximize target catch of deep dwelling species such as bigeye tuna while reducing catch of marlins, sharks, and turtles. Goal: ensure shallowest hooks fish at depths of at least 100 m. Opportunistic trolling may also be conducted to collect pelagic fish specimens for genetic, physiological, and ecological studies.	HARA, ASARA, WCPRA outside prohibited longline fishing areas and up to 500 nm from shore	Variable Opportunistic, subset of 0-130 DAS listed above under Pelagic Longline Hook Trials	Contracted longline fishing vessels	Pelagic longline and trolling	Same as above	Operations are a subset operations per yr listed above under Pelagic Longline Hook Trials
Pelagic Oceanographic Cruise	Investigate physical (e.g., fronts) and biological features that define the habitats for important commercial and protected species of the North Pacific Ocean, especially tuna and billfishes, which are targeted by longline fishers. Sampling includes active acoustics to determine relative biomass density of sound scattering layers; trawls to sample within the scattering layers; surface and water column oceanographic measurements and water sample collection.	Pacific Ocean; Western and Central tropical and subtropical Pacific 25-1000 nm from shore in any direction	Annual (season variable) Up to 30 DAS Midwater trawls are conducted at night, surface trawls are conducted day and night All other activities are conducted day and night	*Oscar Elton Sette*, or equivalent vessel	Large-mesh midwater Cobb trawl Plankton drop net (stationary surface sampling)	Tow speed: 3 kts Duration: 60-240 min 1 meter diameter plankton drop net would be deployed down to 100 m	20 tows per year, alternating with Kona IEA cruise 4 liters of micronekton per tow 20 drops per year (collections would be less than one liter of plankton)
					Small-mesh surface and midwater trawl nets (Isaacs-Kidd, neuston, ring, bongo nets)	Duration: up to 60 min Depth: 0-200 m	15-20 tows (any combination of the nets described) <1 liter of organisms per tow
					Active acoustics (split multi-beam: Reson8101 ER; deep water: Simrad EK60, OES Netmind)	38-200 kHz	Intermittent continuous during surveys
					ADCP (RD Instruments Ocean Surveyor 75)	75 kHz	Intermittent continuous during surveys
					CTD profiler	45-90 min cast duration	60 casts per year, alternating with Kona IEA cruise# of 60 tows/yr
Lagoon Ecosystem Characterization *(Geographic scope is expanded to include areas throughout WCPRA in the Preferred Alternative)*	Measures abundance of juvenile bumphead parrotfish in the interior lagoon at Wake Atoll over a two-week-long period by employing standardized transect and photo-quadrant techniques using SCUBA and snorkeling gear. A collection net may also be used to non-lethally sample fish species inhabiting the lagoon to determine genetic identity.	Wake Atoll lagoon	Variable in season, Up to 14 DAS Conducted during the day	Small boats	Divers with hand net	SCUBA, snorkel, 12-inch diameter small mesh hand net	10 dives per survey 10 fin clips collected for genetic analyses
		Palmyra Atoll	Variable in season, Up to 14 DAS Conducted during the day	Small boats	Hook-and-line	Standard rod and reel using lures or fish bait from shoreline or small boat	1-30 min casts 60 casts per survey

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As shown in Table 2.2-1, PIFSC fisheries research surveys are conducted annually and within four primary geographic areas: the HARA, the MARA, the ASARA, and WCPRA (see Figure 1.1-2).The gear types fall into several categories: pelagic surface and midwater trawl gear used at various levels in the water column, pelagic longlines with multiple hooks, and other gear (e.g., various fine-meshed plankton nets, active and passive acoustic instruments, video recording equipment, autonomous underwater vehicle (AUV), Conductivity Temperature Depth [CTD] profiler).

The Status Quo Alternative consists of the research activities described in Table 2.2-1 (see also Appendices A and B), including a suite of mitigation measures that were developed by PIFSC in consultation with marine mammal scientists and other protected species experts. These mitigation measures have been phased into PIFSC surveys starting in the 2009 field seasons and refined through 2013. These mitigation measures are anticipated to be required under the Letters of Authorization (LOA) that would be issued under the Preferred Alternative for the specified research activities conducted by PIFSC. However, these mitigation measures may not be sufficient to reduce the effects of PIFSC activities on marine mammals and other protected species to the level of least practicable adverse impact (see the Preferred Alternative), so additional mitigation may be required under the proposed action by the LOA.

The procedures described here are based on protocols used during previous PIFSC research surveys. These procedures are the same whether the survey is conducted on board a NOAA vessel or charter vessel. PIFSC continually reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluations of new mitigation measures include assessments of their effectiveness in reducing risk to protected species. Implementation of any such measures must also be subject to safety and practicability considerations, allow survey results to meet research objectives, and maintain consistency with previous data sets.

2.2.1 Mitigation Measures for Protected Species and Habitats

2.2.1.1 Midwater Trawl Surveys

Visual Monitoring Measures

- The officer on watch, Chief Scientist (or other designated member of the Scientific Party), and crew standing watch visually scan, usually with binoculars, for marine mammals, sea turtles, and other ESA-listed species (protected species) during trawl operations. Because trawling is typically conducted at night, sight distance is generally limited to no more than twenty meters beyond the ship. If trawling is conducted during the day, the member of the crew designated to stand watch for marine mammals and sea turtles visually scans the waters surrounding the vessel with an approximately one-km radius.

Operational Procedures

- “Move-on” Rule: If any marine mammals are sighted anywhere around the vessel in the 30 minutes before setting the gear, the vessel may be moved away from the animals to a different section of the sampling area if the animals appear to be at risk of interaction with the gear at the discretion of the officer on watch in consultation with the CS. Small moves within the sampling area can be accomplished without leaving the sample station. After moving on, if marine mammals are still visible from the vessel and appear to be at risk, the officer on watch may decide, in consultation with the CS, to move again or to skip the station. The officer on watch will first consult with the CS or other designated scientist and other experienced crew as necessary to determine the best strategy to avoid potential takes of these species based on those encountered, their numbers and behavior, position and vector relative to the vessel, and other factors. For

instance, a whale transiting through the area and heading away from the vessel might not require any move or only require a short move from the initial sampling site while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if they follow the vessel. In most cases, trawl gear is not deployed if marine mammals have been sighted from the ship in the previous 30 minutes unless those animals do not appear to be in danger of interactions with the trawl, as determined by the judgment of the CS and officer on watch. The efficacy of the "move-on" rule is limited during night time or other periods of limited visibility; although operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval.

- Trawl operations are usually the first activity undertaken upon arrival at a new station in order to reduce the opportunity to attract marine mammals and other protected species to the vessel. However, in some cases, CTD casts may immediately precede trawl deployment. The order of gear deployment is determined on a case-by-case basis by the CS based on environmental conditions and other available information at the sampling site. Other activities, such as water sampling or plankton tows, are conducted in conjunction with, or upon completion of, trawl activities.
- Once the trawl net is in the water, the officer on watch, CS or other designated scientist, or crew standing watch continue to monitor the waters around the vessel and maintain a lookout for marine mammal presence as far away as environmental conditions allow (as noted previously, visibility is very limited during night trawls). If these species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the officer on watch, in consultation with the CS or other designated scientist and other experienced crew as necessary. These judgments take into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. Generally, if a marine mammal is incidentally caught, it would happen during haul-back operations, especially when the trawl doors have been retrieved and the net is near the surface and no longer under tension. The risk of catching an animal may be reduced if the trawling continues and the haul-back is delayed until after the marine mammal has lost interest in gear, or left the area. In other situations, swift retrieval of the net or cutting the cables may be the best course of action. The appropriate course of action to minimize the risk of incidental take of protected species is determined by the professional judgment of the officer on watch and appropriate crew based on all situation variables, even if the choices compromise the value of the data collected at the station.
- If trawling operations have been delayed because of the presence of marine mammals, the vessel resumes trawl operations (when practicable) only when these species have not been sighted within 30 minutes or else otherwise determined to no longer be at risk. This decision is at the discretion of the officer on watch and will depend upon the circumstances of the situation.
- Care is taken when emptying the trawl, including opening the cod end, as close to the deck as possible in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not protected species are present. It may be necessary to cut the net to remove the protected species.

<u>Tow Duration</u>

- Standard tow durations for midwater Cobb trawls are between two and four hours as target species (e.g., pelagic stage eteline snappers) are relatively rare, and longer haul times are

necessary to acquire the appropriate scientific samples. However, trawl hauls will be terminated and the trawl retrieved upon the determination and professional judgment of the officer on watch, in consultation with the CS or other designated scientist and other experienced crew as necessary, that this action is warranted in order to avoid an incidental take.

Marine mammal excluder devices

- PIFSC currently uses two types of midwater trawl nets; the Cobb trawl and the Isaacs-Kidd trawl. The Cobb trawl and the Isaacs-Kidd trawl have been used throughout the Pacific Islands Region with no interactions with protected species. There are no plans to develop or install marine mammal excluder devices for these types of trawls in this region.

Speed limits and course alterations

- Vessel speeds are restricted on research cruises in part to reduce the risk of ship strikes with marine mammals. Transit speeds vary from six to ten knots, but average nine knots. The vessel's speed during active Cobb trawl operations and active acoustic surveys is typically two to four knots due to trawl net and sea-state constraints. Thus, these much slower speeds greatly reduce the risk of ship strikes.
- At any time during a survey or while in transit, any crew member that sights marine mammals that may intersect with the vessel course immediately communicates their presence to the bridge for appropriate course alteration or speed reduction as possible to avoid incidental collisions, particularly with large whales (e.g., humpback whales).

2.2.1.2 Longline Gear

Operational Procedures

Because longline research is currently conducted in conjunction with commercial fisheries, operational characteristics (e.g., branchline and floatline length; branchline diameter; hook type, size, and wire diameter; bait type; number of hooks between floats) of the longline gear in Hawai'i, America Samoa, Guam, the Commonwealth of the Northern Marianas, or EEZs of the Pacific Insular Areas shall adhere to the requirements on commercial longline gear based on NMFS regulations as summarized at: http://www.fpir.noaa.gov/SFD/SFD_regs_2.html and specified in 50 CFR 229, 300, 404, 600, and 665. PIFSC will adhere to the above regulations and generally follow the below procedures when setting and retrieving longline gear:

- When shallow-setting anywhere and setting longline gear from the stern:

  Completely thawed and blue-dyed bait will be used (two 1-pound containers of blue-dye will be kept on the boat for backup). Fish parts and spent bait with all hooks removed will be kept for strategic offal discard. Retained swordfish will be cut in half at the head; used heads and livers will also be used for strategic offal discard. Setting will only occur at night and begin 1 hour after local sunset and finish 1 hour before next sunrise, with lighting kept to a minimum.

- When deep-setting north of 23°N and setting longline gear from the stern:

  45 g or heavier weights will be attached within 1 m of each hook. A line shooter will be used to set the mainline. Completely thawed and blue-dyed bait will be used (two 1-pound containers of blue-dye will be kept on the boat for backup). Fish parts and spent bait with all hooks removed will be kept for strategic offal discard. Retained swordfish will be cut in half at the head; used heads and livers will also be used for strategic offal discard.

- When shallow-setting anywhere and setting longline gear from the side:

  Mainline will be deployed from the port or starboard side at least 1 m forward of the stern corner. If a line shooter is used, it will be mounted at least 1 m forward from the stern corner. A specified bird curtain will be used aft of the setting station during the set. Gear will be deployed so that hooks do not resurface. 45 g or heavier weights will be attached within 1 m of each hook.

- When deep-setting north of 23°N and setting longline gear from the side:

  Mainline will be deployed from the port or starboard side at least 1 m forward of the stern corner. If a line shooter is used, it will be mounted at least 1 m forward from the stern corner. A specified bird curtain will be used aft of the setting station during the set. Gear will be deployed so that hooks do not resurface. 45 g or heavier weights will be attached within 1 m of each hook.

Operational characteristics of longline research in non-WPRFMC areas of jurisdiction adhere to the regulations of the applicable management agencies, including Western and Central Pacific Fisheries Commission (WCPFC), and Inter-American Tropical Tuna Commission (IATTC). These operational characteristics include WCPFC 2007, WCPFC 2008, ICCAT 2010, ICCAT 2011, IATTC 2007, and IATTC 2011.

The “move-on” rule may be implemented if any protected species are present near the vessel and appear to be at risk of interactions with the longline gear; longline sets are not made if marine mammals or sea turtles have been seen from the vessel within the past 30 minutes and represent a potential for interaction with the longline gear, as determined by the professional judgment of the CS or officer on watch. Longline gear is always the first equipment or fishing gear to be deployed when the vessel arrives on station. Longline gear is set immediately upon arrival at each station provided the conditions requiring the move-on rule have not been met.

If marine mammals are detected while longline gear is in the water, the officer on watch exercises similar judgments and discretion to avoid incidental take of these species with longline gear as described for trawl gear. The species, number, and behavior of the protected species are considered along with the status of the ship and gear, weather and sea conditions, and crew safety factors. The officer on watch uses professional judgment and discretion to minimize risk of potentially adverse interactions with protected species during all aspects of longline survey activities.

If marine mammals are detected during setting operations and are considered to be at risk, immediate retrieval or halting the setting operations may be warranted. If setting operations have been halted due to the presence of these species, setting does not resume until no marine mammals have been observed for at least 30 minutes.

If marine mammals are detected while longline gear is in the water and are considered to be at risk, haul-back is postponed until the officer on watch determines that it is safe to proceed. Marine mammals caught during longline fishing are typically only caught during retrieval, so extra caution must be taken during this phase of sampling.

2.2.1.3 Plankton Nets, Small-mesh Towed Nets, Oceanographic Sampling Devices, Active Acoustics, Video Cameras, Autonomous Underwater Vehicle (AUV), and Remotely Operated Vessel (ROV) Deployments

PIFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises, such as plankton nets, oceanographic sampling devices, video cameras, low-power high-frequency active acoustics directed underneath the ship as a beam, AUVs, and ROVs. It is not anticipated

that these types of gear or equipment would interact with protected species and are therefore not subject to specific mitigation measures. However, the officer on watch and crew visually monitor for any unusual circumstances that may arise at a sampling site and use their professional judgment and discretion to avoid any potential risks to protected species during deployment of all research equipment (e.g., reduced boat speed). Often these types of gear are deployed from small boats, not ships, and therefore visual monitoring is the best measures to avoid interactions with protected species.

2.2.1.4 Handling Procedures for Incidentally Captured Animals

For the Pacific Islands Region, PIFSC follows the guidance on the identification, handling, and release of protected species that has been provided by the NOAA Pacific Islands Regional Office (NOAA 2014a, Appendix D).

Marine Mammals

- Based on previous PIFSC research activities, it is not anticipated that any marine mammals would be captured during the proposed research. However, if a marine mammal was captured live or injured, then it would be extracted from the research gear and returned to the water as soon as possible. Animals would be released without removing them from the water if possible. Data collection would be conducted in such a manner as not to delay release of the animal and should include species identification, sex identification if genital region is visible, estimated length, disposition at release (e.g., live, dead, hooked, entangled, amount and description of gear remaining on the animal), and photographs. The CS or crew should collect as much data as possible from hooked or entangled animals, considering the disposition of the animal; if it is in imminent danger of drowning, it should be released as quickly as possible. Biological specimens would not be collected from marine mammals because PIFSC currently does not have an Incidental Take Authorization. If a large whale is alive and entangled in fishing gear, the vessel should immediately call the U.S. Coast Guard (USCG) at VHF Ch. 16 or the appropriate Marine Mammal Health and Stranding Response Network.

Sea Turtles

- Based on previous PIFSC research activities, it is not anticipated that any sea turtles would be captured during the proposed research. However, if a dead, injured, or stranded sea turtle was encountered, then PIFSC would follow the existing regulations (50 CFR 223.206 and 222.310) and Pacific Islands Regional Office guidance. If possible, data would be collected in such a manner as not to delay release of the animal(s) and should include species identification, sex identification if genital region is visible, estimated length, disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal) and photographs. If scientific personnel onboard the vessel have the appropriate permits for sea turtle research, then they may elect to install PIT tags in the flippers of animals that have not already been tagged. Captured turtles are quickly processed and released in accordance with established handling procedures.

2.2.1.5 Reef Assessment and Monitoring Program and Marine Debris Research and Removal Activities

The following measures are carried out when working in and around shallow water coral reef habitats. These measures are intended to avoid and minimize impacts to protected species and benthic habitats, as well as avoid introducing non-native invasive species. These activities generally include small boat operations and divers in the water.

Small Boat and Diver Operations

- Transit from the open ocean to shallow-reef survey regions (depths of < 35 m) of atolls and islands should be no more than 3 nm, dependent upon prevailing weather conditions and regulations. Each team conducts surveys and in-water operations with at least 2 divers observing for the proximity of protected species sightings, a coxswain driving the small boat, and a topside spotter working in tandem. Topside spotters may also work as coxswains, depending on team assignment and boat layout. Spotters and coxswains will be tasked with specifically looking out for divers, protected species, and environmental hazards.

  Divers, spotters, and coxswains undertake consistent due diligence and take every precaution during operations to avoid interactions with any listed species. Scientists, divers, and coxswains follow the Best Management Practices (BMPs) for boat operations and diving activities. These practices include but are not limited to the following precepts:

  1. Constant vigilance shall be kept for the presence of protected species
  2. When piloting vessels, vessel operators shall alter course to remain at least 100 m from marine mammals and at least 50 m from sea turtles
  3. Reduce vessel speed to 10 km or less when piloting vessels in the proximity of marine mammals
  4. Reduce vessel speed to 5 km or less when piloting vessels in areas of known or suspected turtle activity
  5. Marine mammals and sea turtles should not be encircled or trapped between multiple vessels or between vessels and the shore
  6. If approached by a marine mammal or turtle, put the engine in neutral and allow the animal to pass
  7. Unless specifically covered under a separate permit that allows activity in proximity to protected species, all in-water work will be postponed until whales are within 100 yards or other protected species are within 50 yards. Activity will commence only after the animal(s) depart the area
  8. Should protected species enter the area while in-water work is already in progress, the activity may continue only when that activity has no reasonable expectation to adversely affect the animal(s)
  9. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any protected species

Protocol for Minimizing Benthic Disturbance (including coral reefs)

- Research dives, using scuba, will focus on the goal of data collection for research and monitoring purposes. All care will be taken during anchoring small boats, with sand or rubble substrate targeted for anchorage to minimize benthic disturbance or coral damage. The operational area will be continuously monitored for protected species, with dive surveys being altered, postponed, or canceled and small-boats on standby, neutral, or relocating to minimize disturbances or interactions. The anchor will be lowered rather than thrown, and a diver will check the anchor to make sure it does not drag or entangle any benthos or listed species.

Protocol for Minimizing the Spread of Disease and Invasive Species

The following actions are routinely required to minimize the spread of diseases to coral reef organisms and spreading invasive species on equipment and vessels.

Equipment and Gear

- Equipment (e.g., gloves, forceps, shears, transect lines, photographic spacer poles, surface marker buoys) in direct contact with potential invasive species, diseased coral tissues, or diseased organisms are soaked in a freshwater 1:32 dilution with commercial bleach for at least 10 min and only a disinfected set of equipment is used at each dive site.
- All samples of potentially invasive species, diseased coral tissues, or diseased organisms are collected and sealed in at least 2 of a combination of bags or jars underwater on-site and secured into a holding container until processing.
- Dive gear (e.g., wetsuit, mask, fins, snorkel, BC, regulator, weight belt, booties) is disinfected by one of the following ways: a 1:52 dilution of commercial bleach in freshwater, a 3 percent free chlorine solution, or a manufacturer's recommended disinfectant-strength dilution of a quaternary ammonium compound in "soft" (low concentration of calcium or magnesium ions) freshwater. Used dive gear is disinfected daily by performing the following steps: (1) physical removal of any organic matter and (2) submersion for a minimum of 10 min in an acceptable disinfection solution, followed by a thorough freshwater rinse and hanging to air dry. All gear in close proximity to the face or skin, such as masks, regulators, and gloves, are additionally rinsed thoroughly with potable water following disinfection.

Small Boats

- Small boats that have been deployed in the field are cleaned and inspected daily for organic material, including any algal fragments or other organisms. Organic material, if found, is physically removed and disposed of according to the ship's solid-waste disposal protocol or in approved secure holding systems. The internal and external surfaces of vessels are rinsed daily with freshwater and always rinsed between islands before transits. Vessels are allowed to dry before redeployment the following day.

Sea Turtles and Hawaiian Monk Seals

- To avoid interactions with listed species during surveys and operations, team members and small boat coxswains will monitor areas while in transit to and from work sites. If a listed species is sited the vessel will alter course in the opposite direction. If unable to change course, the vessel will slow or come to a stop awaiting the animal to be clear of the boat as long as passenger safety is not compromised. Currently, there are no known strikes or incidental takes of a listed protected species from a vessel or propeller of a Pacific RAMP vessel in the NWHI, or other surveyed areas around the Pacific.
- As part of due diligence, protected species monitoring will continue throughout all dive operations by at least one team member aboard each boat and two divers working underwater. Operations will be altered and modified as previously listed.
- Mechanical equipment will also be monitored to ensure no accidental entanglements occur with protected species (e.g., with PAM float lines, transect lines, and oceanographic equipment stabilization lines). Team members will immediately respond to an entangled animal, halting operations and providing an onsite response assessment (allowing the animal to disentangle itself,

assisting with disentanglement, etc.), unless doing so would put divers, coxswains, or other staff at risk of injury or death.

- Before approaching any shoreline or exposed reef, all observers will examine the beach, shoreline, reef areas, and any other visible land areas within the line of sight for marine mammals and sea turtles. The Pacific RAMP teams typically do not participate during terrestrial surveys and operations as part of their mandate, and, therefore, minimize the potential for disturbances of resting animals along shorelines.
- Land vehicle (trucks) operations will occur in areas of marine debris where vehicle access is possible from highways or rural/dirt roads adjacent to coastal resources. Prior to initiating any marine debris removal operations, marine debris personnel (marine ecosystem specialists) will thoroughly examine the beaches and nearshore environments/waters for Hawaiian monk seals, humpback whales, green sea turtles, and hawksbill sea turtles before approaching marine debris sites and initiating removal activities. Debris will be retrieved by personnel who are knowledgeable of and act in compliance with all federal laws, rules and regulations governing wildlife in the Papahānaumokuākea Marine National Monument and MHI. This includes, but is not limited to:
    - Decontamination of clothing/soft gear taken ashore by prior freezing for 48 hours, or use of new clothing/soft gear as indicated by USFWS regulations;
    - Avoidance of seabird colonies; and
    - Avoidance of marine turtles and Hawaiian monk seals, maintaining a minimum distance of 50 yards from all monk seals and turtles, and a minimum of 100 yards from females seals with pups.

<u>Shoreline Marine Debris Research and Removal Mitigation Measures to Avoid Historic Properties</u>

The following measures are carried out during marine debris removal activities to avoid impacts to historic properties. The focus of removal efforts are on derelict fishing gear (DFG), which pose a potential entanglement risk to wildlife (e.g., Hawaiian monk seals, sea turtles), and plastics.

- While in-water:
    - As described in the diagram of the marine debris removal protocol (Figure 2.2-1), all DFG is evaluated by divers before any removal activities take place.
    - During this evaluation, the divers look for historic properties that may be the immediate vicinity (e.g., ship wrecks, fish ponds). If a potential historic property is located but is not attached to any DFG, the site is avoided. If a potential historic property is located and it is attached to DFG, then the DFG is treated as stable and only entanglement risks are addressed without disturbing the site. The GPS location of any potential historic property is recorded.
- Along the shoreline:
    - Shoreline survey and removal efforts are conducted within the dynamic zone from approximately the low tide line up to the high tide line on all islands visited. This dynamic zone is characterized by frequent wave and tidal action that can deposit, or wash away, marine debris as well as sand. Because the survey and removal efforts do not take place in uplands or other vegetated areas, they would avoid impacts to upland historic properties (e.g., burial mounds).

- Most DFG (primarily fishing nets) and plastics are found at rest on the surface of the shoreline and require no excavation of the subsurface thereby avoiding impacts to buried historic properties.
- DFG that does require excavation is usually found in the dynamic zone between the low and high tide lines where wave and tidal action deposits debris and sand. Historic properties, or sites eligible for listing, are highly unlikely to be found in between the low and high tide lines.

If an unidentified object (e.g., HAZMAT) is found during excavation, then the DFG will be left in place and only potential entanglement hazards (e.g., loops in lines) will be cut free and removed (similar operating protocols for in-water removal).

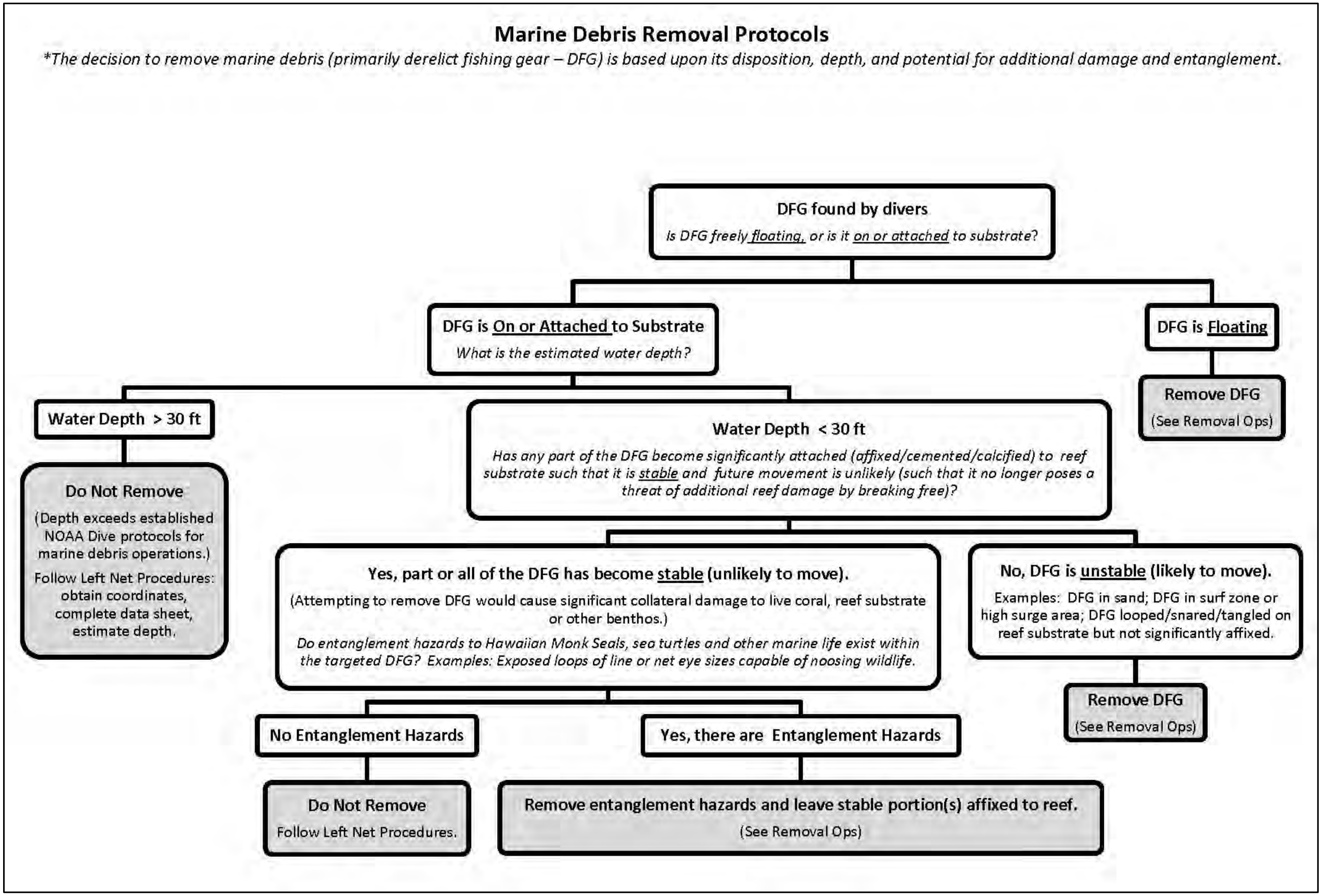

Figure 2.2-1 Diagram of Marine Debris Removal Protocol

2.2.2 Mitigation Measures for Essential Fish Habitat

Some of the mitigation measures described for marine mammals and protected species under the Status Quo Alternative are also designed to protect EFH, including the following:

- Speed limits and course alterations - slower vessel speeds reduce the risk of vessel groundings and damage to EFH habitat such as coral reefs. Transit from the open ocean to shallow-reef survey regions (depths of < 35 m) of atolls and islands should be no more than 3 nm, dependent upon prevailing weather conditions and regulations.
- Small boat and diver operations – Care is taken during anchoring small boats, with sand or rubble substrate targeted for anchorage, to minimize benthic disturbance or coral damage. The anchor is lowered rather than thrown, and a diver checks the anchor to ensure it does not drag or entangle any benthos.
- Minimizing the spread of disease and invasive species – Equipment in direct contact with potential invasive species, diseased coral tissues, or diseased organisms are soaked in freshwater 1:32 dilution with commercial bleach for at least 10 minutes and only a disinfected set of equipment is used at each dive site. Small boats that have been deployed in the field are cleaned and inspected daily for organic material, including any algal fragments or other organisms. Organic material, if found, is physically removed and disposed of according to the ship's solid-waste disposal protocol or in approved secure holding systems. The internal and external surfaces of vessels are rinsed daily with freshwater and always rinsed between islands before transits. Vessels are allowed to dry before redeployment the following day.

2.3 ALTERNATIVE 2 - PREFERRED ALTERNATIVE - CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH (NEW SUITE OF RESEARCH) WITH MITIGATION FOR MMPA AND ESA COMPLIANCE

The Preferred Alternative is comprised of a combination of research activities continued from the past and additional, new research surveys and projects. The Preferred Alternative would not include several of the projects described in Table 2.2-1 under the Status Quo. Those surveys have been noted in Table 2.2-1 and include the following:

- The Northwestern Hawaiian Islands Lobster Survey
- The Northwestern Hawaiian Islands Bottomfish Survey
- Pelagic Longline Hook Trials
- Longline Gear Research Surveys
- Marlin Longline Surveys

Although these research projects would not continue under the Preferred Alternative under the auspices of PIFSC, similar research may continue to be conducted and funded by the Pacific Islands Regional Office through contracts with commercial fisheries. Any incidental takes resulting from such research would be authorized under the MSA and incidental takes of protected species resulting from such research would be considered to be the result of the commercial fishery. The impacts of such surveys are included in the analysis of cumulative impacts (Chapter 5) but are not considered further in this analysis of the Preferred Alternative.

Under the Preferred Alternative, the Cetacean Ecological Assessment surveys described under the Status Quo would include increased levels of effort, and would include midwater trawling with a Cobb net. Several new research surveys and projects have been added to the Preferred Alternative that were not included in the Status Quo Alternative and other existing research projects have been modified (e.g., new or updated instruments); these new projects and changes in existing projects are summarized in Table 2.3-1.

The conduct of fisheries and ecosystem research by PIFSC under the Preferred Alternative would require regulations and authorizations for incidental take of marine mammals under the MMPA and incidental take of protected species under the ESA. Under this alternative, PIFSC would apply to the NMFS Headquarters Office of Protected Resources (OPR) requesting regulations governing the issuance of LOAs for incidental take of marine mammals under the MMPA. OPR would make the necessary findings, and, if appropriate, promulgate regulations and issue LOAs to PIFSC. If regulations are promulgated and LOAs are issued, they would prescribe the permissible methods of taking; a suite of mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals and their habitats during the specified research activities; and require reporting that will result in increased knowledge of the species and the level of taking.

In addition, both OPR and PIFSC would engage in ESA section 7 consultations with the NMFS Pacific Islands Regional Office (and U.S. Fish and Wildlife Service [USFWS], as appropriate) for species that are listed as threatened or endangered. These consultations, when completed, may result in the development of one or more Biological Opinions (BiOps) that state the opinions of the services as to whether or not the federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The BiOps may contain incidental take statements (ITSs) for ESA-listed species that would include reasonable and prudent measures along with implementing terms and conditions intended to minimize the impact of incidental take of ESA-listed species during PIFSC research activities. PIFSC would also apply for authorizations under the MMPA and the ESA for

incidental take of protected species during these research activities. The Preferred Alternative includes mitigation measures for protected species designed to reduce adverse impacts to protected species (conservation engineering and analysis). Under the Preferred Alternative, these mitigation measures would be implemented during the period covered by this DPEA.

PIFSC would also engage in MSA-EFH consultation with PIRO HCD. This consultation process would include notification regarding the proposed action and an EFH Assessment. This Draft PEA would satisfy the requirements of an EFH Assessment through the analysis of potential adverse effects of the proposed action on EFH, as detailed in Section 4.3.2 of this document.

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Table 2.3-1 Summary Description of Surveys in the Pacific Islands Region Proposed under the Preferred Alternative

Survey Name	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Cetacean Ecology Assessment *(Addition of Cobb midwater trawls and increase from 90 to 180 DAS compared to Status Quo protocols)*	Survey transects conducted in conjunction with cetacean visual and acoustic surveys within the Hawai'i EEZ to develop ecosystem models for cetaceans. Sampling includes active acoustics to determine relative biomass density of sound scattering layers; trawls to sample within the scattering layers; cetacean observations; surface and water column oceanographic measurements and water sample collection.	HARA MARA ASARA WCPRA	Variable, up to 180 DAS depending on area surveyed Midwater trawls are conducted at night, surface trawls are conducted day and night All other gear and instruments are conducted day and night	*Oscar Elton Sette, Hi'ialakai,* small boats	Cobb midwater trawl	Tow speed: 3 kts Duration: 60-240 min	180 trawls per research area
					Small-mesh towed net (surface trawl)	Tow speed: 2.5-3.5 kts Duration: 30-60 min	180 tows per research area
					Active Acoustics (splitbeam Simrad EK60, OES Netmind)	38-240 kHz	Intermittent continuous during surveys
					ADCP (RD Instruments Ocean Surveyor 75)	75 kHz	Intermittent continuous during surveys
					CTD profiler	90 min	2 per day
					XBT	10 min duration. Profiles from surface to up to 1000n m depth	Maximum 5 per day
	<u>Passive Acoustics Calibration</u> - Transmit sound (synthetic pings, dolphin whistles or echolocation clicks, etc.) to passive acoustic recording devices for purposes of in-situ calibration, needed to understand detection distances and received level or frequency-dependent variation in the device performance.	HARA MARA ASARA WCPRA			Underwater sound playback system	Includes underwater projector and amplifier suspended from small boat or ship. Projection depth may vary from near surface to 100 m.	Intermittent
	<u>Stationary Passive Acoustic Recording</u> - Placement of long-term acoustic listening devices for the purposes of recording cetacean occurrence and distribution, ambient and anthropogenic noise levels, and presence of other natural sounds. Recorders are typically deployed and retrieved once or twice per year at each monitoring location.	HARA MARA ASARA WCPRA			HARP, EAR, or similar device	Deployed in seafloor package or mooring configuration consisting of recorder, acoustic releases, anchor and flotation	Up to ten long-term monitoring sites
	<u>Passive Acoustic Monitoring</u> - Deployment of passive acoustic monitoring devices in conjunction with other sampling measures, such as on fishing gear or free-floating.	HARA MARA ASARA WCPRA			Miniature HARPs or similar platforms	Deployed in seafloor package or mooring configuration consisting of recorder, acoustic releases, anchor and flotation	Continuous
	<u>Passive Acoustic or Oceanographic Gliders</u> - Autonomous underwater vehicles used for sub-surface profiling and other sampling over broad areas and long time periods. Passive acoustic device integrated into the vehicle provide measure of cetacean occurrence and background noise. CTD, pH, fluorometer, and other sensors provide oceanographic measures over several months duration.	HARA MARA ASARA WCPRA			Seaglider; WaveGlider; or similar platform	AUV	Continuous
Marine Debris Research and Removal *(Expanded from Status Quo protocols to include net tows and UAS gear, and to include all research areas)*	Surface and midwater plankton tows to quantify floating microplastic in seawater	HARA MARA ASARA WCPRA	Annually, or on an as-needed basis, up to 30 DAS Surface trawls are conducted day and night UAS are conducted during the day or night In-water and beach activities are conducted during the day	*Oscar Elton Sette, Hi'ialakai,* small boats	Neuston, or similar, plankton nets surface towed alongside ship and/or small boats	Tow Speed: varied Duration: < 1 hour	Up to 250 tows per survey per year
	The use of UAS platforms can aid in CRED's efficiency during survey and removal operations by directing efforts to high density areas	HARA			UASs (e.g., NOAA PUMA or NASA Ikhana systems, hexacopter)	Deployed from shore, small boat, or ship. Operate along shoreline or over water around atoll.	Less than 20 operations per island or atoll per year
	Adding more frequent marine debris research and removal activities to other research areas.	MARA WCPRA	Additional 30 DAS		Same as above	Same as above	Same as above
	Collection and sieving of mesoplastics from beach sand located between the low and high tide lines. Plastics are removed for sampling and further study.	HARA			Sieves	Sieving of mesoplastics (> 500 microns in size) from sand.	100 samples per atoll

Survey Name	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
Pacific RAMP *(Expanded from Status Quo protocols to include EARs, water sampling devices, carbonate sensing instruments, UAS and USVs, additional BMUs and CAUs deployments, and additional DAS for reef fish surveys)*	Ecosystem and oceanographic characterization surveys of coral reef ecosystems.	HARA MARA ASARA WCPRA	Year-round, 30-120 DAS depending on area surveyed In-water activities with divers are conducted during the day, all other activities are conducted day and night	*Oscar Elton Sette*, *Hi'ialakai*, small boats	EARs, Water samplers (PUCs, RAS, and hand collecting devices) Carbonate sensing instruments [SEAFET (pH), SAMI (pH), SAMI (pCO_2)] CAUs BMUs	Deployed by use of ~ 70 lb anchors guided into place by divers These CTD sized instruments are anchored to a dead portion of the reef with coated weights and cable ties, typically deployed at 5-30 m deep	25 EARs per year, typically deployed for 1-3 years 30 water samples per year, deployed 1-7 days 150 deployments per year, deployed for approximately 1-3 years Up to 500 BMUs and CAUs per year
	UAS would be used to collect coral reef ecosystem mapping & monitoring data. Initially testing and field trials would be conducted using multispectral, hyperspectral, or IR sensors. Surveys would be conducted around the MHI.	HARA MARA ASARA WCPRA			UASs (e.g., NOAA PUMA or NASA Ikhana systems, hexacopter)	Deployed from shore, small boat, or ship. Operate along shoreline or over water around atoll.	Less than 20 operations per island or atoll per year
	USV – Unmanned Surface Vehicles	HARA MARA ASARA WCPRA Nearshore areas			Emily USV will be used to conduct nearshore sampling of surface and bottom variables, as well as ambient atmospheric conditions near the USV.		
	Visual reef fish surveys	HARA MARA ASARA WCPRA	Year-round, additional 21 DAS		SCUBA and free divers	Visual fish identification and abundance surveys, benthic photo-transect	None
Insular fish Abundance Estimation Comparison Surveys *(Geographic scope expanded from HARA to include all research areas compared to Status Quo protocols)*	Comparison of Fishery-Independent Methods to Survey Bottomfish Assemblages in the Main Hawaiian Islands: Coordinated research between PIFSC EOD and FRMD, State of Hawai'i Department of Land and Natural Resources, University of Hawai'i at Manoa, University of Miami. Day and night surveys are used to develop fishery-independent methods to assess stocks of economically important insular fish. Methods include: active acoustics, stereo baited underwater video camera systems (BotCam, MOUSS, BRUVS), autonomous underwater vehicle (AUV) equipped with stereo video cameras, towed optical assessment device (TOAD), and hook-and-line fishing.	HARA MARA ASARA WCPRA	Variable, up to 30 DAS per research area per year, HARA surveyed annually, ASARA, WCPRA surveyed every 3 years	*Oscar Elton Sette*, *Hi'ialakai*, or equivalent research vessel, and contracted fishing vessels	Hook-and-line	Hand, Electric, Hydraulic reels. Each vessel fishes 2 lines. Each line is baited with 4-6 hooks. 1-30 minutes per fishing operation.	HARA: 7,680 operations per year MARA: 1.920 every 3rd year (average 640 operations per year) ASARA: 1,920 every 3rd year (average 640 per year) WCPRA: 1,920 every 3rd year (average 640 per year)
					Active acoustics (split-beam): Simrad EK60	Hull mounted: 38-200 kHz	Intermittent continuous during surveys
					Underwater Stereo-Video Camera Systems (e.g., BotCam, BRUVS, MOUSS)	Deployed from ship or small boat on line Duration of camera drop: $\leq$30 min	HARA: 7,680 drops per year MARA: 1.920 every 3rd year (average 640 per year) ASARA: 1,920 every 3rd year (average 640 per year) WCPRA: 1,920 every 3rd year (average 640 per year)

Survey Name	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
					AUV	Speed: 5 kts Duration: 3 hrs	HARA: 480 deployments per year MARA: 80 every 3rd year (average 27 per year) ASARA: 80 every 3rd year (average 27 per year) WCPRA: 80 every 3rd year (average 27 per year)
					ROV	Duration: 1 hr	HARA: 480deployments per year MARA: 80 every 3rd year (average 27 per year) ASARA: 80 every 3rd year (average27 per year) WCPRA: 80 every 3rd year (average 27 per year)
					TOAD	Tow speed: 6 kts Duration: 1 hr	HARA: 480per year MARA: 80 every 3rd year (average 27 per year) ASARA: 80 every 3rd year (average 27 per year) WCPRA: 80 every 3rd year (average 27 per year)
Pelagic Troll and Handline Sampling	Surveys would be conducted to collect life history and molecular samples from pelagic species. Other target species would be tagged-and-released. Different tags would used depending upon the species and study, but could include: passive, archival, ultrasonic, and satellite tags. Fishery observers or NOAA scientists conduct on-board documentation of catch and survival.	HARA, MARA, ASARA, 0 to 24 nm from shore (excluding any special resource areas)	Variable, up to 14 DAS Day and night	NOAA research vessels or the equivalent, or contracted fishing vessels.	Pelagic troll and handline (hook-and-line) fishing.	Troll fishing with up to 4 troll lines each with 1-2 baited hooks or 1-2 hook trolling lures at 4-10 kts. Pelagic handline (hook-and-line) fishing at primarily 10-100 m midwater depths and down to bottomfish depths of 600 m, with hand, electric, or hydraulic reels. Up to 4 lines. Each line is baited with 4 hooks.	A total of up to 2 operations of any of these gear types per DAS, totaling 28 operations (all types combined) for the survey.
Kona Integrated Ecosystem Assessment Cruise *(Adds hook-and-line fishing component to Status Quo protocols)*	Survey transects conducted off the Kona coast and Kohala Shelf area to develop ecosystem models for coral reefs, socioeconomic indicators, circulation patterns, larval fish transport and settlement. Sampling includes active acoustics to determine relative biomass density of sound scattering layers; trawls to sample within the scattering layers; cetacean observations; surface and water column oceanographic measurements and water sample collection.	HARA; 2-10 nm from shore	Variable, up to 10 DAS Day and night	*Oscar Elton Sette*	Cobb midwater trawl	Tow speed: 3 kts Duration: 60-240 min	15-20 tows/yr
					Hook-and-line	Electric or hydraulic reel: Each operation involves 1-3 lines, with squid lures, soaked 10-60 min at depths between 200m to 600m.	No more than 50 hours of effort. Approximately 10 mesopelagic squid caught per year
					Small-mesh towed net (surface trawl)	Tow Speed: 2.5-3.5 kts Duration: 30-60 min	
					Active Acoustics Simrad split-beam EK60, trawl mounted OES Netmind, Didson 303	38-200 kHz Didson 303 is usually operated between 400m and 700m depth.	Intermittent continuous during surveys. Up to 12 Didson casts for up to 120 minutes per survey.
					ADCP (RD Instruments Ocean Surveyor 75)	75 kHz	Intermittent continuous during surveys

Survey Name	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details (Approximated)	Total Number of Samples (Approximated)
					CTD	45-90 min/cast	50 casts peryear, alternating with Oceanography Cruise
Sampling of Juvenile-stage Bottomfish via Settlement Traps	Sampling activity to capture juvenile recruits of eteline snappers and grouper that have recently transitioned from the pelagic to demersal habitat. The specimens will provide estimates of birthdate, pelagic duration, settlement date, and pre-and post-recruitment growth rates derived from the analysis of otoliths. The target species include Deep-7 bottomfish and the settlement habitats these stages are associated with.	Main Hawaiian Islands; 0.2-5 nm from shore	July-September Up to 25 DAS Day and night	*Oscar Elton Sette* or equivalent research vessel, small boats	Trap (Settlement)	Cylindrical with dimensions up to 3 m long and 2 m diameter. Frame composed of semi-rigid plastic mesh of up to 5 cm mesh size. Folded plastic of up to 10 cm mesh is stuffed inside as settlement habitat, and cylinder ends are then pinched shut. Traps are clipped throughout the water column onto a vertical line anchored on bottom at up to 400 m, supported by a surface float.	10 traps per line set; up to 4 line sets soaked per day, from overnight up to 3 days. Up to 100 lines of traps set per year. Catch of 2500 juvenile stage bottomfish per year
Lagoon Ecosystem Characterization *(Increased geographic scope to include areas throughout WCPRA compared to Status Quo protocols)*	Measure the abundance and distribution of reef fish (including juvenile bumphead parrotfish) in any of the lagoons in the WCPRA over a two-week-long period by employing standardized transect and photo-quadrant techniques using SCUBA and snorkeling gear. A collection net may also be used to non-lethally sample fish species inhabiting the lagoon to determine genetic identity. Hook-and–line and spear may also be used to lethally collect specimens.	Throughout WCPRA	Up to 14 DAS Conducted during the day	Small boats	Divers with Hand Net or speargun	SCUBA, snorkel, 12-inch diameter small mesh hand net	10 dives per survey 10 fin clips collected for genetic analyses
					Hook-and-Line	Standard rod and reel using lures or fish bait from shoreline or small boat	1-30 minute casts 60 casts per survey
Pelagic Longline, Troll, and Handline Gear Trials	Investigate effectiveness of various types of hooks, hook guards, gear configurations, or other modified fishing practices for reducing the bycatch of non-target species and retaining or increasing target catch. Data collected on catch efficacy, fish size, species selectivity, and survival upon haul-back Investigate the vertical distribution of pelagic species catch and capture time with time-depth recorders (TDRs) and hook-timers. Investigate behavior of catch and bycatch in relation to fishing operations using cameras, hydrophones, or other sensors. Catch may be tagged and released and specimens may be kept for genetic, physiological, and ecological studies. Troll and handline fishing for pelagic species may also be investigated, with tag and release of catch and collection of specimens.	Longline fishing would occur outside of: (1) all longline exclusions zones in the Hawai'i Hawai'i EEZ; (2) the Insular False Killer Whale range, and (3) all special resource areas. Longline fishing would occur up to approximately 500 nm from the shores of the Hawai'i Hawai'i Archipelago.	21 DAS Day and night	*Oscar Elton Sette,* or contracted longline fishing vessels	Pelagic Longline	Gear (See Appendix A). Soak time: 600-1800 min	Up to 21 longline operation per survey per year
		25 to 500 nm from shore (excluding any special resource areas)			Trolling and handline (hook-and-line)	Troll fishing with up to 4 troll lines each with 1-2 baited hooks or 1-2 hook troll lures at 4-10 kts Pelagic handline (hook-and-line) fishing at 10-100 m midwater depths, with hand, electric, or hydraulic reels. Up to 4 lines. Each line is baited with 4 hooks. Up to 4 hrs per troll or handline operation	Up to 21 troll or handline (combined) operations per survey per year

2.3.1 Mitigation Measures for Protected Species

Under the Preferred Alternative, PIFSC would apply for authorizations under the MMPA and the ESA for incidental take of protected species while conducting the suite of research activities described above. This process requires regulations and authorizations for incidental take of marine mammals under the MMPA and incidental take of protected species under the ESA. Under this alternative, PIFSC is applying to NMFS Headquarters OPR requesting regulations governing the issuance of LOAs for incidental take of marine mammals under the MMPA. OPR would make the necessary findings and, if appropriate, promulgate regulations and issue LOAs to PIFSC. The LOAs would prescribe mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals during the specified research activities.

In addition, both OPR and PIFSC would engage in ESA section 7 consultations with NMFS Pacific Islands Regional Office (and U.S. Fish and Wildlife Service [USFWS]) for species that are listed as threatened or endangered. These consultations may result in the development of a Biological Opinion (BiOp) that determines whether or not the federal action would be likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of any critical habitat. The BiOp could contain an incidental take statement (ITS) for ESA-listed species that includes reasonable and prudent measures along with implementing terms and conditions intended to minimize the impact of incidental take of ESA-listed species during PIFSC research activities.

Under the Preferred Alternative, PIFSC would also continue to apply for ESA section 10 directed research permits for the intentional take of ESA-listed species.

The Preferred Alternative would include the same suite of mitigation measures described in the Status Quo Alternative to reduce the risk of adverse interactions with protected species and EFH. In addition, PIFSC would implement gear modifications under the Preferred Alternative that would reduce the risk of marine mammals getting entangled in instrument deployments (Section 2.3.1.1). PIFSC would also implement a series of improvements to its protected species training, awareness, and reporting procedures under the Preferred Alternative to facilitate and improve the implementation of the mitigation measures described under the Status Quo Alternative (section 2.3.1.2).

2.3.1.1 Gear Modifications

In order to minimize the potential risk of entanglement during instrument deployment, PIFSC would modify the total line length and the relative length of floating line to sinking line used for stationary gear that is deployed from ships or small boats (e.g., stereo-video data collection). A certain amount of extra line (or scope) is needed whenever deploying gear/instruments to the seafloor to prevent currents from moving the gear/instruments off station. If the line is floating line and there is no current then the scope will be floating on the surface. Alternatively, scope in sinking line may gather below the water surface when currents are slow or absent. Because current speeds vary, there is a need for scope every time that gear is deployed.

Line floating on the surface presents the greatest risk for marine mammal entanglement because: (1) when marine mammals (e.g., humpback whales) come to the surface to breathe, the floating line is more likely to become caught in their mouths or around their fins; and (2) humpback whales tend to spend most of their time near the surface, generally in the upper 150 m of the water column.

Currently, PIFSC uses only floating line to deploy stationary gear from ships or small boats. Floating line is used in order to maintain the vertical orientation of the line immediately above the instrument on the seafloor. The floating line also helps to keep the line off of the seafloor where it could snag or adversely affect benthic organisms or habitat features.

This mitigation measure would involve the use of sinking line for approximately the top 1/3 of the line. The other approximately lower 2/3 would still be floating line. This configuration would allow any excess scope in the line to sink to a depth where it would be below where most whales and dolphins commonly occur. Specific line lengths, and ratios of floating line to sinking line, would vary with actual depth and the total line length. This mitigation measure would not preclude the risk of whales or dolphins swimming into the submerged line, but this risk is believed to be lower relative to line floating on the surface.

2.3.1.2 Protected Species Training

PIFSC considers the current suite of monitoring and operational procedures to be necessary and sufficient to minimize adverse interactions with protected species and still allow PIFSC to fulfill their scientific mission. However, many of the mitigation measures described in the Status Quo Alternative could also be considered "best practices" for safe seamanship and avoidance of hazards during fishing. PIFSC researchers are aware of the explicit links between the implementation of these best practices and their usefulness as mitigation measures for avoidance of protected species. However, the specific conditions for implementing these mitigation measures in all situations have not been formalized or widely discussed among all scientific parties and vessel operators. PIFSC therefore proposes a series of improvements to its protected species training, awareness, and reporting procedures under the Preferred Alternative. PIFSC expects these new procedures will facilitate and improve the implementation of the mitigation measures described under the Status Quo Alternative. The enhanced mitigation measures included in the Preferred Alternative are anticipated to be sufficient for and required by NMFS under MMPA and ESA authorizations for the specified research activities affiliated with PIFSC.

- Some mitigation measures such as the move-on rule require judgments about the risk of gear interactions with protected species and the best procedures for minimizing that risk on a case-by-case basis. Ship captains and Chief Scientists are charged with making those judgments at sea. They are all highly experienced professionals but there may be inconsistencies across the range of research surveys conducted and funded by PIFSC in how those judgments are made. In addition, some of the mitigation measures described above could also be considered "best practices" for safe seamanship and avoidance of hazards during fishing (e.g., prior surveillance of a sample site before setting trawl gear). At least for some of the research activities considered, explicit links between the implementation of these best practices and their usefulness as mitigation measures for avoidance of protected species may not have been formalized and clearly communicated with all scientific parties and vessel operators. PIFSC therefore proposes a series of improvements to its protected species training, awareness, and reporting procedures. PIFSC expects these new procedures will facilitate and improve the implementation of the mitigation measures described above.
- PIFSC will initiate a process for its Chief Scientists and vessel captains to communicate with each other about their experiences with protected species interactions during research work with the goal of improving decision-making regarding avoidance of adverse interactions. As noted above, there are many situations where professional judgment is used to decide the best course of action for avoiding marine mammal interactions before and during the time research gear is in the water. The intent of this mitigation measure would be to draw on the collective experience of people who have been making those decisions, provide a forum for the exchange of information about what went right and what went wrong, and try to determine if there are any rules-of-thumb or key factors to consider that would help in future decisions regarding avoidance practices. PIFSC would coordinate not only among its staff and vessel captains but also with those from other fisheries science centers with similar experience.
- Another new element that would be required for all PIFSC research projects is the proposed development of a formalized protected species training program for all crew members that may

be posted on monitoring duty or handle incidentally caught protected species. Training programs would be conducted on a regular basis and would include topics such as monitoring and sighting protocols, species identification, decision-making factors for avoiding take, procedures for handling and documenting protected species caught in research gear, and reporting requirements. PIFSC will work with the Pacific Islands commercial fisheries Observer Program to customize a new protected species training program for researchers and ship crew. The Observer Program currently provides protected species training (and other types of training) for NMFS-certified observers placed on board commercial fishing vessels. PIFSC Chief Scientists and appropriate members of PIFSC research crews will be trained using similar monitoring, data collection, and reporting protocols for protected species as is required by the Observer Program. All PIFSC research crew members that may be assigned to monitor for the presence of marine mammals during future surveys will be required to attend an initial training course and refresher courses annually or as necessary. The implementation of this training program would formalize and standardize the information provided to all research crew that might experience protected species interactions during research activities.

- For all PIFSC research projects and vessels, written cruise instructions and protocols for avoiding adverse interactions with protected species will be reviewed and, if found insufficient, made fully consistent with the Observer Program training materials and any guidance on decision-making that arises out of the two training opportunities described above. In addition, informational placards and reporting procedures will be reviewed and updated as necessary for consistency and accuracy. All PIFSC research cruises already include pre-sail review of protected species protocols for affected crew but PIFSC will review its briefing instructions for consistency and accuracy.
- Following the first year of implementation of the LOA, PIFSC will convene a workshop with PIRO Protected Species, PIFSC fishery scientists, NOAA research vessel personnel, and other NMFS staff as appropriate to review data collection, marine mammal interactions, and refine data collection and mitigation protocols, as required.
- In addition, PIFSC fisheries research personnel working in nearshore or onshore locations in proximity to Hawaiian monk seals will document any disturbances to seals. Such documentation will include date, location, number and reaction of seals, type of disturbance and nature of fisheries research activity being conducted. Reports from such events will be compiled and reviewed on an annual basis for review by PIFSC leadership inorder to devise alternative strategies for reducing any future take. Take events will be reported annually to OPR as required by authorization.

2.3.1.3 Operational Procedures

As discussed in Section 4.2.4.6, PIFSC carefully considered the potential risk of marine mammal interactions with its bottomfishing hook-and-line research gear. PIFSC determined that the risk was not high enough to warrant requesting takes in that gear. However, PIFSC intends to implement the following measures to reduce the risk of potential interactions and to help improve our understanding of what those risks might be for different species. These efforts will help inform the adaptive management process to determine the appropriate type of mitigation needed for research conducted with bottomfishing gear.

- Visual monitoring for marine mammals before gear is set and implementation of the “move-on” rule as described for longline gear.

- To avoid attracting any marine mammals to a bottomfishing operation, dead fish and bait will not be discarded from the vessel while actively fishing. Dead fish and bait may be discarded after gear is retrieved and immediately before the vessel leaves the sampling location for a new area.
- If a monk seal, bottlenose dolphin, or other marine mammal is seen in the vicinity of a bottomfishing operation, then the gear would be retrieved immediately and the vessel would move to another sampling location where marine mammals are not present.
- If a hooked fish is retrieved and it appears to the fisher that it has been damaged by a monk seal, then visual monitoring will be enhanced around the vessel for the next ten minutes. Fishing may continue during this time. If a shark is sighted, then visual monitoring would be returned to normal. If a monk seal, bottlenose dolphin, or other marine mammal is seen in the vicinity of a bottomfishing operation, then the gear would be retrieved immediately and the vessel would be moved to another sampling location where marine mammals are not present. Catch loss would be tallied on the data sheet, as would a “move-on” for a marine mammal.
- If bottomfishing gear is lost while fishing, then visual monitoring will be enhanced around the vessel for the next ten minutes. Fishing may continue during this time. If a shark is sighted, then visual monitoring would be returned to normal. If a monk seal, bottlenose dolphin, or other marine mammal is seen in the vicinity, it would be observed until a determination can be made of whether gear is sighted attached to the animal, gear is suspected to be on the animal (i.e., it demonstrates uncharacteristic behavior such as thrashing), or gear is not observed on the animal and it behaves normally. If a cetacean or monk seal is sighted with the gear attached or suspected to be attached, then the procedures and actions for incidental takes would be initiated. Gear loss would be tallied on the data sheet, as would a “move-on” because of a marine mammal.

2.3.2 Unknown Future PIFSC Research Activities

In addition to the activities identified above, PIFSC may propose additional surveys or modify existing research activities within the timeframe covered by MMPA authorization. For example, over the next five years advancements in technology may lead to new and better sampling instruments and gear, such as video equipment and UAS. Because of the annual cycle under which decisions to fund or conduct research are made, PIFSC cannot identify in advance all the potential future activities that may take place over the next five years. For purposes of this programmatic analysis, NMFS has examined the research activities that have occurred in the past five years and used this information as a proxy for future proposed research activities that may occur through the five-year MMPA authorization period. Taken together these activities comprise the actions evaluated within this DPEA under the Preferred Alternative.

Over the next five years, as future congressional appropriations and NMFS fisheries research budgets are established, PIFSC will examine the proposed future research to determine if the activities are consistent with the scope of actions considered under the Preferred Alternative. To be considered ‘within scope’ under this DPEA, future proposals for specific research projects must be consistent with the gear types, spatial and temporal distribution of research activities, and types of effects analyzed within this document. If future research projects are not consistent with the type or scope of fisheries research activities analyzed in this DPEA, they may be subject to additional NEPA, ESA, and MMPA evaluations.

More specifically, the basic methodology used to evaluate any proposed future research activity will be as follows:

1. Evaluate the activity to determine if it would be conducted within the geographic scope of the region evaluated in the DPEA. The evaluation described in Chapter 4 of this DPEA is based on the historic spatial distribution of research surveys. Any future research activities proposed within the geographic areas described in Chapter 4 would pass this step of the evaluation. The

geographic scope of this DPEA is extensive, but some areas (e.g., areas with permanent exclusions) were not subject to research surveys and are not necessarily included in this evaluation. Any proposed research in those areas may require additional evaluation.

2. Evaluate the seasonal distribution of the activity. The activities evaluated in this DPEA are conducted throughout the year but certain surveys are only conducted in specific time frames or seasons. If a program was proposed that was similar in methodology to past surveys but drastically shifted the timing of research activities from what was analyzed in this DPEA, additional evaluation may be required.
3. Evaluate the gear types proposed. The gear types that were included in the analysis are described in Appendix A. If the proposed future research activity used the same or similar gear in the same manner analyzed in this DPEA, then the research activity would likely fall within the analysis conducted. The research activity would not have to exactly match the descriptions in this DPEA, because the same impacts would be expected from similar gear types and activities. For example, if a new side-scan sonar were to be deployed, but the signal strength and frequency were within the ranges evaluated for bottom sounding sonar evaluated in this DPEA, then the impacts would be similar because only the area swept by the sonar would be changing. If a new type of gear was to be deployed, or if a gear type was to be used in substantially different ways than described, and if environmental impacts not considered in this DPEA could result, then additional NEPA analysis may be required.

To reiterate, any proposed action 1) conducted in regional areas described in this DPEA, 2) during times of the year considered, and 3) using gear types and methods generally equivalent to the methods evaluated, would likely be considered covered by the scope of analysis and conclusions drawn in this DPEA. If future proposed research activities, projects, or programs are not consistent with the type or scope of fisheries research activities analyzed in this DPEA, they may require additional NEPA evaluations.

2.4 ALTERNATIVE 3 - MODIFIED RESEARCH ALTERNATIVE – CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH (NEW SUITE OF RESEARCH) WITH ADDITIONAL MITIGATION

Under the Modified Research Alternative, PIFSC would continue fisheries research as described in Section 2.3 and Appendix A and would apply for authorizations of incidental take of protected species under the MMPA and the ESA. The Modified Research Alternative would include all of the same mitigation measures required by the MMPA and ESA authorization procedures as described for the Preferred Alternative. The difference between the Modified Research Alternative and the Preferred Alternative is that the Modified Research Alternative includes a number of additional mitigation measures derived from a variety of sources including: (1) comments submitted from the public on similar fisheries actions, (2) discussions within NMFS as a part of the proposed rulemaking process, and (3) a literature review of past and current research into potential mitigation measures. The new suite of research activities is a combination of past research and additional, new research, as described for the Preferred Alternative.

As described in the Preferred Alternative, PIFSC continually reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluating new mitigation measures includes assessing their effectiveness in reducing risk to protected species, but measures must also: pass safety and practicability considerations, meet survey objectives, allow survey results to remain consistent with previous data sets, and be consistent with the purpose and need for PIFSC research activities (Section 1.3). Some of the mitigation measures considered in this alternative (e.g., no night fishing, or broad spatial and/or temporal restrictions) would essentially prevent PIFSC from collecting data required to provide for fisheries management purposes under the Magnuson-Stevens Fishery Conservation and Management Act. Some research surveys necessarily target fish species that are preyed upon by marine mammals with an inherent risk of interactions with marine mammals during these surveys. PIFSC acknowledges the inherent risk of these, and it has implemented a variety of measures to mitigate that risk. PIFSC currently has no viable alternatives to collecting the data derived from these surveys and does not propose to implement potential mitigation measures that would preclude continuation of these surveys, such as the elimination of night surveys or elimination of pelagic trawl gear use. An analysis of the potential efficacy and practicability of the additional mitigation measures considered in this alternative is presented in Section 4.4.

The secondary federal action covered under this DPEA is the issuance of regulations and subsequent Letters of Authorization under Section 101(a)(5)(A) of the MMPA that would regulate the unintentional taking of small numbers of marine mammals incidental to PIFSC's research activities. In order to authorize incidental take of marine mammals under the MMPA, NMFS must identify and evaluate mitigation measures to minimize impacts to marine mammals to the level of "least practicable adverse impact." As described above, some mitigation measures could prevent PIFSC from maintaining the utility of ongoing scientific research efforts, and those mitigation measures would normally be excluded from consideration in the DPEA under screening criteria 3 (Section 2.1). However, such mitigation measures would likely be considered during the MMPA incidental take authorization process and/or ESA section 7 consultation and are therefore considered under the Modified Research Alternative in this DPEA.

2.4.1 Additional Mitigation Measures for Protected Species

2.4.1.1 Trawl Surveys

1. Monitoring methods

   Visual observations (using bridge binoculars as needed) by the officer on watch, Chief Scientist or other designated scientist, and crew standing watch are currently the primary means of

detecting protected species in order to avoid potentially adverse interactions. However, there are other detection methods that have been used in commercial fisheries, naval exercises, and geotechnical exploration that could be considered. These additional types of detection methods would be intended to be used in specific circumstances, such as operating at night or in low visibility conditions.

- Visual surveillance by dedicated protected species observers. This measure would require PIFSC to use trained protected species observers whose dedicated job is to detect the presence of marine mammals and other protected species within the survey area and communicate their presence to ship operations personnel. This dedicated observer position would be different than having marine mammal or bird biologists on board whose job is to conduct abundance and distribution surveys. Considerations include the use of dedicated observers for all surveys or during trawl surveys of particular concern.
- Use of a camera or underwater video system to monitor any interactions of protected species with the trawl gear. Underwater video technology may allow PIFSC to determine the frequency of interactions with the trawl gear and to evaluate the effectiveness of a measure's ability to mitigate injurious or lethal interactions.
- Use of passive acoustic monitoring for marine mammal vocalizations to aid in the detection of marine mammals present in the survey area and to implement appropriate modifications of trawl operations.
- Use of aircraft, unmanned aerial vehicles, or autonomous underwater gliders to provide additional detection capabilities.
- Use of infrared (IR) technologies to detect marine mammals.
- Use of night-vision devices to detect marine mammals.

2. Operational restrictions
   - This measure would require PIFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize interactions with marine mammals that would be difficult to detect by visual monitoring.
   - Video sampling with an open codend.
3. Acoustic and visual deterrents
   - This measure would require PIFSC to use deterrents, such as recordings of predator vocalizations to deter interactions with trawl gear, or use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope) to reduce marine mammal interactions with the gear.
4. Temporal or geographic restrictions
   - Spatial or temporal restrictions are one of the most direct means of reducing adverse impacts to protected species. By reducing the overlap in time and space of the survey's footprint with known concentrations of protected species, PIFSC may reduce the amount of incidental take of such species. This measure would require PIFSC to identify areas and times that are most likely to result in adverse interactions with protected species (e.g., areas of peak abundance such as humpback whale wintering in the Main Hawaiian Islands) and to avoid, postpone, or limit research activities to minimize the risk of such interactions with protected species as long as such spatial or temporal restrictions do not conflict with the ability of PIFSC to conduct scientifically valid surveys and to provide the best scientific information available

for purposes of managing commercial fisheries. This may include limits on specific locations, physical or oceanographic features, biologically important times, or gear types.

- Avoidance of certain federal and state marine protected areas. This measure would restrict PIFSC trawl surveys in certain federal or state marine protected areas (Section 3.1.2.4).

2.4.1.2 Longline Gear

1. Monitoring methods
   - Visual surveillance by independent protected species observers. This measure would require PIFSC to use trained, independent, protected species observers on each longline survey to detect the presence of marine mammals and other protected species within the survey area. Considerations include the use of independent observers for all surveys or during longline surveys of particular concern. Montitoring may take place during setting, soaking, and/or hauling.
2. Operational procedures
   - Streamer lines. Under this measure, PIFSC would deploy streamer lines before longline gear is set to mitigate the risk of catching seabirds. Deploying streamer lines on each side of the baited longline to discourage seabirds from diving on baited hooks has been proven effective in reducing seabird bycatch in several Pacific fisheries (Melvin et al. 2001).
3. Acoustic deterrents
   - This measure would require PIFSC to use deterrents such as acoustic pingers or recordings of predator vocalizations (e.g., killer whale) to deter interactions with longline gear.
4. Visual deterrents
   - This measure would require the crew to use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope, or marked lines) to make the longline gear more detectable thereby potentially reducing the likelihood of hooking or entangling a marine mammal. Note that lights and light sticks are prohibited for use on longline gear in some Pacific fisheries as they may contribute to increased turtle bycatch.

2.5 ALTERNATIVE 4 – NO RESEARCH ALTERNATIVE - NO FIELDWORK FOR FISHERIES AND ECOSYSTEM RESEARCH CONDUCTED OR FUNDED BY PIFSC

Under the No Research Alternative PIFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered in the scope of this DPEA in marine waters of the Hawaiian Archipelago Research Area, the Mariana Archipelago Research Area, the American Samoa Archipelago Research Area, and Western and Central Pacific including the Pacific Remote Islands Research Area. This moratorium on fieldwork would not extend to research that is not in scope of this DPEA, such as directed research on marine mammals and ESA-listed species covered under separate research permits and NEPA documents. NMFS would need to rely on other data sources, such as fishery-dependent data (e.g., harvest data) and state or privately supported fishery-independent data collection surveys or programs to fulfill its responsibility to manage, conserve and protect living marine resources in the U.S. Under this alternative, organizations that have participated in joint research programs may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding. Any non-federal fisheries research would occur without NMFS funding, direct control of program design, or operational oversight. It is unlikely that these non-NMFS fisheries research surveys would be consistent with the time series data NMFS has collected over many years, which is the core information supporting NMFS' science and management missions and vital to fishery management decisions made by the Fishery Management Councils, NMFS, and other marine resource management institutions, leading to greater uncertainty for fishery and other natural resource management decisions.

Currently, fisheries and marine ecological research is also being conducted by state and territorial agencies, other international agencies, and research institutes in the four PIFSC research areas, sometimes with funding support from PIFSC. However, this research is limited in scale and generally confined to state and territorial waters as well as near-shore ocean areas and does not cover many of the fisheries topics currently investigated by PIFSC. Under the No Research Alternative, it is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by PIFSC. No agencies or other entities would likely conduct marine research to replace the research abandoned by PIFSC in the four research areas under the No Research Alternative.

2.6 ALTERNATIVES CONSIDERED BUT REJECTED FROM FURTHER ANALYSIS

As stated previously, the alternatives evaluated in an EA must achieve the purpose and need of the proposed action, in part or in full, without violating any of the applicable laws and regulations described in Chapter 6 and summarized in section 1.6. Other potential alternatives that do not satisfy the agency's purpose and need, or would not meet minimum environmental standards, are not considered reasonable and need not be carried forward for evaluation in an EA. The following alternatives were considered but rejected because they do not meet the purpose and need as stated in Section 1.3 or the screening criteria described in Section 2.1.

2.6.1 Sole Reliance on Commercial Fishery Data

One alternative that NMFS considered was to rely solely on commercial fisheries data such as Catch Per Unit Effort, seasonal and geographic distribution of harvests, and other harvest data to assess the status of commercially important stocks. This alternative was rejected from further analysis because it would not provide sufficient information on the age and size class structure of exploited fish stocks and would be insufficient to track fish population dynamics or provide other types of predictive capabilities required to manage the fisheries. Although several large commercial fisheries in the region are assessed using almost exclusively fishery-dependent data (e.g. Hawai‘i shallow-set longline (SSLL) and deep-set longline (DSLL), American Samoa longline and purse seine), sole reliance on commercial fishery data would preclude the collection of complimentary ecosystem data needed to inform long-term decision making by fisheries and ecosystem management organizations. For example, PIFSC provides managers with oceanographic, life history, and community structure data not collected by the commercial or recreational fisheries. In addition, sole reliance on commercial fishery data would not meet the need to maintain a standardized, objective, and unbiased sampling approach provided by independent surveys.

Conclusion: This alternative does not meet screening criteria 1 or 3. It would not meet statutory obligations because directed research activities would not be conducted. It would not maintain scientific integrity of research programs because the results would not provide the holistic and complementary datasets (oceanographic, life history, and abundance data) for the vast geographic areas within the Pacific Islands Region. For these reasons this alternative is not carried forward for detailed evaluation.

2.6.2 New Methodologies

Another alternative considered was to adopt other types of survey methodologies or develop new methodologies based primarily on their potential to eliminate or greatly reduce interactions with protected species or effects on habitat, as opposed to adopting new methods and gear for fisheries research purposes. Although NMFS continues to place a high priority on avoiding adverse interactions with protected species and is continually reviewing potential mitigation measures for research activities, the purpose and need for conducting fisheries research requires future sampling methodologies be consistent with past data sets to maintain long-term trend analyses for commercially fished and ecologically important species. NMFS is currently evaluating alternative sampling methods for fisheries and marine ecosystem research, some of which may reduce the potential for incidental takes of protected species or effects on benthic habitats. However, these new methodologies will be evaluated primarily for consistency with the purpose and need for fisheries and marine ecosystem research and whether they provide information that can build on and supplement past data sets.

Conclusion: This alternative did not meet screening criterion 3. It would not maintain scientific integrity of research programs because the results would not maintain the consistency of data with prior research efforts. Therefore, this alternative is not carried forward for detailed evaluation.

2.6.3 Alternative Research Program Design

In this alternative the types of research conducted would be revised to determine if alternative levels of particular research activities would result in different levels of impacts. This alternative would emphasize minimizing potential adverse environmental impacts when designing research activities. Other factors, such as maximizing efficient use of scientific research funding and maintaining the integrity of long-term data sets, would not be considered in this approach.

Conclusion: This alternative was rejected because it would not meet screening criterion 3 and would intrude on inherently technical and scientific decisions. Therefore, this alternative is not carried forward for detailed evaluation.

2.7 INTERNATIONAL BYCATCH REDUCTION RESEARCH PROJECTS IN FOREIGN TERRITORIAL SEAS: EO 12114 COMPLIANCE

In coordination and collaboration with non-governmental organizations and foreign governments, PIFSC participates in several fisheries technology development and ecosystem monitoring capacity-building projects in foreign territorial seas that include bycatch reduction, electronic monitoring (EM), coral reef research and monitoring, and other fishing technology research projects. These projects take place within 12 nm of the foreign country's baseline. These projects collect data necessary to evaluate the efficacy of various fisheries technologies. For example, bycatch reduction projects are designed to develop and refine gear technologies that have shown potential to reduce bycatch interactions in fisheries (e.g., net, trawl, seine, longline, handline, or hook-and-line fisheries). By collaborating with local (in-country) fishers, international scientists and managers, NGOs, universities, and government fishery scientists, PIFSC contributes to such fisheries research in a manner that is conducted under typical fishing operations and without increasing fishing effort in the fishery. Depending upon the project and the location, the respective foreign governments or fishery agencies may participate directly or indirectly in these research activities (e.g., research partnerships, approved permit, agreements).

PIFSC proposes to administer, collaborate, and participate in the following projects in foreign territorial waters over the next five years:

- **Coral Triangle Initiative.** This program occurs year-round in the nearshore waters around the Philippines, Malaysia, Indonesia, Timor-Leste, Papua New Guinea, Solomon Islands, Vietnam, and other participant nations in the region. It provides technical assistance to develop and institutionalize ecosystem approaches to fisheries management planning for the Arafura Sea ecosystem. It includes governance framework-development and capacity-building, ecosystem approaches to fisheries management and LEAD Training for Core National/Regional Universities in the Philippines. Foreign partners include U.S. Agency for International Development, technical assistance and capacity building on sustainable fisheries management and conservation with local agencies. The protocols for fieldwork include the use of hand gear by SCUBA divers, including a spear gun, slurp gun, and hand net. Protocols also include deployment of ARMs, CAUs, BMUs, and BRUVs. Additional protocols include the use of various multi-frequency active acoustics (38-240 kHz). These protocols are based on the RAMP surveys and activities described in the Status Quo and Preferred Alternatives.
- **Development of innovative bycatch reduction technologies (BRTs).** These are projects that occur throughout the year in the waters of the Eastern Tropical Pacific (Mexico, Guatemala, Honduras, Costa Rica, Panama, El Salvador, Nicaragua, Columbia, Ecuador, Peru, and Chile), the South Atlantic (Brazil, Uruguay, and Argentina), the South China Sea, the Coral Triangle (Indonesia, Vietnam, and Philippines), and the Mediterranean Sea (Spain, Italy, Cyprus, and Israel). These projects aim to develop and refine fisheries technologies that reduce incidental bycatch while still catching target fishes, increase fishing efficiencies, increase fisheries monitoring, and improve fisheries management. Partners include the Ocean Discovery Institute and WWF-USA(United States), Comisión Nacional de Áreas Naturales Protegidas (Mexico), Grupo Tortuguero (Mexico), Instituto Nacional de Pesca (Mexico), ProDelphinus (Peru), Instituto del Mar Del Peru (Peru), Pacifico Laud (Chile), Subscretaria de Recursos Pesqueros (Ecuador), TAMAR (Brazil), World Wildlife Foundation - Indonesia (Indonesia), Ministry of Marine Affairs and Fisheries (Indonesia), Kai Soluciones Avanzades (Spain), ICAPO (U.S., El Salvador, Nicaragua, Honduras), Birdlife International, and SUBMON (Spain). These projects use contracted fishery observers on coastal gillnet fisheries, pelagic longlines, bottom set longline, and fish trap fisheries. Fishery observers monitor the fishermen's use of net illumination technology, visual alerts, electropositive metals, acoustic deterrent devices, modified hooks to test

and develop new mitigation measures to reduce bycatch (e.g., bycatch such as finfish, elasmobranchs, sea turtles, sea birds, marine mammals), as well as place satellite telemetry tags on incidentally caught species (e.g. sea turtles, sharks, etc) to better understand post interaction mortalities, and also help test the use of electronic monitoring devices to better increase observed fishery activities.

- **Testing of BRTs in East Asian Fisheries.** This project occurs near Japan, Taiwan, and China. It seeks to understand bycatch interactions and test BRTs in Japanese fisheries. Emphasis is placed on testing BRTs in fisheries that interact with Northern Pacific loggerhead sea turtles. Foreign partners include the Sea Turtle Association of Japan, Tokyo University of Marine Technology, Japan Fisheries Agency, and Suma Aqualife Park. The protocols for fieldwork include the use of aerial surveys, fishery observers, behavioral studies in aquaria, and satellite telemetry. Fishery observers use pound net escape devices, net illumination, visual alerts, electropositive metals, acoustic deterrents, and modified hooks to develop new mitigation measures for bycatch reduction.
- **Testing BRTs in Western and Central Pacific Ocean**. This project occurs near Fiji and evaluates the effectiveness of various types of circle and tuna hooks at reducing the bycatch of non-target species in longline fisheries. It also collects data in collaboration with local fishers, NGOs, and governmental organizations on catch efficacy, fish size, species selectivity, and survival upon haul-back as based on hook type. Fishery observers conduct on-board documentation of catch and survival data on foreign flag vessels. Fishery observers monitor the fishermen's use of net illumination technology, visual alerts, electropositive metals, acoustic deterrent devices, modified hooks to test and develop new mitigation measures to reduce bycatch, as well as place satellite telemetry tags on incidentally caught species (e.g., sea turtles, sharks) to better understand post interaction mortalities, and also help test the use of electronic monitoring devices to better increase observed fishery activities.

3.1 PHYSICAL ENVIRONMENT

The geographic areas and physical environments potentially affected by the Pacific Islands Fisheries Science Center's (PIFSC) research surveys are located throughout the Pacific Ocean. These areas include the waters around the Hawaiian, American Samoan, and Mariana Archipelagos as well as the high seas in between these island chains, including the Pacific Remote Island Areas. PIFSC research surveys occur both inside and outside the United States (U.S.) Exclusive Economic Zone (EEZ) and sometimes in foreign territorial seas. Often, the surveys span across multiple ecological, physical, and political boundaries.

3.1.1 Large Marine Ecosystems

Large Marine Ecosystems (LMEs) are large areas of coastal ocean space. LMEs generally include greater than 200,000 square kilometers (km²) of ocean surface area, and are located in coastal waters where primary productivity is generally higher than in open ocean areas. LME physical boundaries are based on four ecological criteria: bathymetry, hydrography, productivity, and trophic relationships. Based on these four criteria, 10 LMEs have been delineated for the coastal marine waters of the U.S., and a total of 64 distinct LMEs have been delineated around the coastal margins of the Atlantic, Pacific and Indian Oceans (Sherman et al. 2004). Figure 3.1 1 shows the world's LMEs as defined at www.lme.noaa.gov. Each color represents a distinct LME.

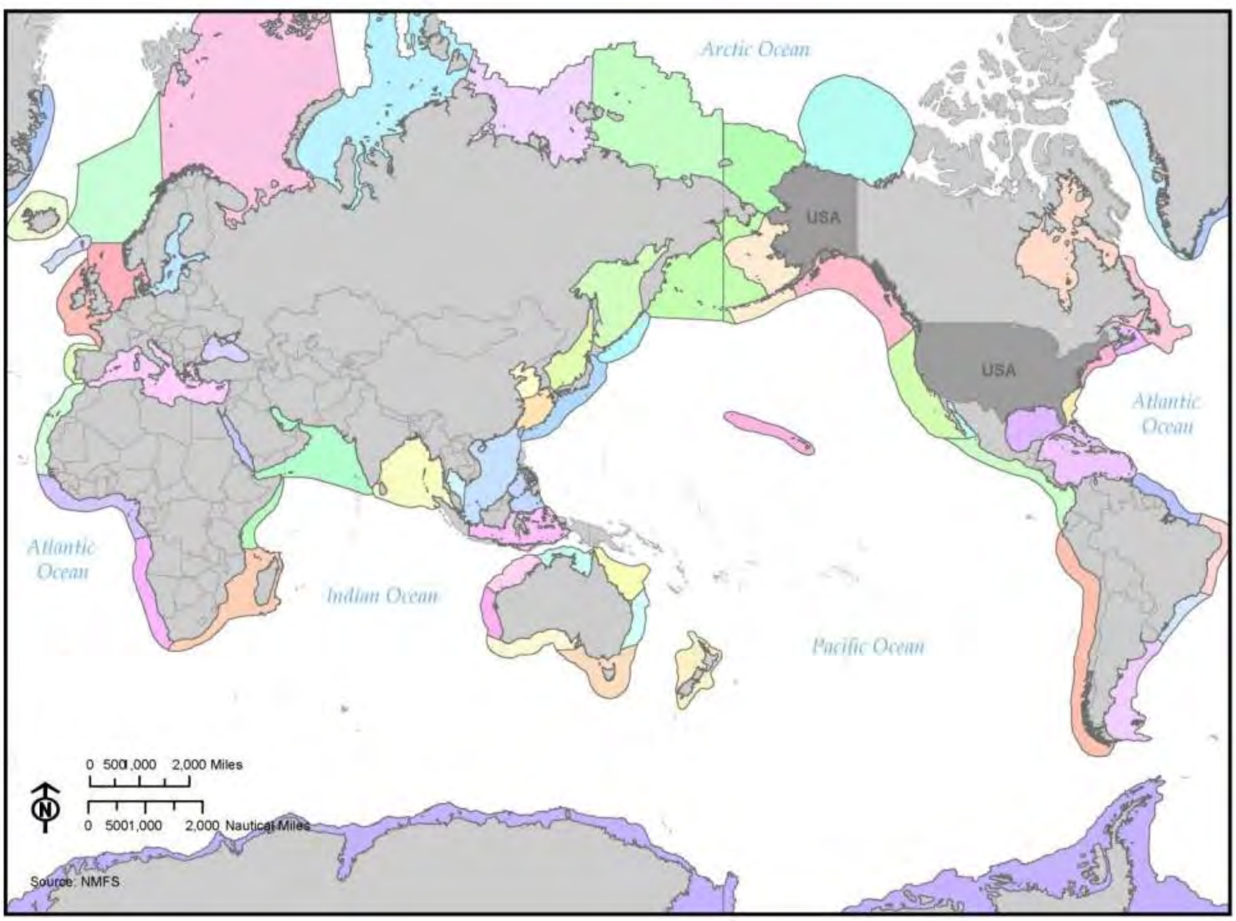


Figure 3.1-1 Large Marine Ecosystems of the World

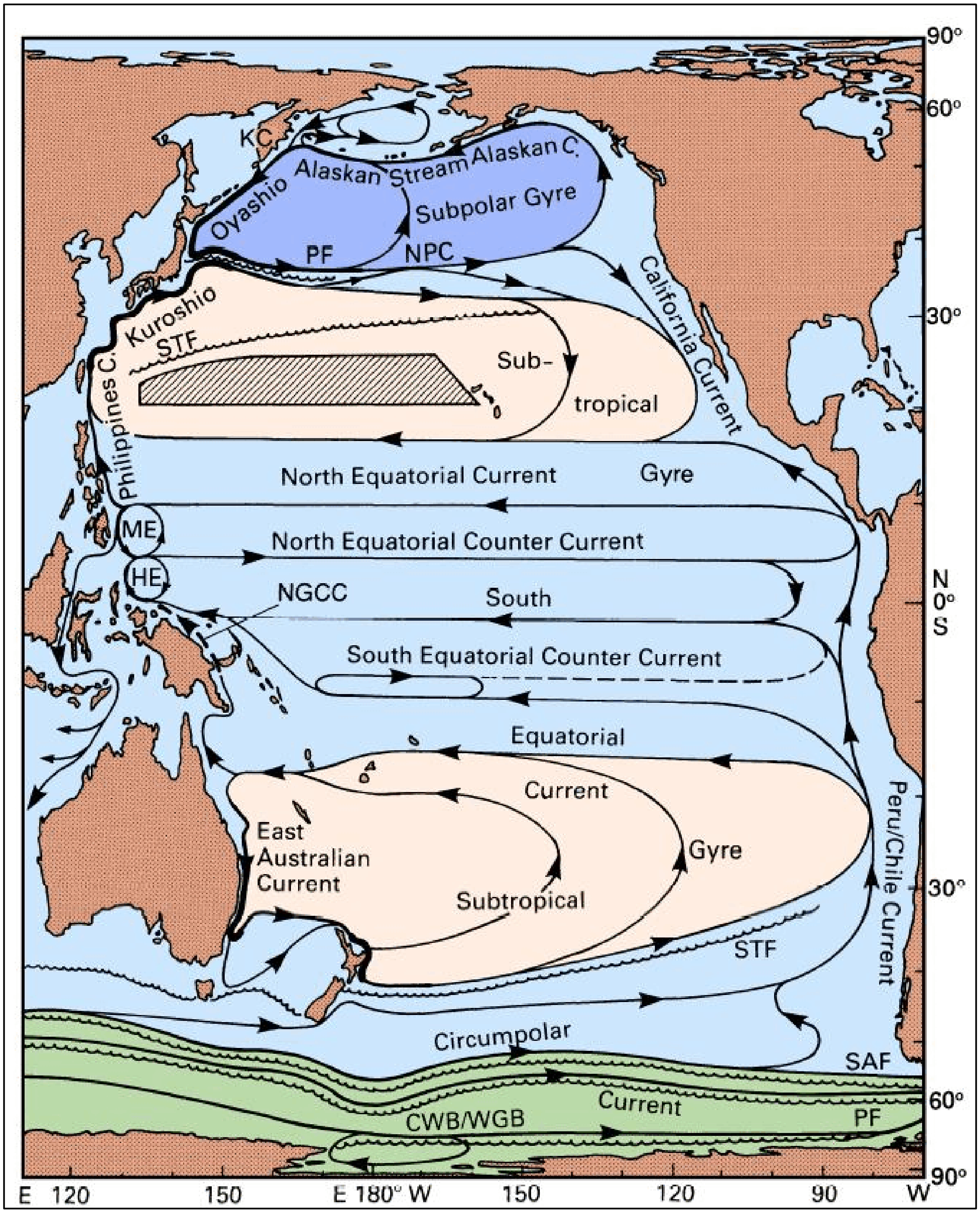
Globally, LMEs are the source of 80 to 95 percent of the world's marine fish harvest, and are centers of economic activity for oil and gas, shipping, and tourism industries. The LME concept provides a practical framework for the application of ecosystem-based approaches to fisheries assessment and management, habitat restoration, and research on pollution and ecosystem health. The National Oceanic and Atmospheric Administration (NOAA) and National Marine Fisheries Service (NMFS) have implemented a management approach designed to improve the long-term sustainability of LMEs and their resources by using practices that focus on ensuring the sustainability of the productive potential for ecosystem goods and services. For more detailed information on the LME management concept and trends in ecosystem health, see *The UNEP* [United Nations Environmental Program] *Large Marine Ecosystem Report: A perspective on changing conditions in LMEs of the world's Regional Seas* (Sherman and Hempel 2008).

PIFSC's fisheries research activities take place in four primary research areas: the Hawaiian Archipelago Research Area (HARA), the Mariana Archipelago Research Area (MARA), the American Samoa Archipelago Research Area (ASARA), and the Western and Central Pacific including the Pacific Remote Islands Research Area (WCPRA), which are described in detail in the following sections (Figure 3.1-2). The HARA includes the Insular Pacific-Hawaiian LME. Additionally, a substantial amount of the PIFSC fisheries research activities are conducted in offshore areas that lie outside of the coastal LME boundaries. LMEs within close proximity to offshore research include the Indonesian Sea LME, Sulu-Celebes Sea LME, Kuroshio Current LME, and the Oyashio Current LME.

3.1.1.1 Hawaiian Archipelago Research Area

The HARA includes waters surrounding the Hawaiian Islands to a seaward extent of approximately 24 nautical miles. PIFSC conducts research surveys in the HARA, primarily inside the Insular Pacific-Hawaiian LME boundary. The Insular Pacific-Hawaiian LME has a surface area of approximately one million km^2, extending 1,500 miles from the main Hawaiian Islands to the outer northwest islands, including a range of islands, atolls, islets, reefs and banks (WPRFMC 2009a). Within the Pacific basin are underwater plate boundaries that define long mountainous chains, submerged volcanoes, islands and archipelagos as well as various other bathymetric features that influence the movement of water and the distribution of marine organisms. The Hawaiian Islands were created during successive periods of volcanic activity and are surrounded by coral reefs. This area contains about 1 percent of the coral reefs and sea mounts in the world and four major estuaries (Aquarone and Adams 2008).

The HARA experiences relatively uniform and tropical meteorological and oceanographic conditions. Sea surface temperatures generally average between 24.5 and 25.3 degrees Celsius and range from 21 to 29 degrees Celsius throughout the HARA. The circulation of ocean water in the HARA and throughout the Pacific Ocean is a complex system primarily driven 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 (WPRFMC 2009a). Unique oceanographic systems including the North Hawaiian Ridge Current, Pacific Ocean-Atmosphere system, cyclonic eddies, and wind-driven ocean circulation drives much of the regional ocean productivity around the HARA (Qiu et al. 1997; Xie et al. 2001; Seki et al. 2001; Chavanne et al. 2002). Figure 3.1-2 shows the major surface currents of the Pacific Ocean.



Source: Tomczak and Godfrey 2003

Figure 3.1-2 Major Surface Currents of the Pacific Ocean

Note: Abbreviations are used for the Mindanao Eddy (ME), the Halmahera Eddy (HE), the New Guinea Coastal Current (NGCC), the North Pacific Current (NPC), and the Kamchatka Current (KC). Other abbreviations refer to fronts: NPC (North Pacific Current), STF (Subtropical Front), SAF (Subantarctic Front), PF (Polar Front), and CWB/WGB (Continental Water Boundary/Weddell Gyre Boundary). The shaded region indicates banded structure (Subtropical Countercurrents). In the western South Pacific Ocean, the currents are shown for April–November when the dominant winds are the trades. During December–March, the region is under the influence of the northwest monsoon, flow along the Australian coast north of 18° S and along New Guinea reverses, the Halmahera Eddy changes its sense of rotation, and the South Equatorial Current joins the North Equatorial Countercurrent east of the eddy (WPRFMC 2009a).

The HARA is seasonally influenced by the Subtropical Front (STF), which corresponds to a shallow subtropical countercurrent that transects the LME in winter and summer (Kobashi et al. 2006). The STF, plays an important role in the regional ecology of the HARA, defining a major trans-ocean migration path and feeding grounds for many species. Additionally, the HARA is subject to high wave energy produced from weather systems generated off the Aleutian Islands and other areas of the North Pacific. Such waves can have major effects on nearshore environment, and may break off coral, move underwater boulders, and shift large volumes of sand and erode islands (WPRFMC 2009a).

Breaking waves from surf generated by Pacific storms influences the structures of exposed reef communities; extreme wave events are believed to play fundamental roles in forming and maintaining the spatial and vertical distributions of corals, algae, and fishes in coral reef ecosystems throughout the HARA (WPRFMC 2009a).

3.1.1.2 Mariana Archipelago Research Area

The MARA includes waters surrounding the Commonwealth of the Northern Mariana Islands (CNMI) and the Territory of Guam to a seaward extent of approximately 24 nautical miles. The Mariana Islands cover approximately 396 square miles. They are composed of 15 volcanic islands that are part of a submerged mountain chain that spans from Guam to Japan. Politically, the islands are split into the Territory of Guam and the CNMI, but are combined for the purposes of defining the MARA. The islands are oriented along a north-south axis, with Guam being the southernmost island in the archipelago. Additionally, there is a chain of submerged seamounts located approximately 120 nautical miles west of the Mariana Islands, also in a north-south pattern, reaching southwest of Guam. Seamounts are mountains rising from the ocean seafloor that do not reach the water's surface. Species richness is greater near seamounts than nearshore or oceanic areas, creating hotspots of pelagic biodiversity (Morato et al. 2010). The islands and seamounts were formed approximately 43 million years ago by the subduction of the Pacific tectonic plate under the Philippine plate. The Mariana Trench is a unique feature created at this subduction zone. Also running in a north-south pattern located east of the island chain, the Mariana Trench is the deepest location on earth with its deepest point, the Challenger Deep, at 11,000 meters (m), which is located just outside of the U.S. EEZ.

Since their formation, the islands have undergone complex changes including periods of volcanism, submarine and subaerial uplift, subsidence, and rifting, all of which have contributed to its heterogeneous surface composition and primarily flat uplifted limestone plateaus (WPRFMC 2009b). Habitats included in this area include coral reefs with wide diversity, deep reef slopes, banks and seamounts, and the deep ocean floor (WPRFMC 2009b). Coral reefs appear to have developed differently throughout the Mariana Archipelago based on the age and geology of the islands. Geological faulting of large areas in the older southern portion has created large, oblique shallow-water surfaces that have supported extensive reef growth and the development of reef flats and lagoons over time. In contrast, the islands in the north are younger with more vertical profiles that do not provide the basis for extensive reef development. Oceanic islands generally lack an extensive shelf area of relatively shallow water extending beyond the shoreline. Instead, most often have a deep reef slope, angled between 45 and 90 degrees toward the ocean floor. Species compositions along deep reef slopes, banks, and seamounts all can vary widely based on depth, light, temperature, and substrate. As a result, this spectrum of physical conditions creates a suite of different habitats that in turn support a variety of biological communities. At the end of the slope lies the deep ocean floor. While most of this dark and cold area is homogenous and low in productivity, there are hot spots where thermal vents spew hot water with relatively high concentrations of various metals and dissolved sulfide. Specialized bacteria found around such thermal vents can make energy from the sulfide and provide a nutrition source for a variety of other species (WPRFMC 2009b).

The primary surface current affecting CNMI and Guam is the North Equatorial Current (see Figure 3.1-2), which flows westward through the islands; however, the Subtropical Counter Current also influences the Northern Mariana Islands and generally flows in a easterly direction. Depending on the season, sea

surface temperatures near the Northern Mariana Islands vary between 27.2 –29.4° C, and the mixed layer extends to depths of 300–400 feet (Eldredge 1983).

3.1.1.3 American Samoa Archipelago Research Area

The ASARA includes waters surrounding the American Samoa archipelago to a seaward extent of approximately 24 nautical miles. The Samoa archipelago is located northeast of Tonga and consists of seven major volcanic islands, several small islets, and two coral atolls. The two largest islands in this chain, Upolu and Savai‘i are governed by the Independent State of Samoa and are not included in the ASARA. The five major inhabited islands of American Samoa are Tutuila, Aunu‘u, Ofu, Olosega, and Ta‘u. The total land mass of American Samoa is about 200 km^2 and surrounded by an EEZ of approximately 390,000 km^2. The largest island, Tutuila, is nearly bisected by Pago Pago Harbor, the deepest and one of the most sheltered embayments in the South Pacific.

The region was believed to be relatively geologically inactive with few seamounts or guyots in comparison to other Polynesian states. New anecdotal evidence indicates that the region is volcanically active. The majority of islands rise from deep (4,000 m) oceanic depths (WPRFMC 2009c). In 2005, NOAA and the University of Hawai‘i conducted research on undersea volcanoes and associated ecosystems between Hawai‘i and New Zealand (WPRFMC 2009c). Using deep-sea submersibles scientists visited the volcanic hotspot at the Vailulu‘u Seamount located in American Samoa near Tutuila. The Vailulu‘u Seamount had been previously bathymetrically mapped; however, in the six years since the most recent mapping a 330-meter tall volcanic cone, known as Nafanua, had grown in the seamount's crater. Scientists speculate this growth will continue and will breach the sea surface within decades forming a new island in the Samoan island group. The seamount cone has several different types of hydrothermal vents which provide habitat for an unusual group of organisms ranging from microbial mats to a species of polychaete worm and at the summit of Nafanua, a thriving population of eels (*Dysommina rugosa*) surviving on crustaceans imported to the system from the water column above (WPRFMC 2009c).

The primary surface current affecting ASARA is the Equatorial Current (see Figure 3.1-2), which flows westward through the islands. The ASARA experiences southeast trade winds that result in frequent rains and a warm tropical climate. The year-round air temperatures range from 70° to 90° F. Humidity averages 80 percent during most of the year. The average rainfall at Pago Pago International Airport is 130 inches per year, while Pago Pago Harbor, only 4.5 miles away, receives an average of 200 inches of rainfall per year (TPC/Dept. of Commerce, 2000). The effects of prominent meteorological features on the ecosystems and marine resources of the American Samoa Archipelago are unclear (WPRFMC 2009c).

3.1.1.4 Western Central Pacific Including the Pacific Remote Islands Research Area (WCPRA)

The WCPRA includes part of the high seas (i.e., international ocean waters) considered under the jurisdiction of the Western and Central Pacific Fisheries Commission. The WCPRA also includes the Pacific Remote Islands Area comprised of Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Wake Atoll, and Palmyra Atoll. This large area essentially captures all past, present, and future PIFSC high seas research surveys (e.g. oceanography, longline gear research) that occur outside of the HARA, MARA, and ASARA, while also approximately aligning with various RFMOs and other geopolitical boundaries.

Baker Island is located approximately 13 miles north of the equator and approximately 1,600 nm to the southwest of Honolulu, Hawai‘i. It is a coral-topped seamount surrounded by a narrow-fringing reef that drops steeply close to shore, and has an emergent land area of 1.4 km^2. Howland Island is located approximately 48 miles north of the equator and 36 nm north of Baker Island. The island is an emergent top of a seamount, fringed by a relatively flat coral reef that drops off sharply, and has an emergent land area of 1.6 km^2. Jarvis Island is approximately 1,300 miles south of Honolulu and 1,000 miles east of

Baker Island. It is a relatively flat, sandy coral island with a total land area of 4.5 km^2. Johnston Atoll is approximately 720 nm southwest of Honolulu. It is an egg-shaped coral reef and lagoon complex on a relatively flat, shallow platform of 205 km^2. Kingman Reef is approximately 33 nm northwest of Palmyra Atoll. It consists of a series of fringing reefs around a central lagoon that does not have any emergent land to support vegetation. Wake Atoll is approximately 2,100 miles west of Hawaiʻi and has a total land area of 6.5 km^2 between three different islets. Palmyra Atoll is approximately 1,056 nm south of Honolulu and consists of 52 islets surrounding three central lagoons (WPRFMC 2009d).

Along with the above major islands and atolls, the Pacific Ocean contains nearly 25,000 islands which can be simply classified as high islands or low islands. High islands, like their name suggests, extend higher above sea level, and often support a larger number of flora and fauna and generally have fertile soil. Low islands are generally atolls built by layers of calcium carbonate secreted by reef building corals and calcareous algae on a volcanic core of a former high island that has submerged below sea level. Over geologic time, the rock of these low islands has eroded or subsided to where all that is remaining near the ocean surface is a broad reef platform surrounding a usually deep central lagoon (Nunn 2003).

The circulation of ocean water in the WCPRA and throughout the Pacific Ocean is a complex system primarily driven 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 (WPRFMC 2009d). Figure 3.1-2 shows the major surface currents of the Pacific Ocean. While the equatorial area has relatively consistent weather patterns and surface currents, variability within the ocean-atmosphere system still results in changes. One 3.3 Social and Economic Environment example in the Pacific Ocean is El Nino-Southern Oscillation (ENSO). ENSO is linked to climatic changes in normal prominent weather features of the Pacific and Indian Oceans, such as the location of the Intertropical Convergence Zone. ENSO, which can occur every 2–10 years, results in the reduction of normal trade winds, which reduces the intensity of the westward flowing equatorial surface current. In turn, the eastward flowing countercurrent tends to dominate circulation, bringing warm, low-salinity, low-nutrient water to the eastern margins of the Pacific Ocean. As the easterly trade winds are reduced, the normal nutrient-rich upwelling system does not occur, leaving warm surface water pooled in the eastern Pacific Ocean (WPRFMC 2009d).

As described in Table 2.2-1, a range of different surveys are conducted in the WCPRA under the Status Quo. These surveys could be divided into (1) ones that occur near the islands and atolls of the PRIA and (2) ones that occur far away from any islands or atolls, in deep, pelagic waters. Nearshore surveys include: Cetacean Ecology, Marine Debris Research and Removal, Coral Reef Benthic Habitat Mapping, Deep Coral and Sponge Research, Insular Fish Life History Survey and Studies, RAMP, and Lagoon Ecosystem Characterization. Off-shore surveys include: Sampling Pelagic Stages of Insular Species, Spawning Dynamics of Highly Migratory Species, Surface Night-Light Sampling, and Pelagic Oceanographic Cruise.

3.1.2 Special Resource Areas and EFH

Special resource areas within the PIFSC research areas include Essential Fish Habitat (Section 3.1.2.1), Habitat Areas of Particular Concern (Section 3.1.2.2), Marine Protected Areas (Section 3.1.2.3), and foreign or international Marine Protected Areas (Section 3.1.2.4).

3.1.2.1 Essential Fish Habitat and Habitat Areas of Particular Concern

Essential Fish Habitat (EFH) is defined and established under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (50 CFR part 600) and comprised of the waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 United States Code [U.S.C.] 1802 sec. 3(10)). Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. Substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities. Since EFH includes hard bottom structures and associated

biological communities, it encompasses corals, seagrass, algae, and mangroves. Ecologically, EFH includes waters and substrate that focus distribution (e.g., migration corridors, spawning areas, rocky reefs) and other characteristics less distinct (e.g., turbidity zones and salinity gradients). EFH is not only a geographic area where a species occurs, but an all-encompassing habitat designation.

Regulatory guidelines explain that EFH should be sufficient to “support a population adequate to maintain a sustainable fishery and the managed species’ contributions to a healthy ecosystem” (50 Code of Federal Regulations [CFR] 600, subpart J). EFH applies to federally managed species in both state and federal jurisdictional waters throughout the range of the species within U.S. waters. Where a species’ range extends beyond U.S. waters, EFH stops at the boundary. Therefore, no EFH exists outside of the U.S. EEZ.

The designation of EFH by itself does not confer any protection of the areas from non-fishing or fishing impacts. Instead, it is a tool used by managers, through a consultation process with NMFS, to reduce adverse impacts on EFH and improve fisheries management. It is described and identified in fishery management plans (FMPs) that are developed by regional Fishery Management Councils (FMCs). NMFS regional offices implement FMPs to facilitate long-term protection of EFH through conservation and management measures. Five current FMPs, termed Fishery Ecosystem Plans (FEPs), have been developed by the Western Pacific Fishery Management Council (WPRFMC): Hawai‘i Archipelago FEP, Mariana Archipelago FEP American Samoa Archipelago FEP, Remote Pacific Island Areas FEP, and Pacific Pelagic FEP (WPRFMC 2009a,b,c,d,e).

EFH may be designated separately for each major life history stage (e.g., eggs, larvae, juveniles, adults). EFH has been designated for all federal Management Unit Species (MUS) (i.e., Bottomfish and Seamount Groundfish, Pelagics, Crustaceans, Precious Corals, and Coral Reef Ecosystem) in the Pacific Islands Region. Bottomfish and Seamount Groundfish MUS include snappers and other groundfish. Pelagic MUS include tunas, some oceanic sharks, billfishes, some squids, and other species. Lobsters, crab, and shrimp comprise Crustacean MUS. Various pink/red, gold, bamboo, and black corals are considered Precious Coral MUS. A more detailed description of the species within each MUS is described in Sections 3.2.1 (fish) and 3.2.5 (invertebrates). A wide variety of currently harvested and potentially harvested coral reef taxa are Coral Reef Ecosystem MUS.

The EFH provisions of the MSA recommend that specific areas of habitat within EFH are identified as “habitat areas of particular concern.” Habitat Areas of Particular Concern (HAPC) are discrete subsets of EFH that provide important ecological functions or are especially vulnerable to degradation. FMCs may designate a specific habitat area as a HAPC for one or more of the following reasons: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; whether and to what extent development activities are, or will be, stressing the habitat type; or the rarity of habitat type.

The intended goal of identifying HAPC is to focus conservation efforts on the most important areas. While the HAPC designation does not trigger any specific regulatory process or confer any specific protection, it highlights certain habitat types that are of high ecological value. This designation is manifested in EFH consultations, during which NMFS can recommend protective measures for specific HAPC.

Several FMCs have designated discrete habitat areas as HAPC, while others have broadly designated all areas of a specific habitat type as HAPC. The WPRFMC has designated HAPC for bottomfish, pelagic species, crustaceans, precious corals, and coral reef ecosystem species. No HAPC has been designated for seamount groundfish or deep-water shrimp.

Table 3.1-1 summarizes the EFH and HAPC for the five management units. The combined EFH includes all bottom habitat to a depth of 400 m and the water column to a depth of 1,000 m between the shoreline and outer limit of the EEZ. Additional EFH for seamount groundfish species includes bottom habitat

within the EEZ to a depth of 600 m bounded by latitude 29°-35° N and longitude 171°-179° W. Additional EFH for deep-water shrimp species includes outer reef slopes within the EEZ to a depth of 700 m. For more in-depth information on EFH and HAPC in the Pacific Islands Region, refer to the appropriate FEPs (WPRFMC 2009a,b,c,d,e). Boundaries for EFH in the HARA, MARA, and ASARA are presented in Figures 3.1-3 to 3.1-5.

Table 3.1-1 EFH and Habitat Areas of Particular Concern (HAPC) Designations by MUS in the Pacific Islands Region

All areas bounded by the shoreline and the seaward boundary of the EEZ unless otherwise indicated.

MUS	Species Complex	EFH	HAPC
Bottomfish and Seamount Groundfish	Shallow-water species (0-100 m): e.g., groupers, snappers, and jacks (genera *Lethrinus, Lutjanus, Epinephelus, Aprion, Caranx, Variola, Cephalopholis*) Deep-water species (100-400 m): e.g., snappers and groupers (genera *Pristipomoides, Etelis, Aphareus, Epinephelus, Cephalopholis*)	Eggs and larvae: the water column from shoreline to a depth of 400 m Juveniles and adults: the water column and all bottom habitat extending from the shoreline to a depth of 400 m	All slopes and escarpments from 40-280 m deep and three known areas of juvenile opakapaka habitat: two off O‘ahu and one off Moloka‘i
	Seamount groundfish species (100-400 m): armorhead (*Pseudopentaceros richardsoni*), ratfish/butterfish (*Hyperoglyphe japonica*), alfonsin (*Beryx splendens*)	Eggs, larvae, and juveniles: the epipelagic zone (0-200 m) of all waters bounded by latitude 29°-35° N and longitude 171° E-179° W Adults: water column and bottom habitat bounded by latitude 29°-35° N and longitude 171° E-179° W from 80-600 m deep	No HAPC designated for seamount groundfish
Pelagic	Temperate and tropical fish: e.g., tunas (genera *Thunnus, Euthynnus, Katsuwonus, Auxis, Gymnosarda, Allothunnus*), billfishes (genera *Makaira, Tetrapturus, Istiophorus, Xiphias*), pomfret (family Bramidae), other pelagics (genera *Coryphaena, Acanthocybium, Lampris, Scomber*) Sharks: genera Alopias, Carcharhinus, Prionace, Isurus, Lamna Squid: *Ommastrephes bartamii, Thysanoteuthis rhombus, Sthenoteuthis oualaniensis*	Eggs and larvae: water column down to 200 m depth Juveniles and adults: water column down to 1,000 m depth	Water column down to 1,000 m that lies above seamounts and banks with summits shallower than 2,000 m
Crustaceans	Spiny and slipper lobster complex: genera *Panulirus, Scyllarides, Parribacus* Kona crab : *Ranina ranina* Deepwater shrimp: *Heterocarpus* spp.	Eggs and larvae: water column to a depth of 150 m Juveniles and adults: bottom habitat from the shoreline to a depth of 100 m Eggs and larvae: the water column and associated outer reef slopes between 550 and 700 m deep Juveniles and adults: the outer reef slopes at depths from 300-700 m	All banks with summits less than 30 m depth No HAPC designated for deepwater shrimp

MUS	Species Complex	EFH	HAPC
Precious Corals	Deep-water precious corals (300-1,500 m): e.g., pink/red, gold, and bamboo corals from genera *Corallium, Gerardia, Callogorgia, Narella, Calyptrophora, Lepidisis, Acanella*	Six known precious coral beds located off Keahole Point, Makapu'u, Ka'ena Point, Wespac bed, Brooks Bank, and 180 Fathom Bank	Includes the Makapu'u bed, Wespac bed, Brooks Banks bed
	Shallow-water precious corals (20-100 m): black corals (*Antipathes dichotoma, A. ulex, Antipathis grandis*)	Three known black coral beds in the Main Hawaiian Islands between Miloli'i and South Point on Hawai'i Island, the 'Au'au Channel, and the southern border of Kaua'i	For black corals, the 'Au'au Channel has been identified as an HAPC
Coral Reef Ecosystems	Currently Harvested Coral Reef Taxa Potentially Harvested Coral Reef Taxa	The water column and all benthic substrate to a depth of 100 m	Includes all no-take MPAs identified in the CRE-FMP, all Pacific remote islands, as well as numerous existing MPAs, research sites, and coral reef habitats throughout the western Pacific

Source: WPRFMC 2009a,b,c,d,e

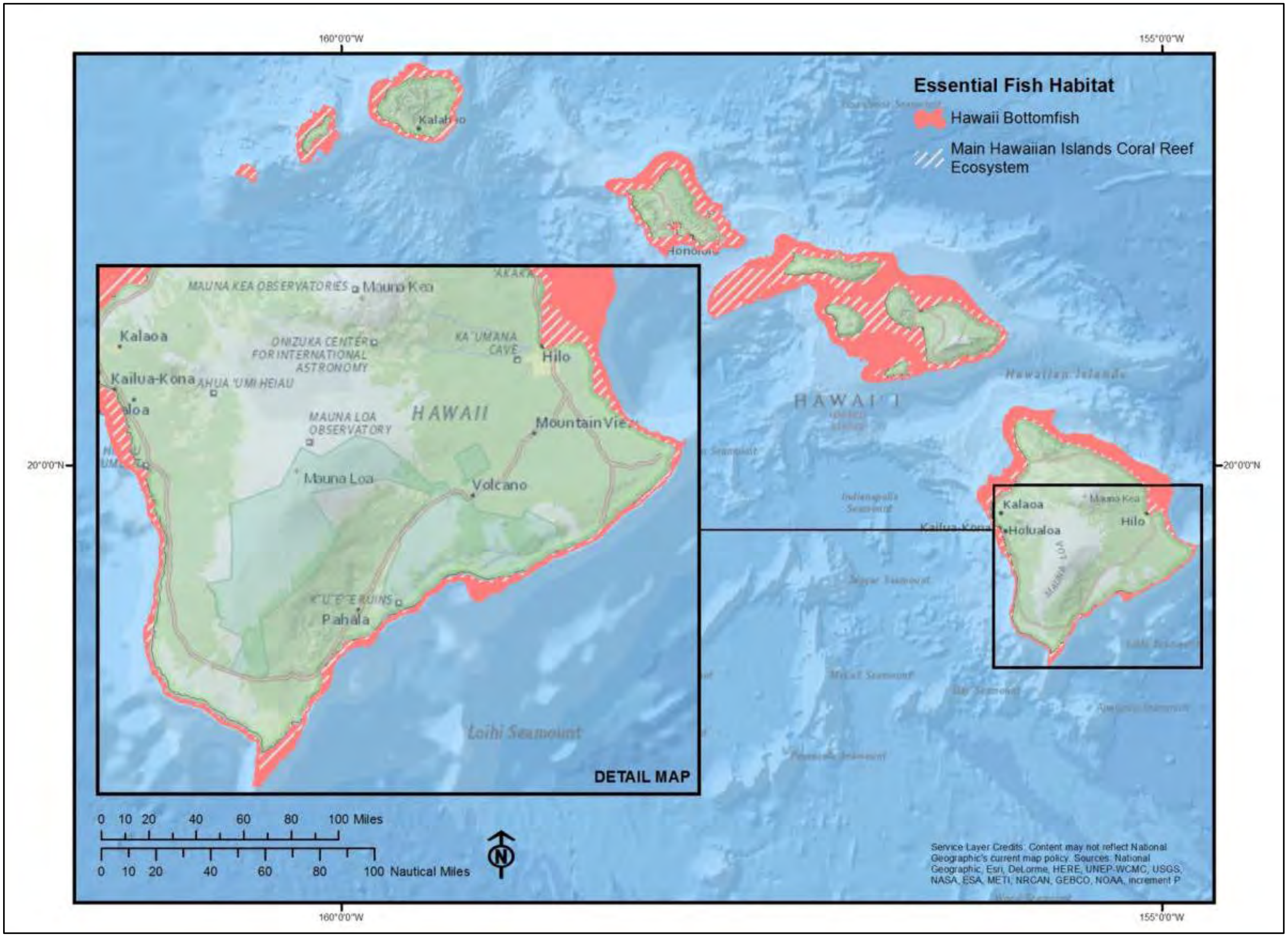


Figure 3.1-3 Essential Fish Habitat for HARA

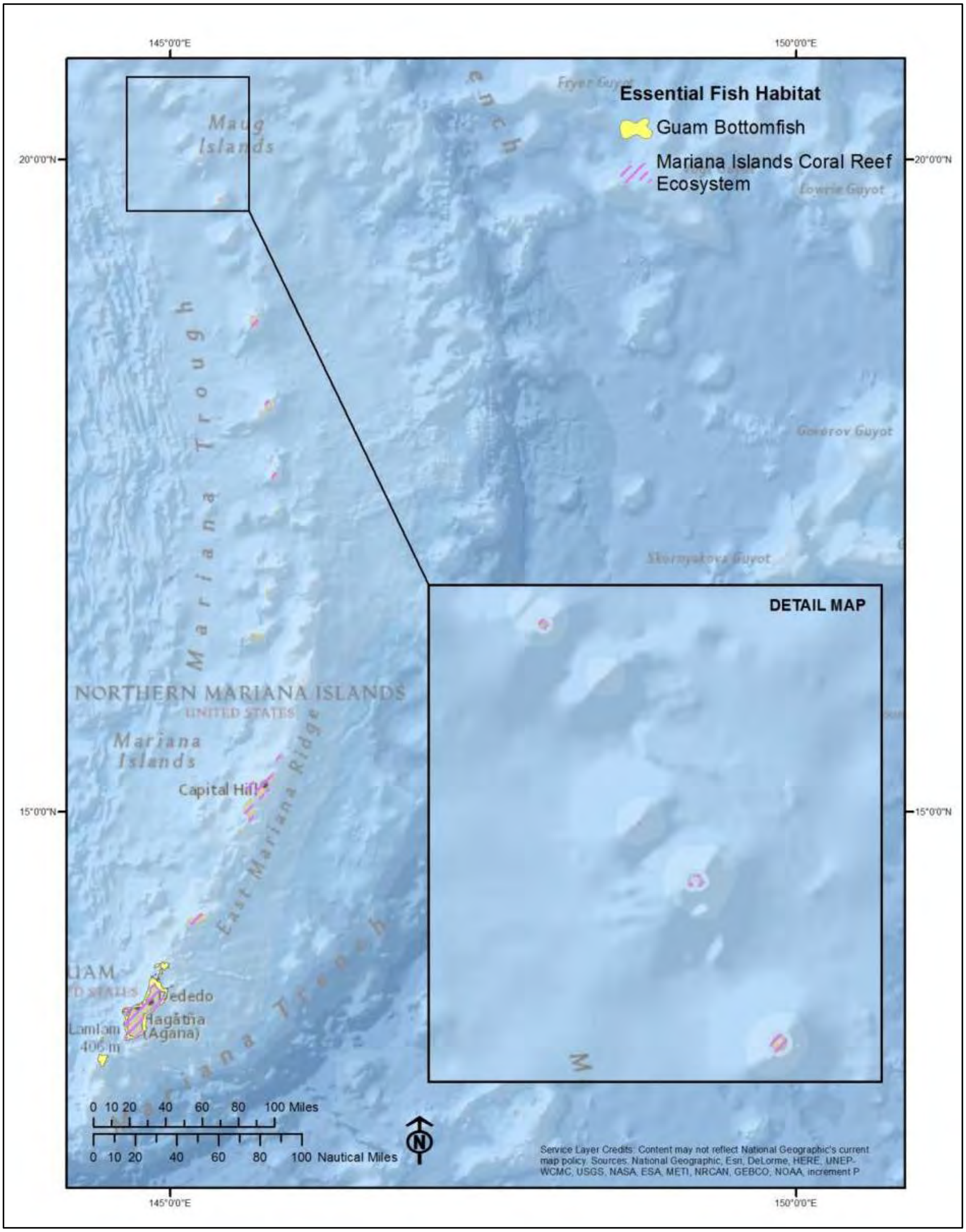


Figure 3.1-4 Essential Fish Habitat for MARA

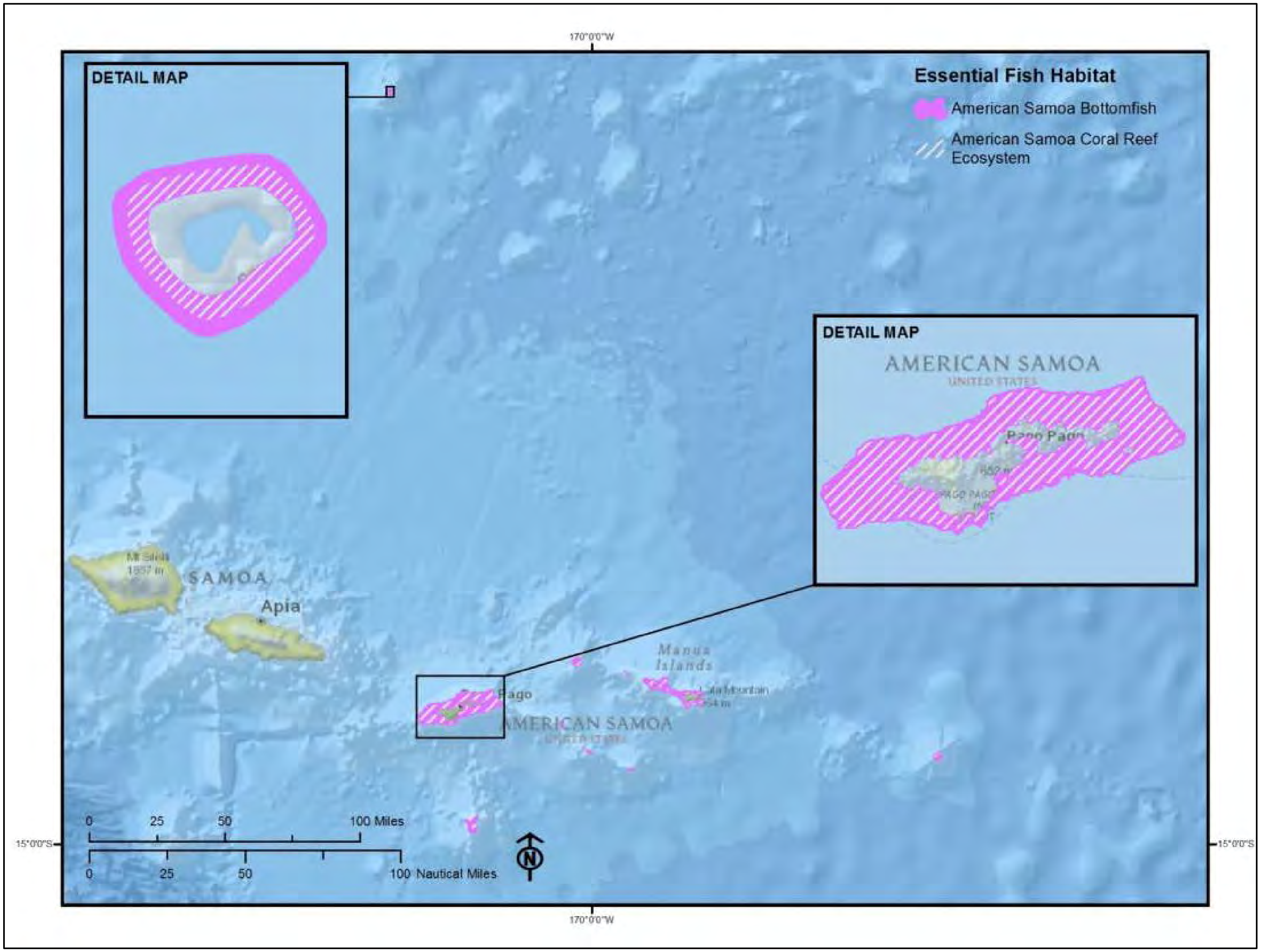


Figure 3.1-5 Essential Fish Habitat for ASARA

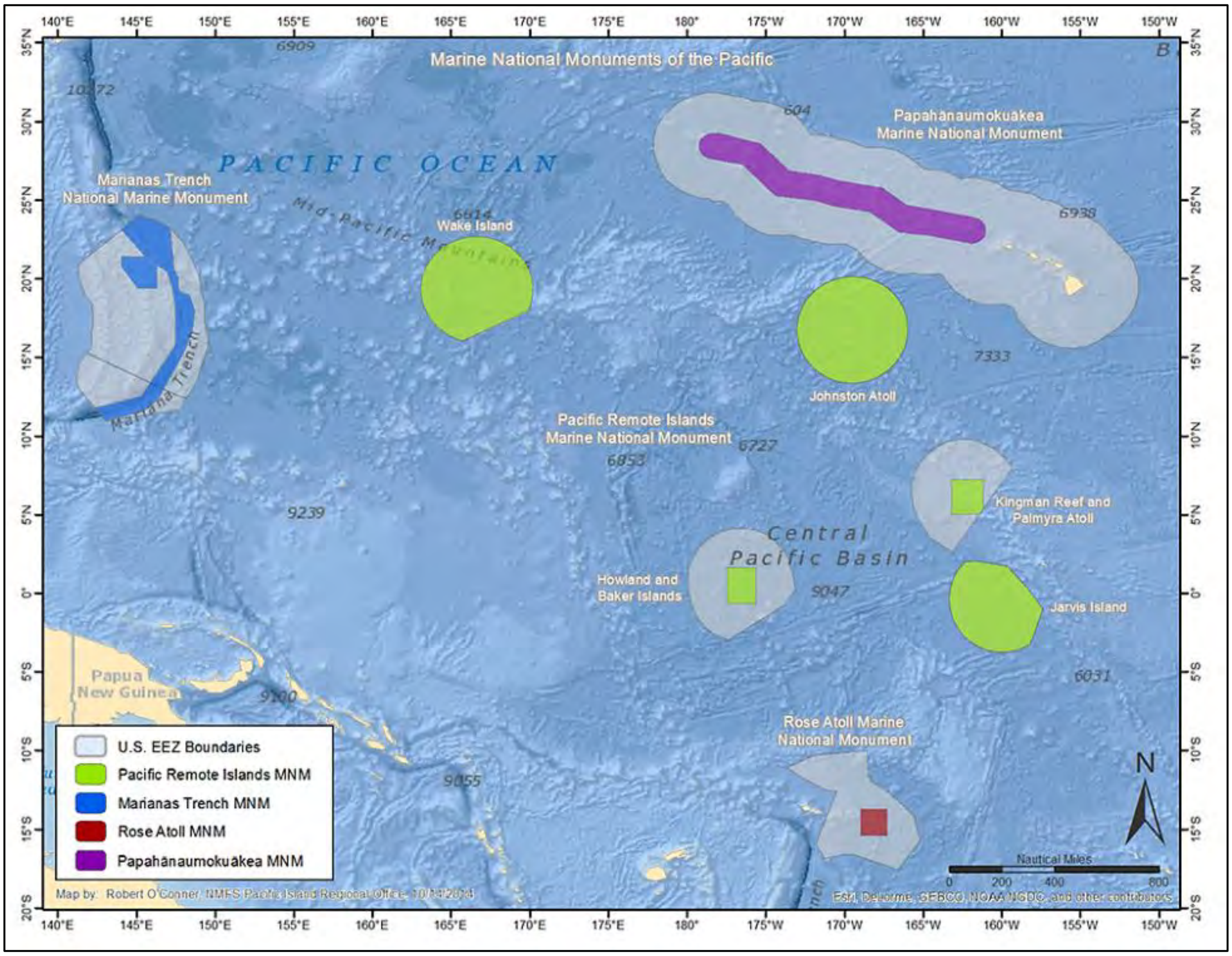
3.1.2.2 Marine Protected Areas

A Marine Protected Area (MPA) is defined by Executive Order (EO) 13158 as "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." They are a group of sites, networks, and systems established and managed by federal, state, tribal, and local governments. Most MPAs have legally established goals, conservation objectives, and intended purposes.

MPAs can be found throughout the PIFSC research areas and are considered an essential part of marine resource management. MPAs also provide a valuable control site for many different types of research projects given their protected status. MPAs in the region include state reserves, no-take marine life conservation districts, fishery management areas, refuges, national parks, marine national monuments, and national marine sanctuaries. For many of the island regions there are overlapping protections, which can create complex management issues. MPAs vary widely in the level and type of legal protection afforded to the site's natural and cultural resources and ecological processes. Many of the MPAs within the action area impose various types of prohibitions (e.g., fishing restrictions). Additional details of MPAs located within the U.S. EEZ, such as geographical coordinates, can be found on the List of National System MPAs (NOAA 2013a).

U.S. Marine National Monuments

National monuments are designated by Presidential Proclamation, under the authority of the Antiquities Act of 1906. The Antiquities Act provides broad power to set aside lands and waters of the United States for protection, and requires no public process. Four marine national monuments (MNMs) are located within the Pacific Islands Region (Figure 3.1-6) and together they encompass approximately 557,947 square miles of water.



Source: http://www.fpir.noaa.gov/Graphics/MNM/Pacific_MNM_DRAFT_10_14_2014.jpg

Figure 3.1-6 Marine National Monuments in the Pacific Islands Region

Papahānaumokuākea Marine National Monument

On December 4, 2000, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NWHICRER) was created by EO 13178 to encompass 137,792 mi^2 of marine water and submerged lands of the Northwestern Hawaiian Islands, pursuant to the NMSA. As part of the establishment of NWHICRER, EO 13178 contains conservation measures that restrict certain activities, and establishes Reserve Preservation Areas around some islands, atolls, and banks where all consumptive or extractive uses are prohibited. On January 18, 2001, after the 30-day comment period, the process and establishment of the reserve was finalized by issuance of EO 13196. This executive order modified EO 13178 by revising certain conservation measures and making permanent the Reserve Preservation Areas, with modifications. NOAA had initiated the process to designate NWHICRER as a national marine sanctuary under the NMSA, when President George W. Bush signed Presidential Proclamation No. 8031 in June 2006 establishing the Northwestern Hawaiian Islands MNM.

The Northwestern Hawaiian Islands (NWHI) MNM was renamed Papahānaumokuākea MNM in 2007 with Presidential Proclamation 8112, and inscribed on the World Heritage list in July 2010. Papahānaumokuākea MNM encompasses 139,797 mi^2. The national monument designation superseded the Midway National Wildlife Refuge (NWR), the proposed NWHI National Marine Sanctuary (NMS), the NWHI Coral Reef Ecosystem Reserve, and the NWHI Bird Refuge. The monument is administered

jointly by three co-trustees: (1) the Department of Commerce through the NOAA's Office of National Marine Sanctuaries and NMFS Pacific Islands Regional Office; (2) the Department of the Interior through the USFWS's Pacific Region National Wildlife Refuge System, Pacific Islands Fish and Wildlife Office, and; (3) the State of Hawai'i; with primary management responsibility of marine areas assigned to Secretary of Commerce, in consultation with Department of Interior.

Within the Papahānaumokuākea MNM, Proclamation No. 8031 allows the Secretary of Commerce and the Secretary of Interior to prohibit access into the monument and certain activities unless a permit is acquired (50 CFR 404.11). Permits can be issued for research, education, conservation and management, Native Hawaiian practices, special ocean uses, and recreational activities. Commercial fishing was prohibited in the monument in 2011, five years from the date of the monument designation. The prohibitions for monument access do not apply to activities and exercises of the Armed Forces (including those carried out by the United States Coast Guard); for emergencies threatening life, property, or the environment; or to activities necessary for law enforcement purposes.

Papahānaumokuākea MNM is also home to many cultural and historic sites. Many Native Hawaiian cultural sites are found on the islands of Nihoa and Mokumanamana, both of which are on the National Register of Historic Places. Midway Atoll includes several National Historic Landmarks on Eastern and Sand Islands that document the Battle of Midway during WWII (National Park Service [NPS] 2014).

Rose Atoll Marine National Monument

On January 6, 2009, Presidential Proclamation 8337 established the Rose Atoll MNM, which consists of approximately 13,451 mi^2 of emergent and submerged lands and waters of and around the Rose Atoll in American Samoa. The Secretary of the Interior has management responsibility for the monument, including Rose Atoll NWR in consultation with the Secretary of Commerce. The Secretary of Commerce, through NOAA, has the primary management responsibility regarding management of marine areas and, as directed by Presidential Proclamation 8337, incorporated the marine waters of the monument and waters surrounding the Vailulu'u Seamount into the National Marine Sanctuary of American Samoa on July 26, 2012 (15 CFR 922). Additionally, the designated lands and submerged lands in the lagoon of the Rose Atoll NWR at the center of the monument are managed by the USFWS. However, for both the refuge and the sanctuary, the monument designation is the dominant federal withdrawal. The Proclamation also directs the Secretaries, in consultation with the Government of American Samoa, to ensure that recreational fishing is managed as a sustainable activity.

Per Proclamation 8337, certain scientific research efforts may be conducted within the monument: *Subject to such terms and conditions as the Secretaries deem necessary for the care and management of the objects of this monument, the Secretary of the Interior may permit scientific exploration and research within the monument, including incidental appropriation, injury, destruction, or removal of features of this monument for scientific study, and the Secretary of Commerce may permit fishing within the monument for scientific exploration and research purposes to the extent authorized by the Magnuson-Stevens Fishery Conservation and Management Act. The prohibitions required by this proclamation shall not restrict scientific exploration or research activities by or for the Secretaries, and nothing in this proclamation shall be construed to require a permit or other authorization from the other Secretary for their respective scientific activities.*

Marianas Trench Marine National Monument

In 2009, President Bush established the Marianas Trench MNM, through Presidential Proclamation 8335, setting aside approximately 95,216 mi^2 of submerged lands and waters. The monument includes three units: the Islands Unit, the waters and submerged lands of the three northernmost Mariana Islands; the Volcanic Unit, the submerged lands within one nautical mile of 21 designated volcanic sites; and the Trench Unit, the submerged lands extending from the northern limit of the EEZ in the CNMI to the

southern limit of the EEZ in the Territory of Guam. No waters are included in the Volcanic and Trench Units, and the CNMI maintains all authority for managing the three islands within the Islands Unit (Farallon de Pajaros, also known as Uracas; Maug; and Asuncion) above the mean low water line.

Proclamation 8335 assigned management responsibility of the monument to the Secretary of the Interior, in consultation with the Secretary of Commerce. The Interior Secretary delegated management responsibility to the USFWS. The Secretary of Commerce, through NOAA, was assigned primary management responsibility with respect to fishery-related activities in the waters of the Islands Unit, where commercial fishing is prohibited. Sustenance, recreational, and traditional indigenous fishing are allowed within the Islands Unit after consultation with the Government of CNMI. The Secretaries have also established a Mariana Trench Monument Advisory Council to provide advice and recommendations on the development of management plans and management of the monument.

Per Proclamation 8335, certain scientific research efforts may be conducted within the monument: *Subject to such terms and conditions as the Secretary deems necessary for the care and management of the objects of this monument, the Secretary of the Interior may permit scientific exploration and research within the monument, including incidental appropriation, injury, destruction, or removal of features of this monument for scientific study, and the Secretary of Commerce may permit fishing within the monument for scientific exploration and research purposes to the extent authorized by the Magnuson-Stevens Fishery Conservation and Management Act. The prohibitions required by this proclamation shall not restrict scientific exploration or research activities by or for the Secretaries, and nothing in this proclamation shall be construed to require a permit or other authorization from the other Secretary for their respective scientific activities.*

Pacific Remote Islands Marine National Monument

On January 6, 2009, Presidential Proclamation 8336 established the Pacific Remote Islands MNM. The monument consists of Baker, Howland, and Jarvis Islands, Wake Atoll, Johnston Atoll, Kingman Reef, and Palmyra Atoll which lie to the south and west of Hawaiʻi. It incorporates approximately 86,888 mi^2 within its boundaries, which extend 50 nautical miles from the mean low water lines of the encompassed islands, reefs, and atolls. The land areas at Wake and Johnston Atolls remain under the jurisdiction of the U.S. Air Force. Due to its significance during WWII, Wake Atoll is also a registered National Historic Landmark. For all of the areas, fishery-related activities seaward from the 12-nautical mile refuge boundaries out to the 50-nautical mile monument boundary are managed by NOAA. Proclamation 8336 permits noncommercial fishing at specific locations upon request as well as noncommercial fishing currently allowed by the USFWS at Palmyra Atoll until the Secretary of Interior determines that this would be incompatible with the purposes of the Palmyra Atoll NWR. On September 25, 2014, the PRIMNM was expanded from 50 nm to 200 nm for Jarvis Island, Wake Atoll, and Johnston Atoll.

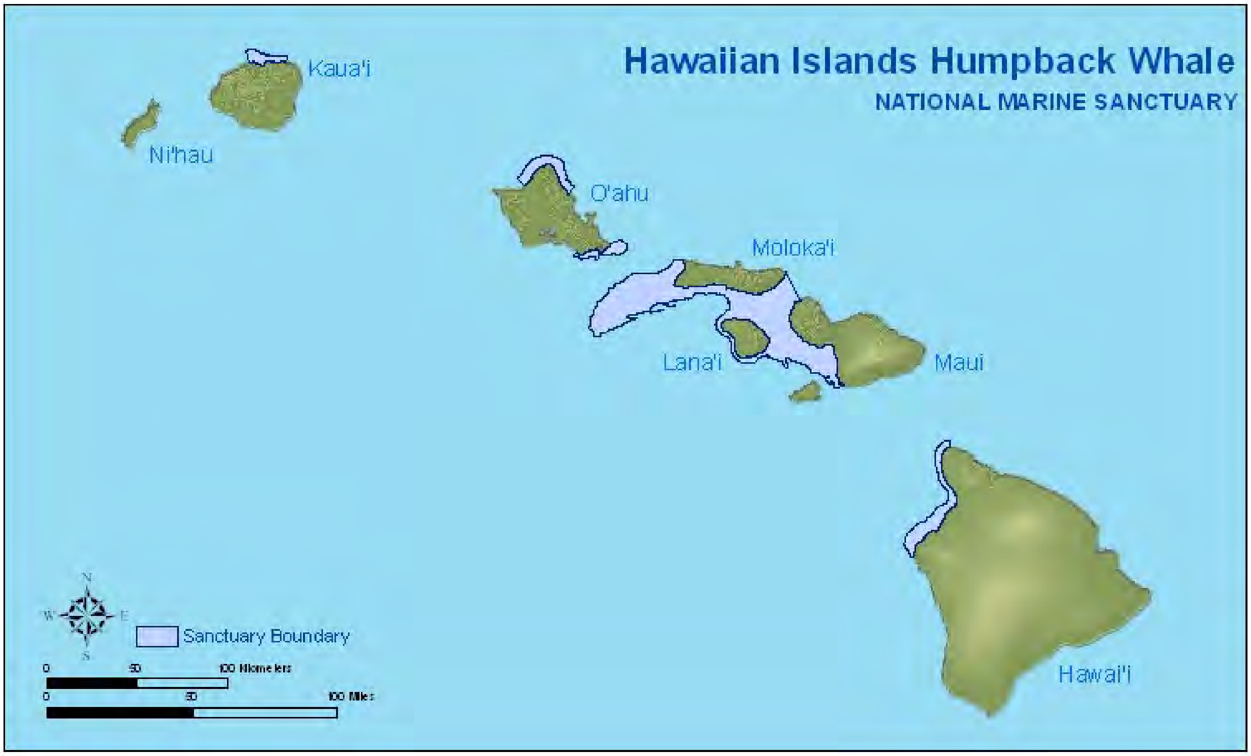
Per Proclamation 8336, certain scientific research efforts may be conducted within the monument: *Subject to such terms and conditions as the respective Secretary deems necessary for the care and management of the objects of this monument, the Secretary of the Interior may permit scientific exploration and research within the monument, including incidental appropriation, injury, destruction, or removal of features of this monument for scientific study, and the Secretary of Commerce may permit fishing within the monument for scientific exploration and research purposes to the extent authorized by the Magnuson-Stevens Fishery Conservation and Management Act. The prohibitions required by this proclamation shall not restrict scientific exploration or research activities by or for the Secretaries, and nothing in this proclamation shall be construed to require a permit or other authorization from the other Secretary for their respective scientific activities.*

U.S. National Marine Sanctuaries

The National Marine Sanctuaries Act of 2000 (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, archeological, educational, or esthetic qualities as NMSs. Day-to-day management of NMSs has been delegated by the Secretary of Commerce to NOAA's Office of National Marine Sanctuaries. The primary objective of the NMSA is to protect marine resources, such as coral reefs, sunken historical vessels, and unique habitats. The National Marine Sanctuary System consists of 14 MPAs that encompass more than 150,000 mi^2 of marine and Great Lakes waters. Descriptions of the two Pacific Island sanctuaries are provided below.

Hawaiian Islands Humpback Whale National Marine Sanctuary

The Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) spans 1,370 mi^2 and is located within waters from the shoreline to the 100-fathom (180-m) isobath around the islands of Hawai‘i, Maui, Moloka‘i, Lana‘i, and parts of O‘ahu and Kaua‘i (Figure 3.1-7). The HIHWNMS purpose is to protect humpback whales and their habitat and manage human uses within the sanctuary. The sanctuary's management plan and designation document do not provide for the management of fishing operations (NOAA 2002). Pursuant to NMSA, NOAA must periodically review management plans for each marine sanctuary. During the sanctuary's first management plan review in 2002, numerous public comments requested the sanctuary to increase its scope to include conservation and management of other marine resources and species. In 2007, the Governor of Hawai‘i approved a document, presented by the sanctuary, for the consideration of additional marine resources for inclusion in the sanctuary. As part of the current management plan review, which began in 2010, the Ecosystem Protections Working Group was established to consider the inclusion of additional marine resources. In 2012, the working group recommended "the HIHWNMS future management plan adopts an integrated approach that considers the entire ecosystem, including humans within the currently designated sanctuary boundaries" (HIHWNMS Advisory Council 2012). The current management plan review process will result in a new management plan and could substantially alter the purpose of the sanctuary. On March 26, 2015, NOAA ONMS proposed the expansion, regulatory revision, and new management plan for the HIHWNMS (80 FR 16224). Regulations governing access and uses within the HIHWNMS can be found in 15 CFR Part 922 Subpart Q.



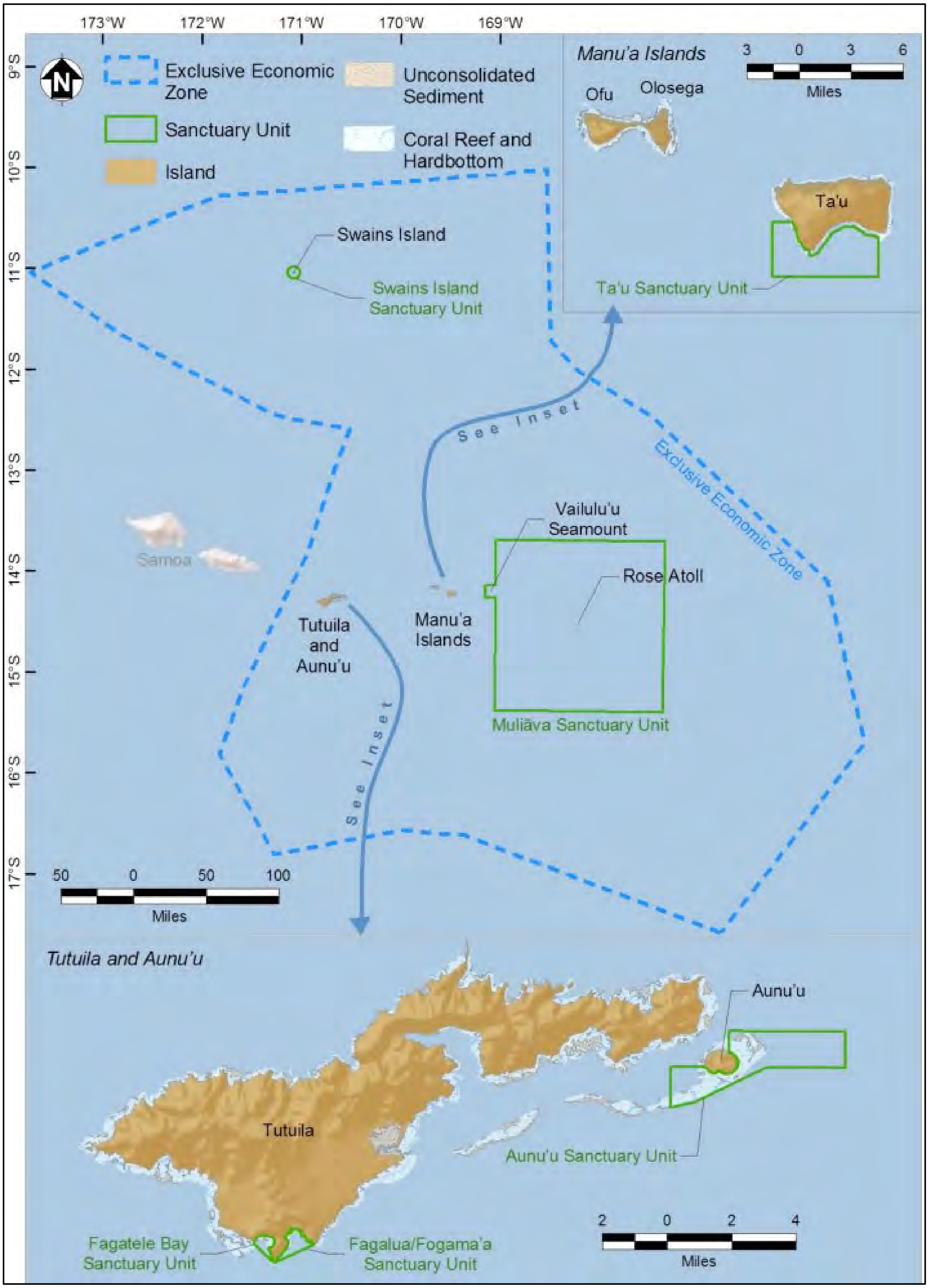
Source: http://hawaiihumpbackwhale.noaa.gov/documents/images/boundary6.jpg

Figure 3.1-7 Hawaiian Islands Humpback Whale National Marine Sanctuary

National Marine Sanctuary of American Samoa

The National Marine Sanctuary of American Samoa (NMSAS) is comprised of six protected areas covering 13,581 mi² of nearshore coral reef and offshore open-ocean waters across the Samoan Archipelago (Figure 3.1-8). The sanctuary was originally designated as Fagatele Bay National Marine Sanctuary in 1986 in response to a proposal from the American Samoa Government to the National Marine Sanctuary Program. The original sanctuary included 0.25 mi² of coral reef ecosystems within Fagatele Bay off the southwest coast of Tutuila Island. In 2012, NOAA expanded the sanctuary to include Fagalua/ Fogama‘a (the next bay east of Fagatele); areas at Aunu‘u, Ta‘u, and Swains islands; and Rose Atoll (called Muliāva in Samoan), which includes the nearby Vailulu‘u Seamount. This is the largest and most remote of the NMSs and includes the only true tropical reef in the sanctuary program. Various activities and gear types are allowed or prohibited on a sanctuary-wide or unit-specific basis. Scientific research that involves otherwise prohibited activities may be permitted by the Director of the Office of National Marine Sanctuaries. Per Presidential Proclamation 8337, the Departments of Commerce and the Interior do not need permits to conduct scientific activities within the Muliāva unit (see description of Rose Atoll MNM in Section 3.1.2.3).

Regulations governing access and uses within the NMSAS can be found in 15 CFR Part 922 Subpart J.



Source: http://sanctuaries.noaa.gov/pgallery/atlasmaps/images/as_lg.jpg

Figure 3.1-8 National Marine Sanctuary of American Samoa

U.S. National Parks

The National Park Service has jurisdiction over several National Parks and Historic Sites in the Pacific Islands Region that include marine waters within the scope of analysis. The War in the Pacific National Historical Park in Guam, American Memorial Park in the Northern Mariana Islands as well as the Pu‘uhonua o Hōnaunau National Historical Park and Kaloko Honokohau National Historic Park in Hawai‘i are focused on preserving important cultural and historical sites, but within each park’s boundaries are ecologically important coral reefs and seagrass beds. The National Park of American Samoa has jurisdiction over several thousand acres of coral reefs along coastlines within park units in American Samoa. The National Park Service manages these waters as MPAs, however, some fishing is allowed.

U.S. Fish and Wildlife Refuges

Nine individual NWRs are scattered across the Pacific Islands Region. USFWS’s primary objective with designated refuges is to conserve and manage fish, wildlife, and plant resources and habitats for the benefit of present and future generations. At the turn of the 20th Century, uninhabited atolls in the central Pacific Ocean were heavily exploited by feather poachers and guano miners. Between 1897 and 1914, over 3.5 million seabirds were killed in the islands in the central Pacific Ocean to supply feathers for the millinery trade (Spennemann 1998). Human activity also led to the introduction of invasive species such as rats, feral cats, and rabbits, which resulted in further environmental degradation. At each of the refuges, USFWS has played an important role in controlling and eradicating invasive species, terrestrial plant restoration, monitoring ecosystem recovery, and managing seabirds and migratory birds. Each of the Pacific Islands refuge within the scope of analysis is addressed below.

Hawaiian Islands NWR spans 254,418 acres of islands, reefs, and atolls from Nihoa to Pearl and Hermes Atoll. It was originally established as the Hawaiian Islands Bird Reservation in 1909 by President Theodore Roosevelt in response to the slaughter of millions of seabirds by poachers. In 1940, President Franklin Delano Roosevelt renamed it the Hawaiian Islands National Wildlife Refuge. When the refuge became part of the Papahānaumokuākea MNM (see Section 3.1.2.3) in 2006, all activities within the refuge became subject to restrictions and permitting established to protect wildlife and marine resources within the monument (NOAA 2014b).

Johnston Atoll NWR was first established as a federal bird refuge in 1926, through EO 4467. The refuge included Johnston and Sand Islands, which totaled approximately 100 acres of emergent lands. In 1934, through EO 6935, the atoll was placed under the jurisdiction of the Navy for administrative purposes and has been used as a military installation since 1939. In 1941, EO 8682 designated Johnston and other Pacific atolls Naval Defensive Sea Areas (NDSAs) (see Section 3.1.2.3). Since 1976, the USFWS, under agreement with the military, assists in the management of fish and wildlife resources on the atoll. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Rose Atoll NWR is part of American Samoa and is located approximately 78 miles east-southeast of Tau Island in the Manua Group of islands. The exterior boundary of Rose Atoll NWR is the extreme low waterline outside of the perimeter reef (i.e., the terrestrial lands and interior lagoon of the atoll). The refuge was established through a cooperative agreement between the Territory of American Samoa and the USFWS in 1973 and is under the joint jurisdiction of the Departments of Commerce and Interior, in cooperation of the Territory of American Samoa. On January 6, 2009, Rose Atoll MNM was established, which includes Rose Atoll National Wildlife Refuge within its boundaries. In 2012, the refuge became part of the National Marine Sanctuary of American Samoa, as directed by Presidential Proclamation 8337, the monument designation document.

Jarvis Island NWR has been administered by USFWS as an NWR since 1974. Originally, the refuge encompassed 1,273-acre Jarvis Island and the surrounding waters out to 3 nautical miles. In 2009, the refuge was expanded to include submerged lands within 12 nautical miles (22 km) of the island. Jarvis

Island NWR is closed to the public, but scientific research may be allowed through a Special Use Permit. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Baker Island NWR has been administered by USFWS as an NWR since 1974. Originally, the refuge encompassed 531-acre Baker Island and the surrounding waters out to 3 nautical miles. In 2009, the refuge was expanded to include submerged lands within 12 nautical miles (22 km) of the island. Baker Island NWR is closed to the public, but scientific research may be allowed through a Special Use Permit. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Howland Island NWR has been administered by USFWS as an NWR since 1974. Originally, the refuge encompassed 400-acre Howland Island and the surrounding waters out to 3 nautical miles. In 2009, the refuge was expanded to include submerged lands within 12 nautical miles (22 km) of the island. Howland Island NWR is closed to the public, but scientific research may be allowed through a Special Use Permit. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Midway Atoll NWR is located in the NWHI and was established under EO 13022 in 1996 with a refuge boundary of approximately 12 miles seaward from the shoreline. The refuge encompasses 590,991 acres of submerged lands and waters. In 1941, the Navy established a Naval Air Facility at Midway followed by the creation of an overlay refuge by the USFWS in 1988 to manage fish and wildlife on the atoll. The Naval Air Facility was closed in 1993 and the property was transferred to the USFWS in 1996. In 2006, the refuge became part of the Papahānaumokuākea MNM (see Section 3.1.2.3).

Palmyra Atoll NWR is a limited take MPA that includes 680 acres of emergent lands and approximately 515,232 acres of submerged lands and associated waters, out to its 12-nautical micle boundary. The refuge was established in 2001 (66 FR 7660). Palmyra Atoll NWR is closed to commercial fishing, but limited recreational bonefishing and sportfishing are permitted. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Kingman Reef NWR is a no-take MPA that includes 3 acres of emergent reef and 483,754 acres of submerged reefs and associated waters, out to its 12-nautical mile boundary. The United States annexed the reef in 1922; and in 2001, it was established as a NWR (66 FR 7660). Kingman Reef NWR is closed to the public, but research and biological surveys may be allowed through a Special Use Permit. In 2009, the refuge became part of the Pacific Remote Islands MNM (see Section 3.1.2.3).

Department of Defense Naval Defensive Sea Areas

Multiple executive orders have provided administrative authority over territories and possessions to the U.S. military for use as airfields and for weapons testing. Of note, EO 8682 of 1941 authorizes the Secretary of the Navy to control entry into the NDSAs around Johnston Atoll, Wake Atoll, Kingman Reef, and Midway Atoll. These NDSAs include "territorial waters between the extreme high-water marks and the three-mile marine boundaries." The objectives of NDSAs are to control entry into naval defensive sea areas; to provide for the protection of military installations; and to protect the physical security of, and ensure the full effectiveness of, bases, stations, facilities, and other installations (32 CFR Part 761). In addition, the Navy has joint administrative authority with the USFWS of Johnston Atoll and has recently transferred administrative authority over Kingman Reef to the USFWS. The Wake Atoll NDSA has been suspended until further notice. Additionally, EO 13022 rescinded the Midway Atoll NDSA.

State and Territorial MPAs

In addition to federally managed MPAs, there is a variety of local state and territorial MPAs in the PIFSC research areas. Table 3.1-2 provides an overview of these local MPAs. Detailed information on each of these MPAs is provided in the proceeding paragraphs.

Table 3.1-2 Local MPAs within the Pacific Islands Region

MPA Description	Size (km^2)	Restricted Activities
HAWAIʻI		
Hanauma Bay Marine Life Conservation District (MLCD)	0.41	Closed to all taking or inuring of marine life, fish feeding, and operation of any watercraft
Pūpūkea MLCD	0.71	Closed to all taking or injuring of marine life and snagging of any akule while fishing from shoreline of Waimea Bay
Waikīkī MLCD	0.31	Closed to all taking or inuring of marine life
Kealakekua Bay MLCD	1.24	Closed to all taking or inuring of marine life, and fish feeding
Lapakahi MLCD	0.59	Closed to all taking or inuring of marine life, and fish feeding
Old Kona Airport MLCD	0.88	Closed to all taking or injuring of marine life, fish feeding, anchoring watercraft in the "No Boating Zone", and commercial diving
Waialea Bay MLCD	0.14	Closed to all taking or inuring of marine life, and fish feeding
Waiopae Tidepools	0.2	Closed to all taking or inuring of marine life, anchoring or mooring of any vessel, and commercial activities
Honolua-Mokuleʻia Bay MLCD	0.18	Closed to all taking or inuring of marine life
Manele-Hulopoʻe MLCD	1.25	Closed to all taking or inuring of marine life, and restrictions to anchoring and mooring
Molokini Shoal MLCD	0.31	Closed to all taking or inuring of marine life, fish feeding, and mooring boats for commercial use
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS (CNMI)		
Managaha Marine Conservation	5	Closed to all taking, fishing, and collecting
Forbidden Island Marine	2.53	Closed to all taking, fishing, and collecting
Bird Island Marine Sanctuary	1.47	Closed to all taking, fishing, and collecting
Sasanhaya Fish Reserve	0.84	Closed to all taking, fishing, and collecting; no anchoring within the Reserve
Tinian Marine Reserve Area	~5	Removal, disturbance, damage, or destruction of any marine life is prohibited except that seasonal fish may be removed during seasons
GUAM		
Tumon Bay Marine Preserve	4.52	Closed to shell collecting, use of gaffs, and removal of sand and rocks; Fishing practices are restricted[1]
Sasa Bay Marine Preserve	3.12	Closed to shell collecting, use of gaffs, and removal of sand and rocks; Fishing practices are restricted[1]
Piti Bomb Holes Marine Preserve	3.63	Closed to shell collecting, use of gaffs, and removal of sand and rocks; Fishing practices are restricted[1]
Achang Reef Flat Marine Preserve	4.85	Closed to shell collecting, use of gaffs, and removal of sand and rocks; Fishing practices are restricted[1]
Pati Point Marine Preserve	20	Closed to shell collecting, use of gaffs, and removal of sand and rocks; Fishing practices are restricted[1]

MPA Description	Size (km^2)	Restricted Activities
AMERICAN SAMOA		
Alega Private Marine Reserve	0.15	Only subsistence fishing with traditional methods by village members is allowed
Alofau Community-Based Fisheries Management Program	0.32	Fishing is prohibited except on occasional Saturday openings for subsistence fishing only
Amanave CFMP Reserve	0.34	Closed to all commercial and recreational fishing except when opened for subsistence fishing one month per year
Amaua and Auto CFMP Reserve	0.37	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Aoa CFMP Reserve	0.34	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Aua CFMP Reserve	0.23	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Fagamalo CFMP Reserve	0.38	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Fagamalo No-Take MPA	2.9	Closed to all types of fishing
Leone Pala Special Management	0.02	No fishing regulation exist beyond territorial regulations
Masausi CFMP Reserve	0.2	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Matu‘u and Faganeanea CFMP Reserve	0.32	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Nu‘uuli Pala Special Management Area (SMA)	2	No fishing regulation exist beyond territorial regulations
Ofu Vaoto Marine Reserve	0.48	Closed to fishing/shellfish harvesting except for subsistence fishing/harvesting by Ofu Island residents per territorial regulations
Pago Pago Harbor SMA	1.2	No fishing regulation exist beyond territorial regulations
Poloa CFMP Reserve	0.36	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Sailele CFMP Reserve	0.08	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year
Vatia CFMP Reserve	0.62	Closed to all commercial and recreational fishing except for subsistence fishing at certain times of the year

Source: CNMI Division of Fish and Wildlife 2014; Hawai‘i Division of Aquatic Resources 2014; Kendall and Poti 2011; Marine Conservation Institute 2014; Waddell and Clarke 2008.

Hawaiʿi

Eleven Marine Life Conservation Districts (MLCDs) have been established in Hawaiʻi to conserve and replenish marine resources. The MLCDs are managed by Hawaiʻi's Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR). In more than half of the MLCDs, it is prohibited to fish for, catch, take, injure, kill, possess, or remove any marine life, or to take, alter, deface, destroy, possess, or remove any sand, coral, rock, or other geological feature. Approximately 0.4 percent of nearshore MHI waters are closed to fishing because of MLCDs (Friedlander et al. 2008). In addition to these protections, each MLCD has more specific regulations, such as anchoring restrictions or designated allowable fishing methods (e.g., fishing for finfish for home consumption is permitted from shore using thrownet or pole and line without reel). Some MLCDs are divided into two subzones that allow different uses (e.g., subzone A = no-take, subzone B = hook-and-line and thrownet for finfish allowed) (Wusinich-Mendez and Trappe 2007).

Hawaiʻi also has Fishery Management Areas (FMAs) which are managed by DAR. FMAs have zones that restrict uses by user type, or areas that are closed to certain fishing gears (e.g., net fishing) or activities (e.g., boating) to reduce conflict and avoid depletion of resources. Each FMA has detailed, site-specific rules that target the issue(s) that it was established to address (Wusinich-Mendez and Trappe 2007). Bottomfish Restricted Fishing Areas (BRFAs) also exist around Hawaiʻi, which restrict possession of bottomfish while in a vessel that is drifting or anchored within any BRFAs (Hawaiʻi Division of Aquatic Resources 2015).

Established in 1973, Ahihi Kinaʻu Natural Area Reserve is the only National Area Reserve (NAR) with a marine component. NARs are managed by DLNR's Division of Forestry and Wildlife. In all NARs, it is prohibited to remove, injure, kill, or introduce any form of plant and animal life, or to remove, damage, or disturb any geological or paleontological feature or substance. Operation of any motorized water vehicle on or in the waters of Ahihi Kinaʻu NAR is also prohibited (Wusinich-Mendez and Trappe 2007).

Kahoʻolawe Island Reserve comprises the island of Kahoʻolawe, a former military training ground and bombing range, and the waters extending two nautical miles from its shoreline. The reserve is managed by the Kahoʻolawe Island Reserve Commission (KIRC) within DLNR. The reserve was established for the purposes of preservation, and practice of, native Hawaiian rights for cultural, spiritual, and subsistence purposes; preservation of the island's archaeological, historical, and environmental resources; rehabilitation, habitat restoration, and re-vegetation; and, education. Access to the Reserve is permitted only with authorization of KIRC for specific purposes, such as restoration, education, and culture. Trolling is permitted on two scheduled weekends each month in waters deeper than 30 fathoms (180 feet) (Wusinich-Mendez and Trappe 2007). No other fishing, ocean recreation, or additional activities are allowed within the reserve. Bottomfishing and use of anchors are also prohibited.

American Samoa

There are a variety of territorial MPAs in American Samoa. There are about a dozen village MPAs (VMPAs) that are part of the Community-Based Fishery Management Program (CFMP). These areas are managed by local villages and the American Samoa Department of Marine and Wildlife Resources (DMWR). The goal of the program is to improve inshore fishery resources and enhance stewardship of marine resources by the village community. Restrictions in VMPAs vary by village but range from no-take to open only on Saturdays to open to villagers only (Richmond and Levine 2012).

The American Samoa Department of Parks and Recreation and DMWR manage Ofu Vaoto Territorial Marine Park. It was established in 1994 "to protect its unique coral reef wildlife habitat while enabling the public to enjoy the natural beauty of the site" (ASCA §18.0214). Fishing and shellfish harvesting are prohibited, with the exception of subsistence fishing and harvesting by Ofu Island residents according to territorial regulations (ASCA §18.0214).

There are three territorial Special Management Areas (SMAs) which contain terrestrial and marine components. They are Leone Pala SMA, Nu'uuli Pala SMA, and Pago Pago Harbor SMA. The SMAs are primarily managed by the American Samoa Coastal Management Program (ASCMP). The main purpose of the SMAs is to protect unique marine ecosystems by regulating upland activities that could degrade these systems. While the SMAs include a marine component, there are no regulations within the marine area that go beyond general territorial regulations (Wusinich-Mendez and Trappe 2007).

Guam

In 1997, five marine preserves were created in Guam through Public Law 24-21 to protect and restore Guam's fishery resources. In 2006, Public Law 28-107 included the protection and preservation of aquatic life, habitat, and marine communities and ecosystems and strengthened the protection of the preserves by making all forms of fishing and taking or altering aquatic life, coral, and any other resources unlawful (unless permitted by the Guam Division of Aquatic and Wildlife Resources). The five preserves are Pati Point Preserve, Tumon Bay Preserve, Piti Bomb Holes Preserve, Sasa Bay Preserve, and Achang Reef Flat Preserve (Burdick et al. 2008).

Commonwealth of the Northern Mariana Islands

There are several marine protected areas in CNMI with varying levels of restricted activities. No-take reserves prohibit the fishing or harvesting of any marine species of plant or animal, prohibit take of coral (live or dead), and prohibit all exploitive or destructive activities to marine life. Mañagaha Marine Conservation Area, Forbidden Island Marine Sanctuary, and Bird Island Marine Sanctuary are no-take reserves in Saipan. Sasanhaya Fish Reserve is located on Rota and is a no-take zone for all marine species. A new, primarily no-take, marine reserve has been established on the Island of Tinian from Southwest Carolinas Point to Puntan Diablo.

3.1.2.3 Foreign or International Marine Protected Areas

There are many foreign and international MPAs in the central and western Pacific. This section focuses on some of the largest MPAs in the region.

Phoenix Islands Protected Area (PIPA) was established in 2008 and comprises 157,626 mi^2 (408,250 km^2) of marine and terrestrial habitats in Kiribati, including 11 percent of the country's EEZ. In 2010, PIPA was designated as a World Heritage Site. Cook Islands Marine Park was established in 2012 and encompasses 411,000 mi^2 (1.065 million km^2) in the southern portion of the Cook Islands. Similarly to the Phoenix Islands Protected Area in Kiribati, the Cook Islands Marine Park will contain a variety of zones with different levels of protection, including areas where all fishing will be banned, and buffer areas where tourism and carefully monitored fishing will be allowed. These MPAs are part of a total of 14 established large-scale MPAs worldwide (Big Ocean 2014).

Several countries in the Pacific Islands Region including Palau, Marshall Islands, French Polynesia, Cook Islands, and New Caledonia have banned shark fishing within their EEZs, effectively creating vast shark sanctuaries. Similarly, Indonesia created an extensive manta ray sanctuary when they banned manta ray fishing in the entire EEZ in 2014.

3.2 BIOLOGICAL ENVIRONMENT

The biological environment of the PIFSC research areas include fish (Section 3.2.1), marine mammals (Section 3.2.2), birds (Section 3.2.3), sea turtles (Section 3.2.4), and invertebrates (Section 3.2.5).

3.2.1 Fish

Thousands of finfish species occur within the PIFSC research areas. This section of the DPEA provides baseline information for species important to the analysis of effects in Chapter 4, important target species caught in PIFSC survey efforts, and prohibited and highly migratory species.

3.2.1.1 Threatened and Endangered Fish Species

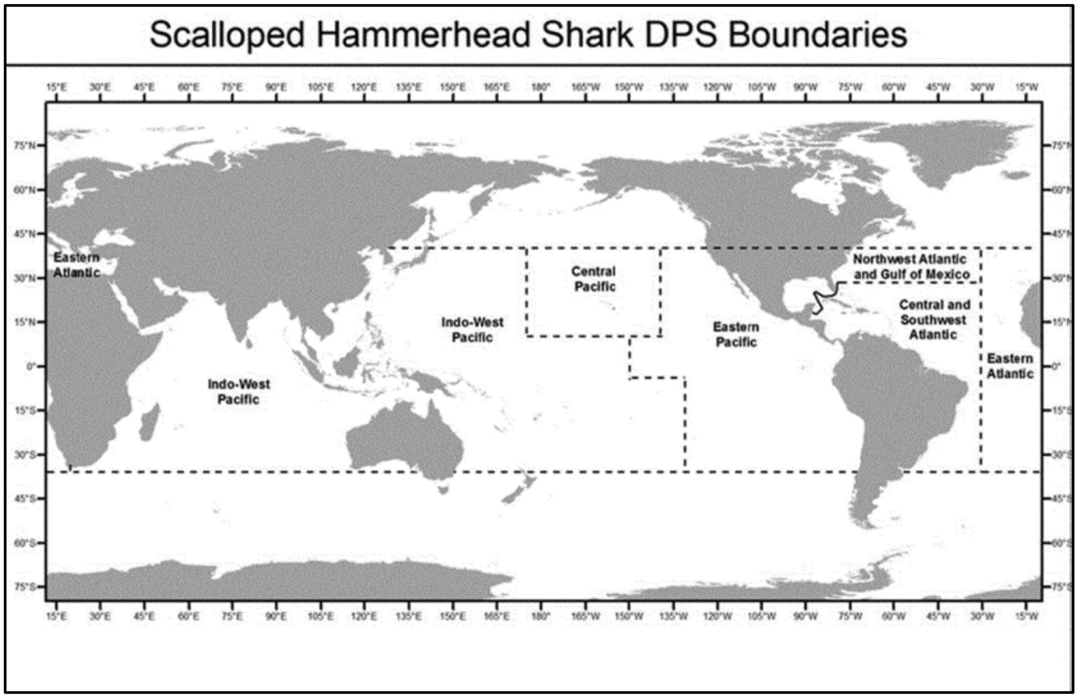
The information presented in the following species account is primarily from the NOAA Fisheries Office of Protected Resources (OPR) website (NOAA 2014d).

<u>Scalloped Hammerhead Shark</u>

The Scalloped hammerhead shark (*Sphyrna lewini*) is a circumpolar species and ranges from the intertidal and surface to depths of approximately 500 meters. Scalloped hammerhead sharks are highly mobile and partly migratory (Maguire et al. 2006). In Kane‘ohe Bay, Hawai‘i, scalloped hammerhead sharks can travel as far as 5.1 km in the same day (Duncan and Holland 2006).

Based on analysis of available data, the scalloped hammerhead shark can be characterized as a long lived (20-30 years), late maturing, and relatively slow growing species (Miller et al. 2014). Juvenile and adult scalloped hammerhead sharks can live as solitary individuals, pairs, or in schools. Neonate and juvenile aggregations are common in nearshore nursery habitats, such as In Kane‘ohe Bay, coastal waters off Oaxaca, Mexico, Guam's inner Apra Harbor, coastal areas in the Republic of Transkei, and coastal intertidal habitats in Cleveland Bay, Australia (Duncan and Holland 2006; Bejarano-Álvarez et al. 2011; Diemer et al. 2011; Tobin et al. 2013).

There are six different Distinct Population Segments (DPS) for the scalloped hammerhead shark, two of which occurs in the PIFSC region: the Central Pacific PDS and the Indo-West Pacific DPS. The Indo-West Pacific DPS was listed as Threatened in July 2014 (79 FR 38213). The Indo-West Pacific DPS includes scalloped hammerhead sharks in the area bounded to the south by 36° S. lat., to the west by 20° E. long., and to the north by 40° N. lat. In the east, the boundary line extends from 175° E. long., then due south to 4° S. lat., then due east along 4° S. lat. to 130° W. long, and then extends due south along 130° W. long., as depicted in Figure 3.2-1. There is no designated critical habitat for the Indo-West Pacific DPS scalloped hammerhead shark at this time.



Source: 79 FR 38213

Figure 3.2-1 Map of Six Scalloped Hammerhead Shark DPS Boundaries

3.2.1.2 Target Species

Target species are those fish which are managed for commercial and recreational fisheries and are the subject of PIFSC research surveys for stock assessment purposes or are often caught as incidental bycatch.

Fishery-caught species within WPRFMC jurisdiction are grouped into Management Unit Species (MUS) or a "multi-species Complex" for which annual catch limits are set. MUS are typically caught in sufficient quantities by fisheries to warrant management or specific monitoring by NMFS and the WPRFMC. MUS within the PIFSC research areas include bottomfish MUS, crustacean MUS, precious coral MUS, and coral reef ecosystem MUS. Included within the Hawai‘i Hawai‘i bottomfish MUS are a subset of species called the "Deep 7" (a managed complex of bottomfish), which has an annual catch limit specific to catches of those species. The coral reef ecosystem MUS includes currently harvested coral reef taxa (CHCRT) and a subgroup of little harvested species (termed potentially harvested coral reef taxa [PHCRT]). The PHCRT are not currently the target of focused fishing harvests, but may become commercially available due to shifting consumer tastes. A full list of the species included in each MUS are defined in 50 CFR 665. This chapter includes only those bottomfish MUS and coral reef ecosystem MUS often caught and which may be directly affected by PIFSC research activities.

Table 3.2-1 displays a list of target and pelagic species commonly caught in PIFSC research areas. The local names of fish species as shown in the regional FEPs (WPRFMC 2009a,b,c) are provided in Hawaiian, Samoan, Chamorro, and Carolinian where available. Chamorro and Carolinian are the two native languages of the Mariana Archipelago. Stock status information was obtained from the NOAA fisheries website at http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html. The proceeding paragraphs provide brief information on the life history traits and habitat for species that are most often caught and kept. For detailed information, please see the WPRFMC website at http://www.wpcouncil.org/.

Table 3.2-1 Target Fish Species in the PIFSC Research Areas

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
BOTTOMFISH MUS						
Silver jaw jobfish/snapper	*Aphareus rutilans*	Lehi (Hawaiian) Palu-gutusiliva (Samoan) Lehi (Chamorro) Maroobw (Carolinian)	Hawai'i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS Pacific Remote Islands Area (PRIA) bottomfish MUS	Not overfished Not overfished Not overfished Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Red/ruby snapper	*Etelis carbunculus*	Ehu (Hawaiian) Palu-malau (Samoan) Buninas agaga (Chamorro) Falaghal moroobw (Carolinian)	Hawai'i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS Pacific Remote Islands Area (PRIA) bottomfish MUS	Not overfished Not overfished Not overfished Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Longtail/red snapper	*Etelis coruscans*	Onaga (Hawaiian) 'Ula'ula koa'e (Hawaiian) Palu-loa (Samoan) Buninas (Samoan) Taighulupegh (Carolinian)	Hawai'i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Unknown Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Blacktip grouper	*Epinephelus fasciatus*	Fausi (Samoan) Gadao (Chamorro) Meteyil (Carolinian)	American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies
Hawaiian sea bass	*Epinephelus quernus*	Hāpu'upu'u (Hawaiian)	Hawai'i bottomfish MUS (Deep 7 species)	Not overfished	WPRFMC	Insular Fish Life History Survey and Studies

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Blue stripe/ blueline snapper	*Lutjanus kasmira*	Ta‘ape (Hawaiian) Savane (Samoan) Funai (Chamorro) Saas (Carolinian)	Hawai‘i bottomfish MUS American Samoa bottomfish MUS Mariana bottomfish MUS	Not overfished Not overfished Not overfished	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Yellowtail snapper	*Pristipomoides auricilla*	Kalekale (Hawaiian) Palu-i‘usama (Samoan) Buninas (Chamorro) Falaghal-maroobw (Carolinian)	Hawai‘i bottomfish MUS American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Not overfished Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Pink snapper	*Pristipomoides filamentosus*	‘Ōpakapaka (Hawaiian) Palu-‘ena‘ena (Samoan) Buninas (Chamorro) Falaghal-maroobw (Carolinian)	Hawai‘i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Not overfished Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Yelloweye snapper	*Pristipomoides flavipinnis*	Palu-sina (Samoan) Buninas (Chamorro) Falaghal-maroobw (Carolinian)	American Samoa bottomfish MUS Mariana bottomfish MUS	Not overfished Not overfished	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Pink snapper	*Pristipomoides sieboldii*	Kalekale (Hawaiian) Palu (Samoan)	Hawai‘i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Not overfished Unknown	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Snapper	*Pristipomoides zonatus*	Gindai (Hawaiian) Palu-ula, palu-sega (Samoan) Buninas rayao amiriyu (Chamorro) Falaghal-maroobw (Carolinian)	Hawai‘i bottomfish MUS (Deep 7 species) American Samoa bottomfish MUS Mariana bottomfish MUS	Not overfished Not overfished Not overfished	WPRFMC	Sampling Pelagic Stages of Insular Fish Species, Insular Fish Life History Survey and Studies
Lunartail grouper	*Variola louti*	Papa, velo (Samoan) Bueli (Chamorro) Bwele (Carolinian)	American Samoa bottomfish MUS Mariana bottomfish MUS PRIA bottomfish MUS	Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies
Coral Reef Ecosystem MUS, Currently Harvested Coral Reef Taxa (CHCRT) and Potentially Harvested Coral Reef Taxa (PHCRT)						
Sergeant-majors	*Abudefduf* spp.	Mamo (Hawaiian) tu'u'u, mutu, mamo, tu'u'u-lumane (Samoan)	Hawai‘i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, Surface Night-Light Sampling Survey, RAMP
Banded damselfish	*Abudefduf abdominalis*	Mamo (Hawaiian) tu'u'u, mutu, mamo, tu'u'u-lumane (Samoan)	Hawai‘i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, Surface Night-Light Sampling Survey, RAMP
blue-banded surgeonfish	*Acanthurus lineatus*	Alogo (Samoan)	Hawai‘i PHCRT American Samoa CHCRT Mariana CHCRT PRIA CHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Flat needlefish	*Ablennes hians*	N/A	Hawai‘i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey, RAMP

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Longnose lancetfish	*Alepisaurus ferox*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Longline Gear Research, Pelagic Longline Hook Trials, Longline Gear Research
Bluefin trevally	*Caranx megalampys*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Unidentified Eteline snappers	*Etelis* spp.	N/A	N/A	Not overfished Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies, RAMP
Unidentified flyingfish	*Exocoetidae* (unidentified)	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey
Barbel flyingfish	*Exocetus monocirrhus*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey
Tropical two-wing flyingfish	*Exocoetus volitans*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey
Eightbar grouper	*Hyporthordus octofasciatus*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Unidentified sea chub	*Kyphosus* spp.	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey, RAMP
Snapper	*Lutjanus* spp.	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies, RAMP
Humpnose big-eye bream	*Monotaxis grandoculis*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Yellowstripe goatfish	*Mulloidichthys flavolineatus*	weke`a or weke a`a (Hawaiian) afolu, afulu (Samoan)	Hawai'i PHCRT American Samoa CHCRT Mariana CHCRT PRIA CHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Lagoon Ecosystem Characterization, Mariana Resource Survey, RAMP
Bigscale soldierfish	*Myripristis berndti*	menpachi, `u`u (Hawaiian) malau-ugatele, malau-va'ava'a (Samoan) saksak (Chamorro) mweel (Carolinian)	Hawai'i CHCRT American Samoa CHCRT Mariana CHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Orangespine unicornfish	*Naso literatus*	kalalei, umaumalei (Hawaiian) ili'ilia, umelei (Samoan) hangon (Chamorro) bwulaalay (Carolinian)	Hawai'i CHCRT American Samoa CHCRT Mariana CHCRT PRIA CHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Bluespine	*Naso unicornus*	Kala (Hawaiian)	Hawai'i CHCRT	Not overfished	WPRFMC	Lagoon Ecosystem Characterization,

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
unicornfish		ume-isu (Samoan) tataga (Chamorro) igh-falafal (Carolinian)	American Samoa CHCRT Mariana CHCRT PRIA CHCRT	Not overfished Not overfished Unknown		Mariana Resource Survey, RAMP
Hawaiian deep anthias	*Odontanthias fuscipinnis*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies, Surface Night-Light Sampling Survey, RAMP
Saddle-back snapper	*Paracaesio kusakarii*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies, RAMP
Ornate jobfish	*Pristipomoides argyrogrammicus*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Yelloweye snapper	*Pristipomoides flavipinnis*	N/A	Hawai'i PHCRT PRIA PHCRT	Not overfished Unknown	WPRFMC	Insular Fish Life History Survey and Studies, Mariana Resource Survey, RAMP
Unidentified driftfishes	*Psenes* spp.	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey
Freckled driftfish	*Psenes cyanophrys*	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Bicolor parrotfish	*Scarus rubroviolaceus*	uhu, palukaluka (Hawaiian) fuga, galo-uluto'i, fuga-valea, laea-mamanu (Samoan) laggua (Chamorro)	Hawai'i CHCRT American Samoa CHCRT Mariana CHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Mariana Resource Survey, RAMP
Unidentified jack	*Seriola* spp.	N/A	Hawai'i PHCRT American Samoa PHCRT Mariana PHCRT PRIA PHCRT	Not overfished Not overfished Not overfished Unknown	WPRFMC	Surface Night-Light Sampling Survey, RAMP
Pacific Pelagic MUS						
Snake mackeral	*Gempylus serpens*	N/A	Pacific pelagic MUS, snake mackerals – Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Sickle pomfret	*Taractichthys steindachneri*	N/A	Pacific pelagic MUS, pomfrets – Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Blue shark	*Prionace glauca*	N/A	Pacific pelagic MUS, Blue shark – North Pacific	Not overfished	PFMC/WPR FMC	Circle and tuna hook trials, longline gear research, marlin longline
White tip shark	*Carcharhinus longimanus*	N/A	Pacific pelagic MUS , oceanic whitetip shark – Tropical Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Silky shark	*Carcharhinus falciformis*	N/A	Pacific pelagic MUS, silky shark - Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Shortfin mako shark	*Thysanoteuthis rhombus*	N/A	Pacific pelagic MUS, shortfin mako – North Pacific	Unknown	PFMC/WPR FMC	Circle and tuna hook trials, longline gear research, marlin longline
Longfin mako shark	*Sthenoteuthis oualaniensis*	N/A	Pacific pelagic MUS, longfin mako – North Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Pelagic thresher shark	*Alopias pelagicus*	N/A	Pacific pelagic MUS, pelagic thresher – North Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline

Common Name	Scientific Name	Local Name	Stock	Stock Status	Fishery Management Council	PIFSC Surveys
Bigeye thresher shark	*Alopias superciliosus*	N/A	Pacific pelagic MUS, bigeye thresher – North Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Bigeye tuna	*Thunnus obesus*	Ahi	Pacific pelagic MUS, bigeye tuna - Pacific	Overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Yellowfin tuna	*Thunnus albacares*	Ahi	Pacific pelagic MUS, Yellowfin tuna, central western Pacific and eastern tropical Pacific	Not overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Skipjack tuna	*Katsuwonus pelamis*	Aku	Pacific pelagic MUS, skipjack tuna - central western Pacific and eastern tropical Pacific	Not overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Blue marlin	*Makaira nigricans*	Kajiki	Pacific pelagic MUS, blue marlin - Pacific	Not overfished	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Striped marlin	*Kajikia audax*	Nairagi	Pacific pelagic MUS, striped marlin – eastern tropical Pacific	Not overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Striped marlin	*Kajikia audax*	Nairagi	Pacific pelagic MUS, striped marlin – western and central Pacific	Overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Swordfish	*Xiphias gladius*	Mekajiki	Pacific pelagic MUS, swordfish – North Pacific	Not Overfished	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Wahoo	*Acanthocybium solandri*	Ono	Pacific pelagic MUS, wahoo - Pacific	Unknown	WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline
Dolphinfish	*Coryphaena hippurus*	Mahimahi	Pacific pelagic MUS, dolphinfish – Pacific	Unknown	PFMC/WPRFMC	Circle and tuna hook trials, longline gear research, marlin longline

Bottomfish MUS

Snappers and Groupers

Snappers and groupers are often the target of commercial fishermen. There are distinct depth associations for certain species of snappers and groupers. Many snappers and some groupers are restricted to feeding in deep water (Parrish 1987). For example, species of the genus Pristipomoides occur at intermediate depths and congregate around rocky outcrops and promontories (Ralston et al. 1986), while Eteline snappers occupy deeper waters. Species of groupers are relatively larger and mostly occur in shallow areas. However, some may occupy deep-slope habitats. Groupers are typically more sedentary and territorial than snappers or emperors, and rely more on hard substrates. In general, groupers may be less dependent on hard substrates at depth (Parrish 1987). The schooling behavior of snappers and groupers are reported more frequently for juveniles than for adults. Snapper and grouper species produce pelagic eggs and larvae and are most abundant over deep reef slope water (WPRFMC 2009a).

Pacific Pelagic MUS

Blue Shark

Blue sharks (*Prionace glauca*) are found in warm seas worldwide and are likely the most wide-ranging of all sharks. Male blue sharks reach sexual maturity around four to five years of age, while females reach maturity between five and six years of age. Blue sharks bear fully formed, live young in litters averaging approximately 30 pups (NOAA 2011). Mating is thought to occur in waters from 20 to 30° N (Nakano and Seki, 2003).

In the North Pacific, seasonal migrations occur with northward movements extending into the Gulf of Alaska as waters warm during the summer months and southward movements occurring during the winter months (NOAA 2011). Blue sharks tagged off southern California have been recaptured to the south off Baja, California and Acapulco, Mexico; northward to off Oregon, and westward to off the Hawaiian Islands and Midway Islands in the central Pacific, indicating a wide ranging stock that may overlap with the population fished by longliners in the central Pacific Ocean (NOAA 2011).

Blue sharks are the most common, incidentally-caught shark in pelagic longline fisheries worldwide (Taniuchi, 1990; Bonfil, 1994). Despite this, blue shark populations in both hemispheres have been found to be above the maximum sustainable yield reference point, and in many model scenarios, close to un-fished biomass levels (Kleiber et al. 2009).

Whitetip Shark

Oceanic whitetip shark (*Carcharhinus longimanus*) is a large carcharhinid with a circumglobal distribution in tropical and warm-temperate open waters, usually found above 20^{0}C. It is primarily oceanic and considered one of the two most abundant oceanic sharks, along with blue shark (Walsh and Clarke 2011).

Silky Shark

Silky shark (*Carcharhinus falciformis*), which is one of the largest species in this genus, is another common carcharhinid species with a circumglobal distribution in all tropical oceans. It also occurs in some warm-temperate waters, usually above 23°C. It has been described as semipelagic because it is often taken in coastal and insular regions. Silky sharks are most abundant near the Line Islands between 0°–10° N and 155°–165°W in the central Pacific Ocean (Walsh and Clarke 2011).

Tuna

Bigeye tuna (*Thunnus obesus*) is found across the Pacific Ocean between northern Japan and the north island of New Zealand in the western Pacific and from 40°N to 30°S in the eastern Pacific Ocean. Bigeye tuna are capable of large scale migrations and move freely within broad regions of favorable water temperature and dissolved oxygen levels. Juvenile and small adult bigeye tuna school at the surface, sometimes with skipjack and juvenile yellow fin tunas. Schools may associate with floating objects or large, slow moving marine animals such as whale sharks or manta rays. Once reaching sexual maturity at around 3 years of age, bigeyes are capable of spawning throughout the year in tropical waters and seasonally at higher latitudes at water temperatures above 75° F. Bigeye tuna release millions of eggs per spawning event, which float on the top layer of the ocean, buoyed at the surface by a single oil droplet, until they hatch (NOAA 2014c).

The yellowfin tuna (*Thunnus albacares*) is found throughout the tropical and sub-tropical waters of the Pacific Ocean. Yellowfin are known to gather around drifting flotsam, fish aggregating devices, anchored buoys, dolphins and other large marine animals. Yellowfin tuna reach sexual maturity at approximately two years of age and spawn frequently, but are short lived with a maximum life span of six to seven years (NOAA 2014c).

The skipjack tuna (*Katsuwonus pelamis*) is made up of two stocks in the Pacific Ocean, one in the eastern Pacific Ocean and one in the western and central Pacific Ocean. Skipjack tuna live mostly in the open ocean, though they do spend part of their life cycle in nearshore waters. Skipjacks are often found in large schools swimming in surface waters throughout the Pacific. Skipjack tuna reach sexual maturity early, once they reach around 1.3 ft. (4 m.) in length and are capable of spawning almost daily. The maximum life span is estimated between 8 to 12 years (NOAA 2014c).

Mahimahi

The dorado (*Coryphaena hippurus*), also known as dolphinfish or mahimahi, is found in tropical and subtropical waters of all oceans. Dorado are unmonitored, but it is believed the population is stable and is able to withstand a relatively high level of exploitation. Dorado reach sexual maturity at 4 to 5 months of age and are prolific spawners, reproducing repeatedly. Spawning is thought to occur year round in temperate waters, above 75 degrees Fahrenheit, but peaks vary with latitude. Dorado spawning grounds appear to be in the North Pacific in waters less than 50 nm from islands and banks; off the continents, they appear to spawn on the continental shelf. The lifespan of dorado is thought to be five years for a female, longer for males (NOAA 2014c).

Marlin and Swordfish

The striped marlin (*Tetrapturus audax*) is widely distributed throughout most tropical and sub-tropical waters of the Pacific and Indian oceans. Movements tend to be diffuse as striped marlin do not form dense schools, but occur singularly or in small groups, usually segregated by size. Adult fish are found in the north- and south- central Pacific where spawning occurs, in the central Pacific and off central Mexico. Sub-adult fish move east toward the coast of Mexico where they are found in high abundance around the tip of the Baja peninsula, striped marlin are not reproductively active while off southern California (NOAA 2014c).

The North Pacific Swordfish (*Xiphias gladius*) is found worldwide in all tropical, subtropical, and temperate seas, though little is known of their migration patterns. Swordfish are abundant near boundary zones where there are sharp gradients of temperature and salinity. Swordfish reach sexual maturity around five to six years of age and about 5-5.5 feet (1.6 m) in length and have a maximum life span of at least nine years. Swordfish do not seem to have a specific spawning season or grounds, they spawn throughout the year in equatorial waters but in higher latitudes, spawning is restricted to spring and summer (NOAA 2014c).

Coral Reef Ecosystem MUS

As discussed in Section 3.2.1.2, Coral Reef Ecosystem MUS are divided into CHCRT and PHCRT. There are approximately 50 to 100 different species of CHCRT and thousands of species of PHCRT within each stock. It is impractical to provide details for each of these species; a full list of the species included in CHCRT and PHCRT for each stock can be found in 50 CFR 665. The species highlighted in Table 3.2-1 are those whose average catch averaged more than 10 individuals per year by PIFSC research surveys.

3.2.2 Marine Mammals

The marine mammal species listed in Table 3.2-2 occur in the areas frequented by PIFSC research surveys in the HARA, MARA, ASARA, and WCPRA. All marine mammals are federally protected under the U.S. Marine Mammal Protection Act (MMPA) of 1972. In addition, seven cetacean species and one pinniped species in the PIFSC research areas are listed as endangered under the ESA and depleted under the MMPA. The survey areas also encompass designated critical habitat for the Hawaiian monk seal and North Pacific right whale (see Section 3.2.2.2). Threatened and endangered species encountered in the PIFSC survey areas are described in Section 3.2.2.2. Non-ESA listed marine mammals for which Level A and/or Level B takes are requested by PIFSC in the Letters of Authorization (LOA) Application (Appendix C) are described in Section 3.2.2.3.

All life history and abundance data for the marine mammal species described below is obtained from literature as cited and where not cited, is from the most recent NMFS Stock Assessment Reports (Caretta et al. 2015, Allen and Angliss 2015), available on the NMFS website at http://www.nmfs.noaa.gov/pr/sars/region.htm. The minimum population size presented in each species account is calculated as the lower 20th percentile of the log-normal distribution of the most recent abundance estimate (Barlow et al. 1995). The potential biological removal (PBR) level is calculated as the minimum population size within the U.S. EEZ of the stock's region times one half the default maximum net growth rate for the species, times a recovery factor that varies from 1.0 to 0.1 depending on the status of the stock (Wade and Angliss 1997).

Table 3.2-2 Marine Mammal Species that are Known to Occur in the PIFSC Research Areas

Species		HARA	MARA	ASARA	WCPRA	Federal ESA/MMPA Status[1]
Common Name	Scientific Name					
CETACEANS						
Rough-toothed dolphin	*Steno bredanensis*	X	X	X	X	-
Risso's dolphin	*Grampus griseus*	X	X		X	-
Bottlenose dolphin[2]	*Tursiops truncatus*	X	X	X	X	-
Pantropical spotted dolphin[3]	*Stenella attenuata*	X	X	X	X	-
Spinner dolphin[4]	*Stenella longirostris*	X	X	X	X	-
Striped dolphin	*Stenella coeruleoalba*	X	X		X	-
Fraser's dolphin	*Lagenodelphis hosei*	X	X		X	-
Melon-headed whale[5]	*Peponocephala electra*	X	X		X	-
Pygmy killer whale	*Feresa attenuata*	X	X		X	-
False killer whale[6]	*Pseudorca crassidens*	X	X	X	X	Endangered[7]/ depleted

Species		HARA	MARA	ASARA	WCPRA	Federal ESA/MMPA Status[1]
Common Name	**Scientific Name**					
Killer whale	*Orcinus orca*	X	X	X	X	-
Short-finned pilot whale	*Globicephala macrorhynchus*	X	X	X	X	-
Blainville's beaked whale	*Mesoplodon densirostris*	X	X		X	-
Cuvier's beaked whale	*Ziphius cavirostris*	X	X	X	X	-
Longman's beaked whale	*Indopacetus pacificus*	X			X	-
Deraniyagala's beaked whale	*Mesoplodon hotaula*				X	-
Pygmy sperm whale	*Kogia breviceps*	X	X		X	-
Dwarf sperm whale	*Kogia sima*	X	X	X	X	-
Sperm whale	*Physeter macrocephalus*	X	X	X	X	Endangered/ depleted
Blue whale	*Balaenoptera musculus*	X	X		X	Endangered/ depleted
Fin whale	*Balaenoptera physalus*	X	X		X	Endangered/ depleted
Bryde's whale	*Balaenoptera edeni*	X	X	X	X	-
Sei whale	*Balaenoptera borealis*	X	X		X	Endangered/ depleted
Minke whale	*Balaenoptera acutorostrata scammoni*	X	X	X	X	-
Humpback whale[8]	*Megaptera novaeangliae*	X	X	X	X	Endangered/ depleted
North Pacific right whale	*Eubalaena japonica*	X				Endangered/ depleted
PINNIPEDS[9]						
Hawaiian monk seal	*Neomonachus schauinslandi*	X			X	Endangered/ depleted

1. Denotes ESA listing as either endangered or threatened, or MMPA listing as depleted. By default, all species listed under the ESA as threatened or endangered are also considered depleted under the MMPA. All marine mammal stocks are considered protected under the MMPA.
2. Kaua‘i and Ni‘ihau stock, O‘ahu stock, the "4-Island Region" (Moloka‘i, Lāna‘i, Maui, Kaho‘olawe) stock, Hawai‘i Island stock, and the Hawaiian pelagic stocks.
3. Hawaiian Islands stock complex: O‘ahu, 4-Islands, Hawai‘i Island, and Hawaiian pelagic stocks.
4. Hawai‘i Island, O‘ahu/ 4 -Islands, Kaua‘i/Ni‘ihau, Pearl and Hermes Atoll, Kure/Midway, Hawai‘i Pelagic, and American Samoa stocks.
5. Hawaiian Islands stock complex: Hawaiian Islands and Kohala Resident stocks.
6. Hawaiian Islands stock complex: Hawai‘i Hawai‘i Insular, Hawai‘i pelagic, Northwestern Hawaiian Islands, Palmyra Atoll, and American Samoa stocks.
7. Pertains only to the Main Hawaiian Islands insular false killer whale distinct population segment.
8. American Samoa and Central North Pacific stocks.
9. There are documented cases of Northern elephant seals (*Mirounga angustirostris*) in Hawai‘i, but these occurrences are rare and these animals are considered vagrants as they are outside of their normal range.

3.2.2.1 Marine Mammal Acoustics and Hearing

Marine mammals rely on sound production and reception for social interactions (e.g., reproduction, communication), to find food, to navigate, and to respond to predators. General reviews of cetacean and pinniped sound production and hearing may be found in Richardson et al. (1995), Edds-Walton (1997), Wartzok and Ketten (1999), and Au and Hastings (2008). Several recent studies on hearing in individual species or species groups of odontocetes and pinnipeds also exist (e.g., Kastelein et al. 2009, Kastelein et al. 2013, Ruser et al. 2014). Interfering with these functions through anthropogenic noise could result in potential adverse impacts.

Southall et al. (2007) provided a comprehensive review of marine mammal acoustics including designating functional hearing groups. Assignment was based on behavioral psychophysics (the relationship between stimuli and responses to stimuli), evoked potential audiometry, auditory morphology, and, for pinnipeds, whether they were hearing through air or water. Because no direct measurements of hearing exist for baleen whales, hearing sensitivity was estimated from behavioral responses (or lack thereof) to sounds, commonly used vocalization frequencies, body size, ambient noise levels at common vocalization frequencies, and cochlear measurements. NOAA modified the functional hearing groups of Southall et al. (2007) to extend the upper range of low-frequency cetaceans and to divide pinnipeds into phocids and otariids (NOAA 2013b). Detailed descriptions of marine mammal auditory weighting functions and functional hearing groups are available in NOAA (2013b). Table 3.2-3 presents the functional hearing groups and representative species or taxonomic groups for each; most species found in the PIFSC project areas are in the first two groups, low frequency cetaceans (baleen whales) and mid frequency cetaceans (toothed whales).

Table 3.2-3 Summary of the Functional Hearing Groups of Marine Mammals

Functional Hearing Group	Estimated Auditory Bandwidth	Species or Taxonomic Groups
Low Frequency Cetaceans (Mysticetes–baleen whales)	7 Hertz (Hz) to 25 kilohertz (kHz) (best hearing is generally below 1000 Hz (1 kHz), higher frequencies result from humpback whales)	All baleen whales
Mid- Frequency Cetaceans (Odontocetes—toothed whales)	150 Hz to 160 kHz (best hearing is from approximately 10-120kHz)	Includes species in the following genera: *Steno, Tursiops, Stenella, Lagenodelphis, Grampus, Peponocephala, Feresa, Pseudorca, Orcinus, Globicephala, Physeter, Ziphius, Indopacetus, Mesoplodon*
High-frequency Cetaceans (Odontocetes)	200 Hz to 48 kHz (best hearing is from approximately 10-150kHz)	Includes true porpoises, *Kogia*, river dolphins, cephalorhynchid, Lagenorhynchus cruciger and *L. australis*
Phocid pinnipeds (true seals)	75 Hz to 100 kHz (best hearing is from approximately 1-30 kHz)	All seals

Source: Based on Southall et al. 2007, DON 2008, and NOAA 2013b .

3.2.2.2 Threatened and Endangered Marine Mammals

Table 3.2-2 lists all marine mammal species encountered in the PIFSC research areas; this section only discusses species listed as threatened or endangered under the ESA.

False Killer Whale - Main Hawaiian Islands (MHI) Insular Stock

Status and trends: There are currently five recognized Pacific Islands Region management stocks of false killer whales, the: 1) MHI insular stock includes animals within 72 km (approx. 38.9 nm) of the MHI, 2) Northwestern Hawaiian Islands stock includes animals within the NWHI and a 50 nm radius around Kaua‘i, 3) Hawai‘i pelagic stock includes animals in waters more than 11 km (5.9 nm) from the MHI, 4) Palmyra Atoll stock includes animals within the U.S. EEZ of Palmyra Atoll, and 5) American Samoa stock includes animals within the U.S. EEZ of American Samoa (Carretta et al. 2014, Carretta et al. 2013). The MHI insular stock is a distinct population segment (DPS) and the only stock listed under the ESA as endangered (77 FR 70915, November 28, 2012) and, therefore, the only stock discussed in further detail here.

The minimum population estimate for the MHI insular false killer whales is 138 animals and the PBR for this stock is 0.3 animals. The average estimated annual human-caused mortality and serious injury in the Hawai‘i-based deep-set longline fishery is 0.9 animals per year (Carretta et al. 2015).

Based on the best available scientific information (Carretta et al. 2014), the Hawaiian insular false killer whales have been declining over the past 20 years; listed as endangered under the ESA (77 FR 70915, 28 November, 2012), they are automatically considered “strategic” under the 1994 amendments to the MMPA (Carretta et al. 2014, Oleson et al. 2010).

Distribution and habitat preferences: False killer whales are found worldwide in tropical and warm temperate oceans and, occasionally, in cold temperate waters. They are typically pelagic, yet also occur near to shore and in shallow waters around oceanic islands (Baird 2009a). The population of MHI insular false killer whales is in residence in waters around the MHI, year-round. Feeding occurs throughout this area and there is no specific breeding area within this range. Satellite telemetry and photo-identification data suggest that the MHI insular false killer whale population consists of three social clusters with distinct high-use areas. The three identified high-use areas are 1) off the north end of Hawai‘i Island, 2) north of Maui and Moloka‘i, and 3) southwest of Lana‘i (Baird et al. 2012). The higher density areas tend to be in shallow water, with gentle slopes, close to shore, with higher chlorophyll conentrations, and on the windward side of the islands (Baird et al. 2012).

Behavior and life history: Three large, distinct social groups exist within the MHI insular false killer whale population (Baird et al. 2012). Males and females show strong fidelity to natal social groups. Mating occurs within and between social groups, which could lead to inbreeding depression and further impact this small population (Martien et al. 2011).

False killer whales in Hawai‘i largely feed on fish found primarily at the surface, but may also bring prey up from depth. Seven of the ten species of pelagic fish documented as prey of false killer whales from the MHI insular stock are harvested commercially: yellowfin tuna (*Thunnus albacares*), albacore tuna (*T. alalunga*), skipjack tuna (*Katsuwonus pelamis*), broadbill swordfish (*Xiphias gladius*), dolphin fish (or mahimahi, *Coryphaena hippurus*), wahoo (or ono, *Acanthocybium solandri*), and lustrous pomfret (or monchong, *Eumegistus illustrus*) (Baird 2009b).

Sperm whale

Status and trends: Sperm whales within the Pacific U.S. EEZ are divided into three stocks: 1) waters around Hawai‘i, 2) California, Oregon, and Washington waters, and 3) Alaskan waters (Carretta et al. 2014, Carretta et al. 2013). The Hawaiian stock includes whales found within the Hawaiian Islands EEZ and in adjacent international waters. Stock status is, however, based on data from the Hawaiian Islands, as data on abundance, distribution, and human-caused impacts are limited for international waters. Sperm whales are listed as endangered under the ESA and, consequently, the Hawaiian stock is also considered as a depleted and strategic stock under the MMPA (Carretta et al. 2013).

The minimum population estimate is 2,539 whales and the calculated PBR is 10.2 sperm whales per year (Carretta et al. 2015). There are no recent fishery-related mortalities or serious injuries of sperm whales in the Hawaiian Islands EEZ (Carretta et al. 2015). Based on one observed interaction with the Hawai‘i-based deep-set longline fishery in 2011 and there being a 75 percent probability of a serious injury based on known outcomes for other whales with this type of injury, the estimated mortality and serious injury for commercial fisheries within the Hawaiian EEZ for 2007-2011 is 0.7 sperm whales (Carretta et al. 2014).

Distribution and habitat preferences: Sperm whales are distributed across the entire North Pacific and into the southern Bering Sea in summer, but most are thought to be south of 40° N in winter. Sperm whales are the most abundant large whale in Hawaiian waters during summer and fall. During shipboard surveys in 2002, they were broadly distributed throughout the U.S. EEZ waters surrounding Hawai‘i, including the Northwestern Hawaiian Islands area (Barlow 2006). Sperm whales near the MHI most commonly occur in deep water (>3,000 m) (Baird et al. 2013).

Behavior and life history: Females reach sexual maturity at about age 9 when they are roughly 9 m long; they give birth about every 5 years following a gestation period of 14-16 months. Males may not be active breeders until their late 20s and may not reach physical maturity until roughly 50 years old and 16 m long (Whitehead 2009). Female and immature sperm whales are quite social animals, whereas young males leave their natal units to between 4 and 21 years of age. Older males are generally seen alone and tend to frequent higher latitude areas (Whitehead 2009). Sperm whales consume numerous varieties of deep water fish and cephalopods.

<u>Blue whale</u>

Status and trends: The two stocks of blue whales within the Pacific U.S. EEZ are the central North Pacific stock that includes whales around the Hawaiian Islands during winter, and the eastern North Pacific stock that feeds primarily off California (Carretta et al. 2014). Although there are acoustic recordings off O‘ahu Island and Midway Atoll and few documented sightings, blue whales are uncommon in Hawaiian waters. No blue whales were sighted during aerial surveys in 1993-1998 or during shipboard surveys in 2002. Two blue whales were sighted during a survey of the Hawaiian U.S. EEZ in November 2010 and four sightings were made by observers on Hawai‘i-based longline vessels (Bradford et al. 2013 in Carretta et al. 2014).

The 2010 line-transect survey of the Hawaiian Islands EEZ resulted in a summer/fall abundance estimate of 81 blue whales. Although currently considered the best available estimate for Hawaiian waters, most blue whales from this stock were likely feeding in higher latitudes during the time of the survey (Carretta et al. 2014). The PBR for this stock in the Hawaiian Islands EEZ is 0.1 per year, based on a minimum estimate of 38 whales. There have been no fishery-related mortalities or serious injuries of blue whales reported within the Hawaiian Islands EEZ (Carretta et al. 2014). Blue whales are listed as endangered under the ESA and are therefore automatically considered a depleted and strategic stock under the MMPA.

Distribution and habitat preferences: Blue whales occur worldwide in circumpolar and temperate waters and undertake seasonal migrations between high-latitude and subtropical waters. Blue whales of the central Pacific stock may feed during summer near Kamchatka, the Aleutian Islands, and in the Gulf of Alaska and migrate to lower-latitudes in the western and central Pacific, including Hawai‘i, in winter (Stafford et al. 2001, Stafford 2003). There have been no sightings or strandings of blue whales reported in the waters of American Samoa or the Pacific Remote Island Areas (WPRFMC 2009c, d).

Behavior and life history: Blue whales reach sexual maturity at 5-15 years of age; length at sexual maturity in the Northern Hemisphere for females is 21-23 m. and for males it is 20-21 m. (Sears and Perrin 2009). Females give birth about every 2-3 years in winter after a 10-12 month gestation. Longevity

is thought to be at least 80-90 years (Sears and Perrin 2009). Blue whales occur primarily in offshore deep waters and feed almost exclusively on euphausiids.

Fin whale

Status and trends: The three stocks of fin whales in the North Pacific recognized in MMPA stock assessment reports are the: 1) Hawai‘i stock, 2) California/Oregon/Washington stock, and 3) Alaska stock. The Hawai‘i stock includes fin whales within the Hawaiian Islands EEZ and adjacent high-seas waters. Few data exist for the high-seas, so stock status is based on data from Hawaiian Islands EEZ waters (Carretta et al. 2014). Fin whales are listed as endangered under the ESA and are considered a depleted and strategic stock under the MMPA.

Currently, the best abundance estimate for the Hawai‘i stock of fin whales is 58, derived from a 2010 shipboard line-transect survey of the Hawaiian Islands EEZ; however most fin whales were likely feeding in higher latitudes during the time of the survey (Bradford et al. 2013 in Carretta et al. 2014). Based on the 2010 abundance estimate, the minimum population size is 27 and the PBR is 0.1 fin whales per year. There were no reported fishery-related mortalities or serious injuries within the Hawaiian Islands EEZ (Carretta et al. 2014); however, between January and March 2015 the Hawai‘i-based pelagic longline fishery reported an interaction with a fin whale, which was categorized as “released injured”. Following this interaction, NMFS will review the more detailed observer notes and calculate the total fishery-related mortality and serious injury designation for this stock.

Distribution and habitat preferences: Fin whales are distributed widely in the world’s oceans and occur in both the Northern and Southern Hemispheres between 20° to 75° latitude (DON 2008). In the northern hemisphere, they migrate from high Arctic feeding areas to low latitude breeding and calving areas. Fin whales seasonally migrate into the PIFSC research areas, although sightings are few. There have been no reports of fin whales in American Samoa waters (WPRFMC 2009c).

Behavior and life history: Fin whales become sexually mature between six to ten years of age, and reproduce primarily in the winter. Gestation lasts about 11 months and nursing occurs for 6 to 11 months (Aguilar 2009). Fin whales feed on planktonic crustaceans, including *Thysanoessa* sp. and *Calanus* sp., as well as schooling fish including herring, capelin and mackerel (Aguilar 2009).

Sei whale

Status and trends: Sei whales within the Pacific U.S. EEZ are divided into three areas for the purposes of stock assessments: 1) waters around Hawai‘i, 2) waters off California, Oregon and Washington, and 3) Alaskan waters. The Hawai‘i stock includes sei whales within the Hawaiian Islands EEZ and in adjacent high-seas waters. Data are scarce for the high-seas areas, so stock status is based on data from U.S. EEZ waters of the Hawaiian Islands (Carretta et al. 2014 and citations therein).

Summer/fall surveys of the entire Hawaiian Islands EEZ in 2002 and 2010 resulted in four and three sei whale sightings, respectively; an abundance estimate of 178 sei whales was derived from the 2010 survey (Carretta et al. 2014 and citations therein). Although this is currently the best available abundance estimate for this stock, most sei whales would be expected to be feeding in higher latitudes waters during the time of the survey. The minimum estimate is 93 whales and the PBR is 0.2 sei whales per year (Carretta et al. 2014). A single sei whale was seen entangled in heavy-gauge polypropylene line in 2011; the source of the line was not determined. There have been no other observed fisheries-related mortalities and serious injuries. The estimated rate of fisheries-related mortality and serious injury of sei whales in the Hawaiian Islands EEZ is 0.2 animals per year for the period from 2007 to 2011 (Carretta et al. 2014).

Sei whales are listed as endangered under the ESA and, consequently, the Hawai‘i stock is automatically considered to be a depleted and strategic stock under the MMPA.

Distribution and habitat preferences: Sei whales have a worldwide distribution, but are found primarily in cold temperate to subpolar latitudes rather than in the tropics or near the poles (Horwood 2009). Sei whales spend the summer months feeding in subpolar higher latitudes and return to lower latitudes to calve in the winter. There is some evidence from whaling catch data of differential migration patterns by reproductive class, with females arriving at and departing from feeding areas earlier than males. For the most part, the location of winter breeding areas is unknown (Horwood 2009).

Behavior and life history: Sei whales mature at about 10 years of age for both sexes. They are most often found in deep, oceanic waters of the cool temperate zone. Sei whales appear to prefer regions of steep bathymetric relief, such as the continental shelf breaks, canyons, or basins situated between banks and ledges. In feeding grounds, their distribution is largely associated with oceanic frontal systems (Horwood 2009). In the North Pacific, sei whales feed along the cold eastern currents (Perry et al. 1999). Prey includes calanoid copepods, krill, fish, and squid.

Humpback whale

Status and trends: In the North Pacific, there are at least three separate populations of humpback whales which migrate between specific summer/fall feeding areas and winter/spring calving and mating areas. The California/Oregon/Washington (formerly called the eastern Pacific) stock spends the winter in coastal waters of Mexico and Central America and the summer along the U.S. West Coast from California to British Columbia. The Central North Pacific stock spends winters in Hawai‘i and summers in Alaska (Aleutian Islands, Bering Sea, Gulf of Alaska, and Southeast Alaska/northern British Columbia), and its distribution may partially overlap with that of the California/Oregon/Washington stock off the coast of Washington and British Columbia (Clapham 2009). Finally, the Western North Pacific stock spends winters near Japan and probably migrates to the Bering Sea and Aleutian Islands in summer (Carretta et al. 2014). There is some mixing between these populations, though they are still considered distinct stocks. The Central North Pacific stock occurs within the HARA.

The bias-corrected abundance estimate for the entire North Pacific Basin is 20,800 humpback whales. Point estimates of abundance for Hawai‘i range from 7,469 to 10,103 whales. Currently, the minimum population estimate for the Central North Pacific stock of humpback whales is 7,890 whales and the calculated PBR is 82.8 whales (Allen and Angliss 2015).

Reports of entangled humpback whales found swimming, floating, or stranded with fishing gear attached occur in both Alaskan and Hawaiian waters. In Hawaiian waters, humpback whale mortalities and serious injuries caused by commercial and recreational fishery entanglement from 2007-2012 included 39 vessel collisions and 48 entanglements. For the 2008-2012 period, relevant to the 2014 Marine Mammal Stock Assessment Report, there were 34.88 serious injuries and one mortality in Hawai‘i relevant to the PBR comparison, averaging 7.18 serious injuries per year (Bradford and Lyman 2015). Additional mortality and serious injury due to vessel collisions, 2007-2012, included an annual mean of 1.8 whales in Alaska and 2.43 in Hawaiian waters (Allen and Angliss 2013b).

The Oceania subpopulation (American Samoa stock) of humpback whales, as defined by the IUCN Red List process, ranges throughout the South Pacific, except for the west coast of South America, from the equator to the edges of the Antarctic ice (Childerhouse et al. 2008). For MMPA stock assessment reports, the stock of interest is the American Samoa stock (Carretta, et al. 2014, Carretta et al. 2013). Evidence of breeding and calving has been documented in American Samoa waters. The feeding area of American Samoan whales is not well defined, but at least two whales from Samoa have also been seen off the Antarctic Peninsula (Robbins et al. 2011). There is currently no estimate of abundance for humpback whales in American Samoan waters. The minimum population estimate for this stock is 150 whales, based on those photo–ID data between 2003 and 2008 (Carretta et al. 2013). However, 150 whales is likely an underestimation of the true minimum population size as photo ID studies were only conducted over a few weeks per year and there is evidence of exchange of animals between other feeding and

breeding grounds (Carretta, et al. 2014). Data are not sufficient to estimate the proportion of time Oceania humpback whales spend within or outside of waters of American Samoa. Since this stock is migratory, whales likely spend at least half the year outside of the relatively small American Samoa EEZ. Therefore, the PBR allocation for U.S. waters is half of 0.8, or 0.4 whales. No human-related mortalities of humpback whales have been recorded in American Samoan waters (Carretta et al. 2013).

In April 2015, the NMFS completed a status review of humpback whales and proposed to revise the listing status by splitting the endangered species into 14 distinct population segments (DPSs) worldwide (80 FR 22304, April 21, 2015). The Central North Pacific stock would be divided into three DPSs: Hawaiʿi, Mexico, and Central America. The American Samoa stock would be part of the Oceania DPS. ESA-listings would be defined by DPS breeding population. The result would be two DPSs listed as endangered (Cape Verde Islands/Northwest Africa and Arabian Seas DPSs), two as threatened (Western North Pacific and Central America DPSs), and ten not proposed for listing (the West Indies, Hawaiʿi, Mexico, Brazil, Gabon/Southwest Africa, Southeast Africa/Madagascar, West Australia, East Australia, Oceania, and Southeastern Pacific DPSs).

All humpback whale stocks are currently listed as endangered under the ESA and depleted under the MMPA.

Distribution and habitat preferences: Humpback whales are found throughout the world's oceans where they seasonally migrate from high latitude feeding grounds to low latitude breeding and calving areas, including the Hawaiian Islands and American Samoa. They are typically found in coastal or shelf waters in summer and close to islands and reef systems in winter (Clapham 2009). Humpbacks primarily occur near the edge of the continental slope and deep submarine canyons, where upwelling concentrates zooplankton near the surface for feeding. They often feed in shipping lanes which makes them susceptible to mortality or injury from large ship strikes (Douglas et al. 2008).

As summarized in Fleming and Jackson (2011), there is a high degree of interchange of humpback whales between the principal breeding and calving areas of the Hawaiian Islands, although the extent of interchange does not simply relate to distance between islands. In the coastal waters of American Samoa, humpbacks are most common to the north and west.

While the Central North Pacific stock of humpback whales spends the boreal winters in the waters of the MHIs, humpbacks in the more southerly portions of the PIFSC research areas (e.g., American Samoa, Fagatele Bay National Marine Sanctuary) occur during the austral winter months, beginning in June. In Fagatele Bay National Marine Sanctuary, southern humpback whales mate and calve from June through September. Humpbacks arrive in American Samoa as early as June or July and remain as late as December, although they are most common during September and October (WPRFMC 2009c and citations therein).

Behavior and life history: Humpback whales are known for their spectacular aerial behaviors and the complex songs of males, the latter of which is presumably to attract females. They calve in warm tropical waters after an 11 month gestation period; calves feed independently after about 6 months. Humpback whales feed on euphausiids and various schooling fishes, including herring, capelin, sand lance, and mackerel (Clapham 2009).

Hawaiian Monk Seal

Status and trends: The best estimate of total abundance is 1,153; this estimate is based on the estimated abundance at the six main NWHI subpopulations, an extrapolation of counts at Necker and Nihoa Islands, and an estimate of minimum abundance in the MHI (Carretta et al. 2015). The minimum population size for the entire stock is 1,118 seals and 138 in the MHI. Population trends suggest a continuing decline in the Northwestern Hawaiian Islands of 3.3 percent per year (2003-2012) and an increasing trend of 6.5 percent in the MHI, as well as positive growth at Necker and Nihoa Islands (Carretta et al. 2014). Since

the Hawaiian monk seal population is well below historical levels and has, on average, declined at a rate of 3.3 percent per year since 2002, PBR is undetermined. (Carretta et al. 2014).

Fishery interactions with monk seals include direct interaction with gear and entanglement in derelict gear. In the MHIs, nearshore gillnets are a common source of mortality, with three confirmed deaths (in 2006, 2007, and 2010), and one possible death in 2010 under similar circumstances, but the carcass was not recovered (Carretta et al. 2014). Seals are also observed with embedded hooks each year. No mortality or serious injuries have been attributed to the MHI bottomfish handline fishery (Carretta et al. 2014 and citations therein). In the past, interactions between the Hawai‘i-based domestic pelagic longline fishery and monk seals were documented (Carretta et al. 2014 and citations therein). In October 1991, in response to 13 unusual seal wounds thought to have resulted from interactions with the pelagic longline fishery, NMFS established a Protected Species Zone extending 50 nm around the NWHI and the corridors between the islands; following this action, no additional monk seal interactions with the swordfish or tuna components of the longline fishery have been observed (Carretta et al. 2014).

At least 323 cases of seals entangled in fishing gear or other debris have been observed since 1982, including eight documented deaths result from entanglement in marine debris (Carretta et al. 2014 and citations therein). However, the fishing gear entangling Hawaiian monk seals only rarely includes the types used in Hawai‘i fisheries. For example, trawl net and monofilament gillnet accounted for approximately 35 percent and 34 percent, respectively, of the debris removed from reefs in the NWHI by weight, and trawl nets accounted for 88 percent of the debris by frequency (Donohue et al. 2001). However, trawl fisheries have been prohibited in Hawai‘i since the 1980s (Carretta et al. 2014). The mean estimated annual mortality and serious injury of Hawaiian monk seals due to fisheries is ≥1.0 (Carretta et al. 2015).

Distribution and habitat preferences: Hawaiian monk seals occur throughout the MHIs and the NWHI, with subpopulations at French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll, Kure Atoll, and Necker and Nihoa Islands (the southernmost islands in the NWHI), and Johnston Atoll (NMFS 2014a). Recent studies confirm a high degree of connectivity and movement within the Northwestern Hawaiian Islands and within the MHIs, as well as between the MHI and NWHI, two populations which were previously considered effectively isolated from one another (Johanos et al. 2013).

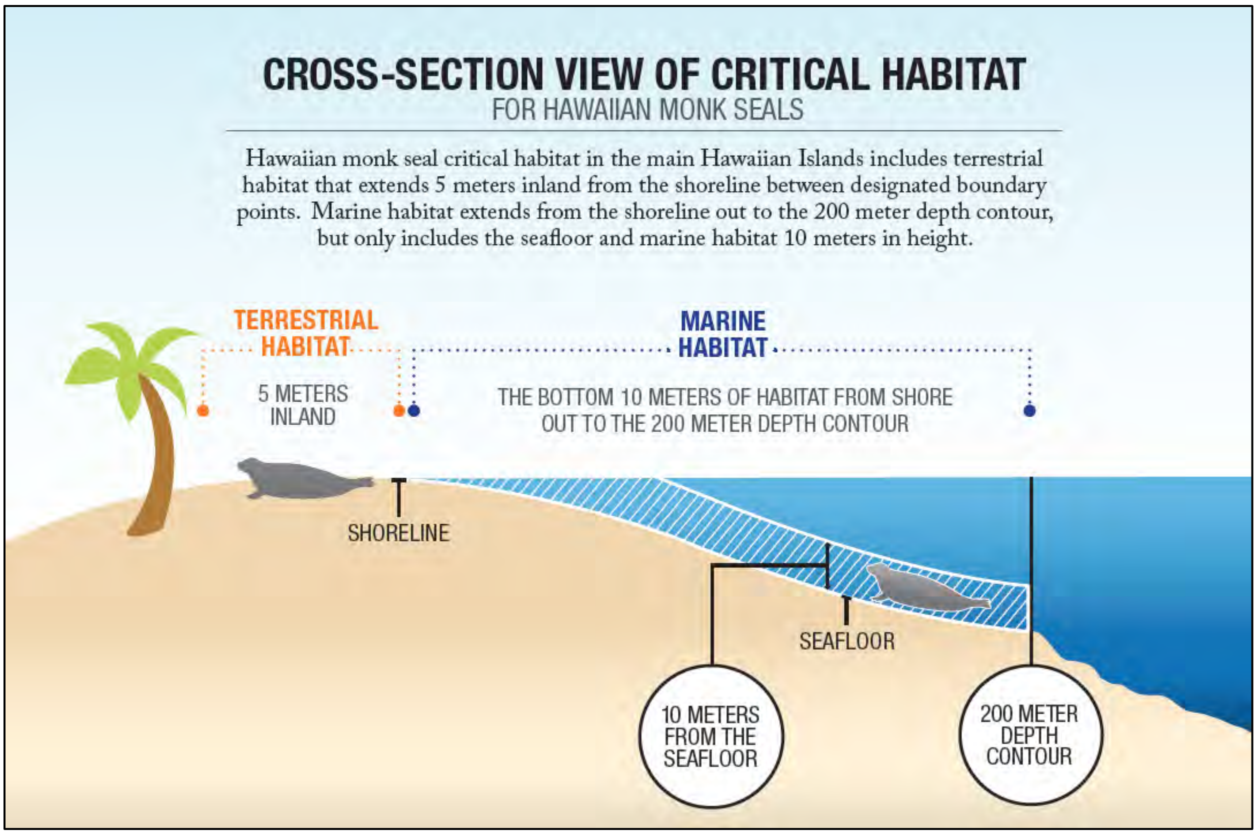
Monk seals require both marine and terrestrial environments. Although most of their time is spent in the water, monk seals haul-out on sandy beaches, rocky shores, ledges, and reefs to rest, molt, give birth, nurse, and avoid predators (NMFS 2014a). The marine environment is used for foraging, resting, thermoregulating, and socializing. Seals use submerged habitat to depths of at least 500m, including sea mounts, banks, reefs, and marine terraces, and forage at depths from one to 500m (NMFS 2014a).

In 1986, critical habitat for the Hawaiian monk seal was originally designated at all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and ocean waters out to a depth of 10 fathoms (18.3 m) around Kure Atoll, Midway Islands (except Sand Island), Pearl and Hermes Reef, Lisianski Island, Laysan Island, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island in the NWHI (51 FR 16047; April 30, 1986). In 1988, critical habitat was expanded to include Maro Reef and waters around previously designated areas out to the 20 fathom (36.6 m) isobath (53 FR 18988; May 26, 1988). On August 21, 2015 (80 FR 50925), a final rule was published in the Federal Register revising critical habitat for Hawaiian monk seals across the Hawaiian Archipelago.

The revised boundaries include 16 occupied areas within the range of the species: ten areas in the Northwestern Hawaiian Islands (NWHI) and six in the main Hawaiian Islands (MHI). These areas contain one or a combination of habitat types: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas, that will support conservation for the species. Specific areas in the NWHI include all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent

inland, lagoon waters, inner reef waters, and including marine habitat through the water's edge, including the seafloor and all subsurface waters and marine habitat within 10 meters (m) of the seafloor, out to the 200-m depth contour line around the following ten areas: Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island. Specific areas in the MHI include marine habitat from the 200-m depth contour line, including the seafloor and all subsurface waters and marine habitat within 10 m of the seafloor, through the water's edge 5 m into the terrestrial environment from the shoreline (Figure 3.2-2) between identified boundary points on the islands of: Ka'ula, Ni'ihau, Kaua'i, O'ahu, Maui Nui (including Kaho'olawe, Lāna'i, Maui, and Moloka'i), and Hawai'i. In areas where critical habitat does not extend inland, the designation ends at a line that marks mean lower low water.

Certain areas within these general boundaries were excluded from designation because they were inaccessible, lacked natural areas to support seals, presented national security benefits for exclusion, or were managed under Integrated Natural Resouce Management Plans (see 80 FR 50925). The final rule became effective September 21, 2015.



Source: http://www.fpir.noaa.gov/PRD/prd_critical_habitat.html

Figure 3.2-2 Cross-section View of Designated Critical Habitat for Hawaiian Monk Seal

Behavior and life history: Female Hawaiian monk seals become reproductively active at about 6-7 years of age, on average. Births usually occur from February to August, with a peak in April to June, but can occur at other times of the year. During lactation, female monk seals do not forage (Gilmartin and Forcada 2009). Pups wean at about six weeks of age. The life expectancy of monk seals is 25-30 years, though it is uncommon for them to live this long in the wild.

Hawaiian monk seals eat a variety of fish species ranging from reef fish to deep water fish (i.e., at depths over 1,500 feet). They also eat squid, octopus, eels, and several types of crustaceans (i.e., crabs, shrimp,

and lobsters). (Gilmartin and Forcada 2009). Recent analyses suggest that the approximately 200 monk seals in the MHIs consume about 1300 kg/day (2900 lbs/day or 15 lbs/day/seal) of prey (Sprague et al. 2013).

3.2.2.3 Non-ESA Listed Marine Mammals that Could Be Taken during PIFSC Fisheries and Ecosystem Research Activities.

Species included in this section are non-ESA listed species that could be taken by mortality/serious injury or 'Level A' harassment during the course of PIFSC fisheries research over the next five years. This includes species that have been taken in analogous commercial fisheries having vulnerabilities similar to the gears used in anticipated fisheries research, primarily studies involving longline gear, but also midwater trawls and scientific instruments deployed or anchored with lines. Detailed species descriptions and take determinations are available in Appendix C (the LOA Application) and, for the latter, in Table 4.2-7 of this DPEA.

<u>Bottlenose Dolphin (*Tursiops truncatus truncatus*) – Hawaiian Islands Stock Complex: Kaua'i/Ni'ihau Stock, O'ahu Stock, "4-Islands Region" (Moloka'i, Lāna'i, Maui, Kaho'olawe) Stock, Hawai'i Island Stock, and the Hawaiian Pelagic Stock</u>

Status and trends: As summarized in Carretta et al. (2012, and citations therein), recent photo-identification and genetic studies off O'ahu, Maui, Lāna'i, Kaua'i, Ni'ihau, and Hawai'i suggest limited movement of bottlenose dolphins between islands and into offshore waters. These data suggest the existence of demographically distinct resident populations at each of the four main Hawaiian Island groups – Kaua'i & Ni'ihau, O'ahu, the "4- Island Region" (Moloka'i, Lāna'i, Maui, Kaho'olawe), and Hawai'i. In addition, the genetic data indicate that the deeper waters surrounding the MHIs are utilized by a larger pelagic population. For the MMPA Pacific stock assessment reports, bottlenose dolphins within the Pacific U.S. EEZ are divided into seven stocks, five of which occur in the PIFSC research areas: (1) Kaua'i and Ni'ihau, (2) O'ahu, (3) the "4-Island Region" (Moloka'i, Lāna'i, Maui, Kaho'olawe), (4) Hawai'i Island and (5) the Hawaiian pelagic stock, including animals found both within the Hawaiian Islands EEZ and in adjacent international waters.

Distribution and habitat preferences: In general, bottlenose dolphins are distributed world-wide; in the North Pacific they are commonly found as far north as the southern Okhotsk Sea, Kuril Islands, and central California. Bottlenose dolphins are distributed in tropical and warm-temperate waters that range from about 10^{o} to 32^{o} C. They inhabit temperate and tropical shorelines, adapting to a variety of marine and estuarine habitats, even ranging into rivers (Wells and Scott 2009). They are primarily coastal, but do occur in pelagic waters, near oceanic islands and over the continental shelf. In many regions separate coastal and offshore populations exist and there is some evidence that these two populations occur in Hawaiian waters. As summarized in Carretta et al. (2012, and citations therein), Over 99 percent of the bottlenose dolphins are known to be part of one of the insular populations which are photo-identified around the main Hawaiian Islands (Baird et al. 2009) and have been documented in waters of 1000 m or less. Based on these data, the boundaries between the insular stocks and the Hawai'i pelagic stock have been placed along the 1000 m isobath. Since that isobath does not separate O'ahu from the 4-Islands Region, the boundary between those stocks would run approximately equidistant between the 500 m isobaths around O'ahu and the 4-Islands Region, through the middle of Kaiwi Channel.

Behavior and life history: Births have been reported from all seasons with peaks during spring-summer months. Females may give birth as late as their 48th year. The bottlenose diet consists of a large variety of fish and squid, but varies by region; although they do seem to prefer sciaenids (drums and croakers), scombrids (mackerels and tunas), and mugilids (mullets) (Wells and Scott 2009). Most fish consumed by bottlenose dolphins are bottom dwellers and sharks are probably the most important predators on bottlenose dolphins. As summarized in DON (2008a, and citations therein), dive durations as long as 15 minutes are recorded for trained individuals, but typical dives are more shallow and of a much shorter

duration. Mean dive durations of Atlantic bottlenose dolphins typically range from 20 to 40 seconds at shallow depths and can last longer than 5 minutes during deep offshore dives. Offshore bottlenose dolphins regularly dive to 450 m and possibly as deep as 700 m.

Blainville's Beaked Whale (*Mesoplodon densirostris*) - Hawai‘i Stock

Status and trends: A 2010 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 2,338 for the Hawai‘i stock of Blainville’s beaked whales (Bradford et al. 2013). The minimum population estimate is 1,088 whales within the Hawaiian Islands EEZ; the calculated PBR is 11 whales per year (Carretta et al. 2015, Bradford et al. 2013, Barlow 2006).

Blainville's beaked whales are not listed as depleted or strategic under the MMPA. Information on fishery-related mortality of cetaceans in Hawaiian waters is limited, but gear types used in Hawaiian fisheries are responsible for marine mammal mortality and serious injury in other fisheries throughout U.S. waters. From 2007 to 2011, no Blainville’s beaked whales were observed killed or seriously injured within the Hawaiian EEZ in the shallow-set longline (SSLL) fishery (with 100 percent observer coverage) or the DSLL fishery (20-22 percent observer coverage) (Bradford & Forney 2013, Carretta et al. 2014 and citations therein). However, one Blainville’s beaked whale was observed taken, but not seriously injured, in the SSLL fishery and one unidentified Mesoplodont whale and one unidentified beaked whale were taken in the SSLL fishery and both were considered to be seriously injured (Bradford & Forney 2013). Average mortality and serious injury for 2007-2011 are zero Blainville’s beaked whales within or outside of the U.S. EEZs, and 0.4 Mesoplodont or unidentified beaked whales outside the U.S. EEZs (Carretta et al. 2014).

Distribution and habitat preferences: Blainville's beaked whales have a cosmopolitan distribution in tropical and temperate waters; apparently, they have the most extensive known distribution of any Mesoplodon species (Mead 1989). Analysis of Blainville’s beaked whale resighting and movement data near the MHIs suggest the existence of an insular and offshore (pelagic) population of this species in Hawaiian waters and a division of an additional island-associated stock may be warranted in the future (Carretta et al. 2014 and citations therein). They prefer deep water with mean and maximum depths of 3.5 km and 5.75 km, respectively, that ranges from well-mixed to stratified (Ferguson et al. 2006). They were sighted 1000 km offshore, on average, but distance from shore ranged from 40 to over 3,700 km (Ferguson et al. 2006).

Behavior and life history: Blainville's beaked whales are usually found individually or in small social groups averaging between 3-7 individuals, but have been occasionally seen in larger groups of up to 12 animals. Groups may consist of various combinations and/or be segregated depending on age or sex. Adult populations in productive waters over the continental shelf (like the Bahamas) may be grouped in harems and consist of several adult females with a single adult mature male (Jefferson et al. 2008). Males commonly battle over access to females, which is probably the cause of the long linear scars seen on individuals.

Cuvier’s Beaked Whale (*Ziphius cavirostris*) Hawaiian Pelagic Stock

Status and trends: Previous abundance estimates for this species of beaked whale have been imprecise and biased downward by an unknown amount because of the large proportion of time this species spends submerged. Wade and Gerrodette (1993) made an estimate for Cuvier's beaked whales in the Eastern Tropical Pacific (ETP), but it is not known whether any of these animals are part of the same population that occurs around the Hawaiian Islands. In 2010, a shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 1,941 Cuvier’s beaked whales (Bradford et al. 2013), including a correction factor for missed diving animals. This is currently the best available abundance estimate for this stock. The minimum population estimate is 1,142 whales within the Hawaiian Islands

EEZ with a calculated PBR of 11.4 whales per year. Cuvier's beaked whales are not listed as depleted or strategic under the MMPA.

Distribution and habitat preferences: Cuvier's beaked whales are distributed in all oceans and seas except the high polar regions. Cuvier's beaked whales are generally sighted in waters >200 m deep, and are frequently recorded at depths >1,000 m; they are commonly sighted around seamounts, escarpments, and canyons (Heyning and Mead 2009). In Hawai'i, a study of Cuvier's beaked whales spanning 21 years showed a high degree of site fidelity and showed that there was an offshore population and an island associated population (McSweeney et al. 2007). The site fidelity in the island associated population was hypothesized to take advantage of the influence of islands on oceanographic conditions that may increase productivity (McSweeney et al. 2007). Waters deeper than 1,000 m are the area of highest utilization for the Cuvier's beaked whale in the Northeast Pacific, while water depths between 500 m and 1,000 m are less utilized. Occurrence in waters shallower than 500 m is rare (DON 2008b).

Behavior and life history: Little is known of the feeding preferences of Cuvier's beaked whales. They may be midwater and bottom feeders on cephalopods and, rarely, fish. There is little information on beaked whale reproductive behavior. Recent studies by Baird et al. (2006) show that Cuvier's beaked whales dive deeply (maximum of 1,450 m) and for long periods (maximum dive duration of 68.7 min), but also spent time at shallow depths. Tyack et al. (2006) has also reported deep diving for Cuvier's beaked whales with a mean depth of 1,070 m and mean duration of 58 min.

Dwarf Sperm Whale (*Kogia sima*) -Hawai'i Stock

Status and trends: The Hawai'i stock of dwarf sperm whales includes animals found both within the Hawaiian Islands EEZ and in adjacent international waters; however, because data on abundance, distribution, and human-caused impacts are largely lacking for international waters, the status of this stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands. Baird (2005) reports that dwarf sperm whales are the sixth most commonly sighted odontocete around the MHIs. This species' small size, tendency to avoid vessels, deep-diving habits, combined with the high proportion of Kogia sightings that are not identified to the species level, may result in negatively biased relative abundances in this region. There were no on-effort sightings of dwarf sperm whales during the 2010 shipboard survey of the Hawaiian EEZ (Bradford et al. 2013, Carretta et al. 2014), hence there is no current abundance estimate for this stock and therefore no minimum population estimate or PBR (Carretta et al. 2014). There have been no recent records of fishery-related mortality or serious injuries within the Hawaiian Islands EEZ for this stock.

Distribution and habitat preferences: Dwarf sperm whales have a worldwide distribution in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans (McAlpine 2009).

Behavior and life history: As summarized in DON (2008b, and citations therein) pygmy and dwarf sperm whales likely prey on fish and invertebrates that feed on the zooplankton in tropical and temperate waters. There is no information regarding the breeding behavior of either species. Kogia feed on cephalopods and, less often, on deep-sea fishes and shrimps. Kogia make dives of up to 25 min and median dive times of around 11 minutes have been documented. A satellite-tagged pygmy sperm whale released off Florida was found to make long nighttime dives, presumably indicating foraging on squid in the deep scattering layer (Scott et al. 2001). Most sightings are brief; these whales are often difficult to approach and they may actively avoid aircraft and vessels.

Pygmy Sperm Whale (*Kogia breviceps*) – Hawai'i Stock

Status and trends: A 2010 shipboard line-transect survey within the Hawaiian EEZ did not result in any sightings of pygmy sperm whales (Bradford et al. 2013), hence no minimum estimate of abundance is available for pygmy sperm whales and PBR is undetermined.

Distribution and habitat preferences: Pygmy sperm whales are found throughout the world in tropical and warm-temperate waters (Caldwell and Caldwell 1989). Pygmy sperm whales have been observed in nearshore waters off O‘ahu, Maui, Ni‘ihau, and Hawai‘i Island (Shallenberger 1981, Mobley et al. 2000, Baird 2005, Baird et al. 2013). Nothing is known about stock structure for this species.

Pygmy sperm whales have a worldwide distribution in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans (McAlpine 2009). Pygmy sperm whales are sighted primarily along the continental shelf edge and over deeper waters off the shelf. However, along the U.S. west coast, sightings of the whales have been rare, although that is likely a reflection of their pelagic distribution and small size rather than their true abundance (Carretta et al. 2012). Several studies have suggested that pygmy sperm whales live mostly beyond the continental shelf edge.

Behavior and life history: See summary for Kogia in the dwarf sperm whale account above.

False Killer Whale (*Pseudorca crassidens*) – Hawaiian Islands Stock Complex: Hawai‘i Insular, Hawai‘i Pelagic, Northwestern Hawaiian Islands, Palmyra Atoll, and American Samoa Stocks

Status and trends: There are currently five recognized Pacific Islands Region management stocks of false killer whales: 1) the MHI insular stock includes animals within 72 km (approx. 38.9 nm) of the MHI, (discussed in Section 3.2.2.2, so will not be discussed further in this section) 2) the Northwestern Hawaiian Islands stock includes animals within the NWHI and a 50 nm radius around Kaua‘i, 3) the Hawai‘i pelagic stock includes animals in waters more than 11 km (5.9 nm) from the MHI, 4) the Palmyra Atoll stock includes animals within the U.S. EEZ of Palmyra Atoll, and 5) the American Samoa stock includes animals within the U.S. EEZ of American Samoa (Carretta et al. 2014, Carretta et al. 2013).

PIFSC is requesting takes for the Hawai‘i pelagic stock of false killer whales and animals on the high seas that may not have a specified stock status. The Hawai‘i pelagic stock of false killer whales has a minimum population estimate of 935 animals and a PBR of 9.4 whales per year (Carretta et al. 2015). The minimum abundance estimate has not been corrected for vessel attraction and may be an over-estimate of minimum population size. The average annual rate of fishery-related mortality and serious injury to false killer whales within the Hawaiian Islands EEZ is 13.0 whales per year, which exceeds PBR. This stock is therefore considered a strategic stock under the MMPA and subject to efforts to reduce incidental take of the stock in fisheries.

The False Killer Whale Take Reduction Plan (FKWTRP) was finalized in 2012 to reduce the level of mortality and serious injury of false killer whales in Hawai‘i-based longline fisheries for tuna and billfish (77 FR 71260). Regulatory measures in the FKWTRP include gear requirements, prohibited areas, training and certification in marine mammal handling and release, and posting of NMFS-approved placards on longline vessels. PIFSC does not conduct fisheries and ecosystem research with longline gear within any of the exclusion zones established by the FKWTRP.

Distribution and habitat preferences: False killer whales are found worldwide in tropical and warm temperate oceans and, occasionally, in cold temperate waters. They are typically pelagic, yet also occur near to shore and in shallow waters around oceanic islands (Baird 2009a).

Behavior and life history: Males and females show strong fidelity to natal social groups. Mating occurs within and between social groups, which could lead to inbreeding depression and further impact this species (Martien et al. 2011). False killer whales in Hawai‘i largely feed on fish found primarily at the surface, but may also bring prey up from depth. Seven of the ten species of pelagic fish documented as prey of false killer whales from the MHI insular stock are harvested commercially: yellowfin tuna (*Thunnus albacares*), albacore tuna (*T. alalunga*), skipjack tuna (*Katsuwonus pelamis*), broadbill swordfish (*Xiphias gladius*), dolphin fish (or mahimahi, *Coryphaena hippurus*), wahoo (or ono, *Acanthocybium solandri*), and lustrous pomfret (or monchong, *Eumegistus illustrus*) (Baird 2009b).

Pantropical Spotted Dolphin (*Stenella attenuata attenuata*) - Hawaiian Islands Stock Complex: Oʻahu, 4-Islands, Hawaiʻi Island, and Hawaiʻi Pelagic Stocks

Status and trends: There are four recognized management stocks of pantropical spotted dolphins within the Hawaiian Islands EEZ and in adjacent international waters: the Oʻahu stock, which includes spotted dolphins within 20 km of Oʻahu; the 4-Island stock, which includes spotted dolphins within 20 km of Maui, Molokaʻi, Lānaʻi, and Kahoʻolawe , collectively; the Hawaiʻi Island stock, which includes spotted dolphins found within 65 km from Hawaiʻi Island; and the Hawaiʻi pelagic stock, which includes animals inhabiting the waters throughout the Hawaiian Islands EEZ, outside of the insular stock areas, but including adjacent high seas waters (Carretta et al. 2014, Oleson et al. 2013). Fishery interactions with pantropical spotted dolphins demonstrate that this species also occurs in U.S. EEZ waters around Palmyra Island, but it is not known whether these animals are part of the Hawaiian stock or a separate stock of pantropical spotted dolphins. Minimum population estimates are only available for the Hawaiʻi pelagic stock, which has an estimated 11,508 dolphins with a calculated PBR of 115 animals. There are no recent records of fishery-related mortality or serious injury (Carretta et al. 2015).

Distribution and habitat preferences: Pantropical spotted dolphins are primarily found in tropical and subtropical waters worldwide (Perrin et al. 2009). Much of what is known about the species in the North Pacific has been learned from specimens obtained in the large directed harvest in Japan and in the ETP tuna purse-seine fishery (Perrin et al. 2009). Spotted dolphins are common and abundant throughout the Hawaiian archipelago, including nearshore where they are the second most frequently sighted species during nearshore surveys (Baird et al. 2013).

Behavior and life history: Pantropical spotted dolphins often occur in large multi-species schools, particularly with spinner dolphins (Perrin 2009b). In 2006, >50 percent of the offshore spotted dolphins recorded were in mixed species schools (Jackson et al. 2008). School size ranges from a few hundred to several thousand, with mean school size of 120 in the ETP (Perrin 2009b).

Pygmy Killer Whale (*Feresa attenuata*) – Hawaiian Stock

Status and trends: A 2010 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 3,433 pygmy killer whales (Bradford et al. 2013). This is currently the best available abundance estimate for this stock. The minimum population estimate for this stock is 2,274 pygmy killer whales within the Hawaiian EEZ. No data are available on current population trend and the calculated PBR is 23 pygmy killer whales.

Distribution and habitat preferences: Pygmy killer whales occur in tropical and subtropical waters worldwide (Donahue and Perryman 2009). Sightings are more common in warmer coastal waters near to Central America than offshore (Hamilton et al. 2009; Wade and Gerrodette 1993). As summarized in Carretta et al. (2014, 2012 and citations therein), most knowledge of this species in Hawaiian waters is from stranded or live-captured specimens. Several recent studies suggest that while relatively rare in Hawaiian waters, a small resident population of pygmy killer whales reside in the MHIs (Carretta et al. 2014). A 22 year study off the island of Hawaiʻi indicates a year round and stable social group of pygmy killer whales, such that division of this population into a separate island-associated stock may be warranted in the future (Carretta et al. 2014).

Behavior and life history: Pygmy killer whales are generally in small schools of 12-50 animals, although larger schools have been observed. They are known to bow ride. Pygmy killer whale life history and feeding behavior is poorly understood. Remains of cephalopods and small fish have been found in stomachs of stranded and incidentally caught individuals.

Rough-Toothed Dolphin (*Steno bredanensis*) - Hawaiʽi Stock

Status and trends: Global estimates of abundance are lacking for this species and little is known about rough-toothed dolphin population or stock structure. However, preliminary results of genetic studies of individuals sampled from Kaua‘i/Ni‘ihau and Hawai‘i Island, together with resight data, suggest there may be at least two island-associated stocks of rough-toothed dolphins in the MHIs (Oleson et al. 2013; Jefferson 2009b).

The 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 6,288 rough-toothed dolphins (Bradford et al. 2013). This is currently the best available abundance estimate for this stock. The minimum population size is calculated as 4,581 for the Hawaiʽi stock with a PBR of 46 rough-toothed dolphins per year. Fishery interactions are not known.

Distribution and habitat preferences: Rough-toothed dolphins are a tropical to warm temperate species found in oceanic waters worldwide, as well as over continental shelf and coastal waters in some areas (Jefferson 2009b; May-Collado 2005). They are present around all the MHIs, though they are uncommon near Maui and the 4-Islands region (Baird et al. 2013) and have been observed close to the islands and atolls at least as far northwest as Pearl and Hermes Atoll (Bradford et al. 2013). Rough-toothed dolphins have occasionally been seen offshore throughout the EEZ of the Hawaiian Islands (Barlow 2006, Bradford et al. 2013).

Behavior and life history: Rough-toothed dolphins commonly occur in mixed schools with other delphinids and have been observed associating with flotsam (Jefferson 2009b). School size is variable, but commonly in the range of 10-20 (Jefferson 2009b). Rough-toothed dolphins feed on a variety of fish and cephalopods, and may take some large fish (Jefferson 2009b). The maximum recorded dive is 70 m. Rough-toothed dolphins, however, appear well adapted for deeper dives (Jefferson 2009b). The only life history information available is from Japan, where males reach sexual maturity at about 14 years of age and females at about 10 years old. The maximum recorded age was 32-36 years (Jefferson 2009b).

Risso's Dolphin (*Grampus griseus*) - Hawaiʽi Stock

Status and trends: The Hawaiʽi stock includes animals found both within the Hawaiian Islands EEZ and in adjacent international waters; however, because data on abundance, distribution, and human caused impacts are largely lacking for international waters, the status of this stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands. The 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 7,256 Risso's dolphins (Bradford et al. 2013); this is currently the best available abundance estimate for this stock. The minimum population estimate is 5,207 with a PBR of 42 Risso's dolphins. The average annual fisheries-related mortalities and serious injuries are 0.6 animals per year (Carretta et al. 2015).

Distribution and habitat preferences: Risso's dolphins are distributed world-wide in tropical and warm-temperate waters. They seem to prefer steep edged habitat between 400 and 1000 m deep. In the North Pacific, they can be found as far north as the Gulf of Alaska and the Kamchatka Peninsula and south to Tierra del Fuego and New Zealand (Baird 2009a).

Behavior and life history: As summarized in Baird (2009a, and citations therein), Risso's dolphins are relatively gregarious, typically travelling in groups of 10-50 individuals; the largest group reported had over 4,000 individuals. They have been observed "bow riding" and generally harassing gray whales and are often seen surfing in swells. Gestation is 13-14 months and calving intervals are about 2.4 years with peak calving during winter in the eastern North Pacific. Sexual maturity for females is thought to be 8-10 years of age and males 10-12 years of age. They feed almost exclusively on squid, likely at night (Baird 2009a).

Short-Finned Pilot Whale (*Globicephala macrorhynchus*) - Hawaiʻi Stock

Status and trends: The 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 12,422 short-finned pilot whales (Bradford et al. 2013). This is currently the best available abundance estimate for short-finned pilot whales within the Hawaiian Islands EEZ. The minimum population size is estimated as 8,782 short-finned pilot whales, resulting in a PBR of 70.

Distribution and habitat preferences: The short-finned pilot whale is found in tropical to warm-temperate seas; they are commonly observed around the MHIs and are also present around the NWHIs (Shallenberger 1981, Barlow 2006, Baird et al. 2013, Bradford et al. 2013). Worldwide, pilot whales usually are found over the continental shelf break, in slope waters, and in areas of high topographic relief, but movements over the continental shelf and close to shore at oceanic islands can occur (Carretta et al. 2014).

Behavior and life history: Pilot whales are very social and may travel in groups of several to hundreds of animals, often with other cetaceans. They appear to live in relatively stable, female-based groups (DON 2008b). Sexual maturity occurs at 9 years for females and 17 years for males. The mean calving interval is 4 to 6 years. Pilot whales are deep divers; the maximum dive depth measured is about 971 m (Baird et al. 2002). Short-finned pilot whales feed on squid and fish. Stomach content analysis of pilot whales in the Southern California Bight consisted entirely of cephalopod remains. The most common prey item identified was *Loligo opalescens*, which has been documented in spawning concentrations at depths of 20-55 m.

Striped Dolphin (*Stenella coeruleoalba*) - Hawaiian Stock

Status and trends: Striped dolphins within the Pacific U.S. EEZ are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington, and 2) waters around Hawai‘i, including animals found both within the Hawaiian Islands EEZ and in adjacent international waters (Carretta et al. 2014). The abundance of striped dolphins in this region appears to be variable between years and may be affected by oceanographic conditions. The 2010 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 20,650 striped dolphins (Bradford et al. 2013). This is currently the best available abundance estimate for this stock. The minimum population estimate is 15,391 striped dolphins with a PBR of 154 dolphins. Fishery interactions are not known.

Distribution and habitat preferences: Striped dolphins are found in tropical to warm-temperate waters throughout the world (Perrin et al. 2009). In the Hawai‘i region, sightings have historically been infrequent in nearshore waters (Carretta et al. 2014 and references therein). Striped dolphins are usually found beyond the continental shelf, typically over the continental slope out to oceanic waters and are often associated with convergence zones and waters influenced by upwelling.

Behavior and life history: As summarized from Archer (2009, and references therein), mating is seasonal and gestation lasts 12-13 months. Females become sexually mature between 5 and 13 years of age and males mature between 7 and 15 years of age. Striped dolphins are acrobatic and perform a variety of aerial behaviors but they do not commonly bow ride. They often feed in pelagic or benthopelagic zones along the continental slope or just beyond it in oceanic waters. The species feeds on a variety of pelagic and benthopelagic fish and squid. A majority of their prey possesses luminescent organs, suggesting that striped dolphins may be feeding at great depths, possibly diving to 200 to 700 m to reach potential prey. Striped dolphins may feed at night in order to take advantage of the deep scattering layer's diurnal vertical movements (Archer 2009).

Spinner dolphin (*Stenella longirostris)*

Status and trends: For the MMPA stock assessment reports, there are seven stocks of spinner dolphins found within the PIFSC fisheries research areas: 1) Hawai‘i Island, 2) O‘ahu/4-Islands, 3) Kaua‘i/Ni‘ihau,

4) Pearl and Hermes Atoll, 5) Kure/Midway, 6) Hawai‘i pelagic, including animals found both within the Hawaiian Islands EEZ (outside of island-associated boundaries) and in adjacent international waters, and 7) the American Samoa stock, which includes animals inhabiting the EEZ waters around American Samoa. Minimum abundance estimates and PBR are only available for the Hawai‘i Island stock (585 dolphins with PBR of 5.9 animals) and the O‘ahu/4-Islands stock (329 dolphins with PBR of 3.3 animals). Recent fishery interactions are not known. However, there is no systematic monitoring of nearshore fisheries that may take animals from both island-associated and pelagic regions of the stock complex.

Distribution and habitat preferences: Spinner dolphins occur in all tropical and most sub-tropical waters between 30-40^{o} N and 20-40^{o} S latitude; generally, in areas with a shallow mixed layer, shallow and steep thermocline, and little variation in surface temperatures (Perrin 2009a). Within the central and western Pacific, spinner dolphins are island-associated and use shallow protected bays to rest and socialize during the day then move offshore at night to feed. They are common and abundant throughout the entire Hawaiian archipelago (Carretta et al. 2012, and citations therein).

Behavior and life history: The most conspicuous behavior of the spinner dolphin – the spinning for which the species is named – is a mystery. Theories as to why spinners spin include communication, play, and dislodging remoras (Perrin 2009a). School size varies from a few animals to over a thousand. Mixed schools with other species, particularly pantropical spotted dolphins, are common (Perrin 2009a). Mating appears to be promiscuous. Gestation is about 10 months and breeding is seasonal. Females reach sexual maturity at 4-7 years, and males at 7-10 years. Calving interval is 3 years and calves nurse for 1-2 years (Perrin 2009a).

3.2.3 Birds

Numerous bird species occur within the PIFSC research areas. This section of the DPEA provides baseline information for species important to the analysis of effects in Chapter 4, including ESA-listed bird species and others which may potentially interact with research vessels and gear.

3.2.3.1 Threatened and Endangered Species

The ESA allows the USFWS to list bird species as endangered or threatened regardless of which country the species lives in. Although greater legal protections are given to ESA-listed species within the U.S. EEZ, the law also provides protection to listed species wherever they occur from potentially adverse interactions with people and entities subject to U.S. jurisdiction, such as PIFSC and its researchers. Table 3.2-4 identifies the ESA-listed species that may interact with marine fisheries and ecosystem research activities and their occurrence within the four PIFSC research areas: HARA, MARA, ASARA, and WCPRA. There are numerous other listed species that occur in these areas that are primarily terrestrial (see http://www.fws.gov/pacificislands/teslist.html) and unlikely to interact with PIFSC fisheries and ecosystem research activities.

Table 3.2-4 ESA-listed Seabirds Occurring in the PIFSC Research Areas

Species		HARA	MARA	ASARA	WCPRA	Federal ESA Status
Common Name	**Scientific Name**					
Short-tailed albatross	*Phoebastria albatrus*	X			X	Endangered
Hawaiian dark-rumped petrel	*Pterodroma sandwichensis*	X				Endangered
Newell’s shearwater	*Puffinus auricularis newelli*	X	X	X	X	Threatened

Short-tailed Albatross

The short-tailed albatross is the largest of the three albatross species found in the North Pacific Ocean. The species used to be the most abundant albatross in the North Pacific but was almost exterminated by feather and meat hunters on its Japanese breeding grounds in the early 1900s. The short-tailed albatross was listed as endangered by the USFWS in 2000 and a Final Recovery Plan was published in 2008 (USFWS 2008). Conservation efforts have helped the population grow at near-maximum rates but the total population is still less than 3000 birds (USFWS 2009a). In January 2014 a short-tailed albatross chick hatched on Midway Atoll; only the third hatching in recorded history on any place other than two small islands near Japan (USFWS 2014a). Major threats to this species include natural threats to their nesting habitat on volcanic islands, mortality in longline fisheries, and ingestion of plastic debris (USFWS 2008).

Hawaiian Dark-rumped Petrel

The Hawaiian dark-rumped petrel occurs in the central subtropical Pacific and nests only in the Hawaiian Islands. This species was listed as an endangered species by the USFWS in 1967 due to its limited distribution and the marginal status of known breeding populations. The Hawaiian dark-rumped petrel and Newell's shearwater recovery plan was finalized in 1983 (USFWS 1983). Major threats to this species include attraction to and disorientation by artificial lights leading to exhausted birds landing in dangerous situations and colliding with power lines and other structures, habitat destruction, and predation by non-native terrestrial mammals (USFWS 2011a).

Newell's Shearwater

Newell's shearwaters occur in the central subtropical Pacific and breed exclusively in the Hawaiian Islands (Ainley at al. 1997). This species was listed as threatened in 1982 due to limited distribution and the marginal status of known breeding populations (USFWS 1983). Major threats to this species include predation on nesting grounds by non-native terrestrial mammals, human disturbance, destruction of nesting habitat, and attraction to artificial light. The Newell's Shearwater depends on tuna to force prey within its reach. These tuna are targeted in commercial fisheries which decrease their abundance and cause foraging shearwaters to exert more energy to find schools of tuna (Ainley et al. 1997).

3.2.3.2 Other Bird Species

There are many seabird species that occur in the four PIFSC fisheries research areas which may potentially interact with research vessels and gear. However, birds have never been caught incidentally in PIFSC fisheries surveys. The following accounts describe conservation concerns for seabirds in each of the four PIFSC research areas. Table 3.2-5 gives an overview of the marine bird communities found within the research areas.

Hawaiian Archipelago

Threats to seabirds in the Hawaiian Archipelago include: urban development and habitat loss, introduced species (cats, dogs, rats, and mongoose), longline fishery, oil spills, contaminants, physical and chemical effects of plastics, global warming and sea level rise. Longline fisheries can be a serious threat to seabird populations worldwide, and particularly affect surface-feeding albatrosses while the gear is being set. The pelagic longline fishery in Hawai‘i targets tuna, billfish, oceanic sharks and swordfish, and has killed approximately 1000-3000 each of Laysan and black-footed albatrosses annually from 1994 to 1998 (USFWS 2005). Seabird mortality decreased while swordfish fishing was banned in 2001-2004. Mitigation measures to protect seabirds and sea turtles are now required on Hawaiian based longline

vessels. Recent mitigation measures include shorter leaders that place weighted swivels closer to hooks, reducing the likelihood of baited hooks becoming available to surface-scavenging albatrosses (Gilman et al. 2014).

On Midway Atoll, Laysan and black-footed albatrosses are exposed to lead contamination, from lead-based paint that has flaked off of deteriorating buildings and contaminated the soil. Chicks ingest the contaminated soil and paint chips causing lead contamination and poor fledgling success. Midway Atoll supports the world's largest Laysan albatross colony (TenBruggencate 2006, USFWS 2005). The hook-and-line troll fishery can also cause seabirds to become entangled in gear. Feral cats and the Indian mongoose are present on most of the main Hawaiian Islands and have been implicated in the near extinction of the Hawaiian dark-rumped petrel and the Newell's Shearwater (USFWS 2005).

Mariana Archipelago

Major threats to seabirds in this research area include: longline fishery, introduced species (rats, monitor lizard, and brown tree snake), oil pollution, global warming and sea level rise. Oil spills in this area have been originating from vessels that sank during WWII (USFWS 2005).

American Samoa Archipelago

Threats to seabirds in the American Samoa Archipelago include introduced species (cats and rats), longline fishery, global warming and sea level rise. Since 1995, the pelagic longline fishery replaced most of the troll-based fishery in American Samoa (USFWS 2005).

Pacific Remote Islands

Threats to seabirds on the Pacific Remote Islands include: introduced species (cats and rats), contamination, global warming, exposure and ingestion of marine debris (e.g., nets, monofilament, plastic) and sea level rise. On Jarvis Island, cats were responsible for killing an estimated 24,000 seabirds each year, and only four breeding species remained by the time that cats were eradicated from the island (USFWS 2005). In 2011, the USFWS implemented a rat eradication project on Palmyra Atoll (USFWS 2011b). Cats and rats have now been completely eradicated from most of the Pacific Remote Islands. Seabirds in the Pacific Remote Islands are at risk from various contaminants from historic military operations (USFWS 2005).

Table 3.2-5 Other Bird Species Occurring in the PIFSC Research Areas

Species	Scientific Name	HARA	MARA	ASARA	WCPRA
Black-footed albatross	*Phoebastria nigripes*	X			X
Laysan albatross	*Phoebastria immutabilis*	X			X
Wedge-tailed shearwater	*Puffinus pacificus*	X	X	X	X
Audubon's shearwater	*Puffinus lherminieri*		V	X	
Christmas shearwater	*Puffinus nativitatis*	X		X	X
Flesh-footed shearwater	*Puffinus carneipes*	X			
Sooty shearwater	*Puffinus griseus*	X			
Bonin petrel	*Pterodroma hypoleuca*	X			
Bulwer's petrel	*Bulwera bulwerii*	X			
Tahiti petrel	*Pseudobulweria rostrata*	V		X	
Herald petrel	*Pterodroma heraldica*	V		X	

Species	Scientific Name	HARA	MARA	ASARA	WCPRA
Collared petrel	*Pterodroma brevipes*			X	
Mottled petrel	*Pterodroma inexpectata*	X		V	
Phoenix petrel	*Pterodroma alba*			V	
Petrels	*Pseudobulweria* spp., *Pterodroma* spp.				X
Leach's storm-petrel	*Oceanodroma leucorhoa*	X	V		
Matsudaira's storm-petrel	*Oceanodroma matsudairae*		V		
Tristrams storm petrel	*Oceanodroma tristrami*	X			
White-bellied storm-petrel	*Fregetta grallaria*			V	
Polynesian storm-petrel	*Nesofregetta fuliginosa*			V	
Red-footed booby	*Sula sula*	X	X	X	X
Brown booby	*Sula leucogaster*	X	X	X	X
Masked booby	*Sula dactylatra*	X	X	X	X
White-tailed tropicbird	*Phaethon lepturus*	X	X	X	X
Red-tailed tropicbird	*Phaethon rubricauda*	X	X	X	X
Great frigatebird	*Fregata minor*	X	X	X	X
Lesser frigatebird	*Fregata ariel*	X		X	X
Common fairy-tern (white tern)	*Gygis alba*	X	X	X	X
Little tern	*Sternula albifrons*	X			
Spectacled tern	*Onychoprion lunatus*	X			
Sooty tern	*Sterna fuscata*	X	X	X	X
Black-naped tern	*Sterna sumatrana*			V	
Brown noddy	*Anous stolidus*	X	X	X	X
Black noddy	*Anous minutus*	X	X	X	X
Blue-gray noddy	*Procelsterna cerulea*	X		X	
Laughing gull	*Larus atricilla*	X		V	

Notes:
V = Visitor

3.2.4 Sea Turtles

Five species of sea turtles occur within the PIFSC research areas: green, hawksbill, leatherback, loggerhead, and olive ridley sea turtles (See Table 3.2-6). The two most common species found in the nearshore environment in the Pacific Islands Region are green and hawksbill sea turtles. PIFSC research activities cover an extremely large area, much of which is uninhabited, so while there are not documented sightings for all life stages and associated size classes, it is likely that they occur within the PIFSC research areas.

Table 3.2-6 Occurrences of Marine Turtles in the Four PIFSC Research Areas

Species	HARA	MARA	ASARA	WCPRA
Green sea turtle	N	N	N	N
Hawksbill sea turtle	N	N	N	X
Leatherback sea turtle	X	X	X	-
Loggerhead sea turtle	X	-	-	-
Olive ridley sea turtle	X	-	X	-

N - Nesting occurs within this research area.

Notes: This table shows the documented occurrences of marine turtles in the respective research areas. It is possible that leatherback, loggerhead, and olive ridley sea turtles occur in the Pacific Remote Islands, but since the area is remote and uninhabited, those occurrences have not been documented, so are not shown here.

Additional background information on the range-wide status of these species has been published in a number of documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995, Hirth 1997), as well as recovery plans for the green sea turtle (NMFS and USFWS 1998a), hawksbill sea turtle (NMFS and USFWS 1998b), leatherback sea turtle (NMFS and USFWS 1998c), loggerhead sea turtle (NMFS and USFWS 1998d), and olive ridley sea turtle (NMFS and USFWS 1998e).

3.2.4.1 Threatened and Endangered Species

All of the sea turtles found in the area of the PIFSC research activities are listed as threatened or endangered under the federal ESA. The following sections describe these species and their occurrences in each of the PIFSC research areas.

Table 3.2-7 ESA-listed Sea Turtles found within the PIFSC Research Areas

Common Name	Scientific Name	Status
Green sea turtle	*Chelonia mydas*	Threatened
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Endangered[2]
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened

Notes:

1. Central North Pacific DPS in the HARA, Central West Pacific DPS in the MARA, and Central South Pacific DPS in the ASARA
2. North Pacific Ocean DPS (north of the equator and south of 60° north latitude) and South Pacific Ocean DPS (south of the equator, north of 60° south latitude, west of 67° west longitude, and east of 141° east longitude)

<u>Green Sea Turtle</u>

Green sea turtles (*Chelonia mydas*) are a circumglobal and highly migratory species, nesting and feeding in tropical and subtropical regions with a preference for water temperatures above 20°C (68°F) (WPRFMC 2009a). Eleven green sea turtle DPSs have been proposed for listing to replace the species-wide listing (80 FR 15271). PIFSC research areas are within three different DPSs: the Central North

Pacific DPS in the HARA, the Central West Pacific DPS in the MARA, and the Central South Pacific DPS in the ASARA.

The life cycle of the green sea turtle involves a series of long-distance migrations to and from their feeding and nesting areas (Craig 2002). Green sea turtles often return to the same foraging areas following subsequent nesting migrations, then move within specific areas or home ranges where they seek out specific habitats for foraging and resting. However, some green sea turtles remain in the open-ocean environment for extended periods of time and may never recruit to coastal foraging locations (NMFS and USFWS 2007a).

Mortality related to commercial fishing accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities such as dredging, pollution, and habitat destruction account for an unknown level of other mortality. Removal of green sea turtles has been recorded by sea sampling coverage in the pelagic driftnet, pelagic longline, sea scallop dredge, southeast shrimp trawl, and summer flounder bottom trawl fisheries (WPRFMC 2009a).

Green Sea Turtles in the HARA

Green sea turtles are known in Hawaiian as *honu*. In the Pacific, the only major (> 2,000 nesting females) populations of green turtles occur in Australia and Malaysia. Smaller colonies occur in the insular Pacific islands of Polynesia, Micronesia, and Melanesia (Wetherall 1993) and on six small sand islands at French Frigate Shoals, a long atoll situated in the middle of the Hawai‘i Archipelago (Balazs et al. 1994). Approximately 90-95 percent of the nesting and breeding activity in the HARA occurs at the French Frigate Shoals, and at least 50 percent of that nesting takes place on East Island. Long-term monitoring studies suggest that there is strong island fidelity within the regional rookery. Low-level nesting also occurs at Laysan Island, Lisianski Island, and on Pearl and Hermes Atoll (NMFS and USFWS 1998a).

The nesting population of Hawaiian green turtles has gradually increased following the establishment of the ESA in 1973 (Balazs 1996; Balazs and Chaloupka 2004). Between 1973 and 1977, the mean annual nesting abundance of green sea turtles on East Island was 83 females. Nester abundance increased rapidly at this rookery during the early 1980s, leveled off during the early 1990s, and again increased rapidly during the late 1990s to the present. The most recent survey from 2002 to 2006 counted a mean annual nesting abundance of 400 females. This increase over the last 30 years corresponds to an approximate increase of 5.7 percent per year (NMFS and USFWS 2007a). This increase is likely attributed to increased female survivorship since the harvesting of turtles was prohibited in addition to the cessation of habitat damage at the nesting beaches since the early 1950s (Balazs and Chaloupka 2004). While the Hawaiian green sea turtle stock has exhibited a sustained increase in nesting females since its protection 25 years ago, there are still substantial threats to the survivial of the population (e.g., rising sea levels and the subsequent loss of nesting habitat in the NWHI, disease, loss of shoreline in the MHI, and marine debris).

Green Sea Turtles in the MARA

Green sea turtles are known in Chamorran, the indigenous language of the Mariana Islands, as *haagan*. An estimated 1,000 to 2,000 green sea turtles forage in the MARA, including the islands of Rota, Tinian, and Saipan (NOAA 2005).

Nesting surveys for green sea turtles in Guam have been conducted since 1973 with the most consistent data collected since 1990. The annual number of nesting females on Guam from 1990 to 2001 fluctuated between 2 and 60 females (NMFS and USFWS 2007a). More recently, aerial surveys from 1994 to 2002 show a fairly constant nearshore abundance of 150 to 250 nesting females on Guam (Cummings 2002).

The green sea turtle is a traditional food of the native population and although harvesting them is illegal, divers have been known to take them at sea and others have been taken as nesting females (NMFS and USFWS 1998a). Turtle eggs are also harvested in the CNMI. Nesting beaches and seagrass beds on

Tinian and Rota are in good condition but beaches and seagrass beds on Saipan have been impacted by hotels, golf courses and general tourist activities (WPRFMC 2009b).

Green Sea Turtles in the ASARA

Green sea turtles are known as *laumei ena`ena* and *fonu* in native Samoan. The only confirmed nesting area within the ASARA is at Rose Atoll, with an estimated 25 to 35 nesting females (NMFS and USFWS 1998a). Green turtles leave Rose Atoll When they finish laying their eggs and migrate to their feeding grounds somewhere else in the South Pacific. After several years, the turtles will return to Rose Atoll to nest again. Every turtle returns to the same nesting and feeding areas throughout its life, but that does not necessarily imply that all turtles nesting at Rose Atoll will migrate to exactly the same feeding area (WPRFMC 2009c). A tagging study, conducted in the mid-1990s tracked eight tagged green sea turtles by satellite telemetry from their nesting sites at Rose Atoll to Fiji (Balazs et al. 1994).

Green Sea Turtles in the WCPRA

Green sea turtles are reported to nest at Palmyra and Jarvis Islands within the WCPRA. Resident green sea turtles inhabit the lagoon waters of Wake and Palmyra Atolls. Green turtles have also been observed around Howland Island, Baker Island, Kingman Reef, and Johnston Atoll but nesting at these areas is unknown.

Seawall construction at Johnston Atoll negates the potential for nesting while military hazardous and toxic wastes have contaminated the coastal waters (NMFS and USFWS 1998a). Beach erosion has been targeted as a problem at Palmyra Atoll, causing barriers to adult and hatchling turtle movements, and degrading nesting habitat. When the U.S. military occupied Palmyra during World War II, their base was along the coast of a northern island about 5 km from known turtle nesting and feeding areas (WPRFMC 2009d).

Hawksbill Sea Turtle

Hawksbill sea turtles (*Eretmochelys imbricata*) occur from approximately latitudes 30° N to 30° S within the Atlantic, Pacific, and Indian Oceans and associated bodies of water (NMFS and USFWS 1998b). They feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs (WPRFMC 2009a).

The oceanic stage of juvenile hawksbill sea turtles are believed to occupy the pelagic environment. In the Pacific, the pelagic habitat of hawksbill juveniles is unknown. After a few years in the pelagic zone, small juveniles recruit to coastal foraging grounds; their size at recruitment is approximately 15 inches (38 centimeters) in carapace length in the Pacific. This shift in habitat also involves a shift in feeding strategies, from feeding predominantly at the surface to feeding below the surface primarily on animals associated with coral reef environments. In the Indo-Pacific, hawksbills continue eating a varied diet that includes sponges, other invertebrates, and algae (NMFS 2013). After reproduction, some turtles remain close to their rookery and others are highly mobile, traveling hundreds to thousands of km between nesting and foraging areas (NMFS and USFWS 2013a).

Hawksbills face threats on both nesting beaches and in the marine environment with the primary global threat to hawksbills being the loss of coral reef communities. In the Pacific, directed harvest of nesting females and eggs on the beach and hawksbills in the water is still widespread. Directed mortality is a major threat to hawksbills in American Samoa, Guam, the Republic of Palau, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, and the Republic of the Marshall Islands (NMFS and USFWS 1998b). In addition to directed harvest, increased human presence is a threat to hawksbills throughout the Pacific. In particular, increased recreational and commercial use of nesting beaches, beach camping and fires, litter and other refuse, general harassment of turtles, and loss of nesting

habitat from human activities negatively impact hawksbills. Incidental capture in fishing gear (primarily in gillnets and monofilament) and vessel strikes also adversely affect the species' recovery (NMFS 2013).

Hawksbill Sea Turtles in the HARA

Hawksbill sea turtles are known in Hawaiian as *honu'ea* or *'ea*. Hawksbill turtles occur in waters around the Hawai'i Archipelago and nest on Maui and the southeast coast of the Big Island (WPRFMC 2009a). There are fewer than 20 annual nesting females in Hawai'i, a substantial drop from the historical abundance of this species (NMFS and USFWS 2013a). Most of these nesting sites are used consistently by nesting hawksbills and appear critical to species reproduction in Hawai'i.

The primary threats to the Hawaiian population of nesting hawksbill sea turtles are incompatible human activity, non-native egg and hatchling predators, habitat loss by invasive weeds, changes in beach conformation, volcanism, and tidal inundation resulting in nest overcrowding and/or damage to nests and injury to hatchlings (NMFS and USFWS 2013a).

Hawksbill Sea Turtles in the MARA

Hawksbill sea turtles are known in Chamorran as *haagan karai*. Approximately 5-10 annual nesting hawksbill females occur in the MARA (NMFS and USFWS 2013a). In 2009, four hawksbill nests and in 2010, three hawksbill nests were reported on the Island of Guam (Guam DAWR 2011). The populations of hawksbill sea turtles in Guam are thought to be declining (NMFS and USFWS 2013a).

Hawksbill Sea Turtles in the ASARA

Hawksbill turtles are known in Samoan as *laumei uga*. Fewer than 30 annual nesting females are reported in the ASARA (NMFS and USFWS 2013a). Between October 2011 and March 2012, a total of six hawksbill nests were documented on two beaches on the island of Ofu (Tagarino 2012). They are most commonly found at Tutuila Island and the Manu'a Islands, and are also known to nest at Rose Atoll and Swains Island (Utzurrum 2002).

Hawksbill Sea Turtles in the WCPRA

There are no records of hawksbill turtles nesting in the WCPRA (NMFS and USFWS 2013a). However, the hawksbill sea turtle is regularly sighted in the waters of Palmyra Atoll and has been reported from Baker, Howland and Jarvis Islands (WPRFMC 2009d). The Recovery Plan indicates that waters around the WCPRA may provide marine feeding grounds for this species (NMFS and USFWS 1998b).

<u>Leatherback Sea Turtles</u>

Leatherback sea turtles (*Dermochelys coriacea*) are globally distributed from approximately 71°N to 47° S Latitude and nest from 38°N to 34°S latitude (NMFS and USFWS 2013b). The leatherback sea turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances that allow it to forage into the colder waters (NMFS and USFWS 1995). They can consume twice their own body weight in prey per day, feeding exclusively on soft-bodied invertebrates like jellyfish and tunicates. Sea nettle jellyfish and other species of the genus *Chrysaora* are preferred prey for leatherback sea turtles. The Pacific Ocean leatherback population is generally smaller in size than that in the Atlantic Ocean. In the Pacific, the IUCN notes that most leatherback nesting populations have declined more than 80 percent. In other areas of the leatherback's range, observed declines in nesting populations are not as severe, and some population trends are increasing or stable (WPRFMC 2009a).

Leatherback turtles forage widely in temperate pelagic waters, and only leave their pelagic lifestyle during the nesting season when gravid females return to tropical beaches to lay eggs. Males are rarely observed near nesting areas, and it has been proposed that mating most likely takes place outside of

tropical waters, before females move to their nesting beaches (Eckert and Eckert 1988). Leatherbacks are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Eckert 1998). Leatherback may swim more than 10,000 km in a single year (Eckert 1998). There are no known nesting grounds at any of the PIFSC research areas.

Declines in the leatherback population have resulted from fishery interactions as well as exploitation of the eggs (Spotila et al, 1996). Eckert and Eckert (2005) and Spotila et al. (1996) reported that adult mortality has also increased substantially, particularly as a result of driftnet and longline fisheries. The sharp decline in leatherback populations has been attributed to the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment, stemming from elimination of annual influxes of hatchlings because of egg harvesting. Leatherbacks are also susceptible to entanglement in lobster and crab pot gear (Zug and Parham 1996 as cited in WPRFMC 2009a).

Leatherback Sea Turtles in the HARA

Data from genetic research suggest that Pacific leatherback stock structure (natal origins) may vary by region. Due to the fact that leatherback turtles are highly migratory and that stocks mix in high-seas foraging areas, and based on genetic analyses of samples collected by both Hawai‘i-based and west-coast-based longline observers, leatherback turtles inhabiting the northern and central Pacific Ocean comprise individuals originating from nesting assemblages located south of the equator in the western Pacific (e.g., Indonesia, Solomon Islands) and in the eastern Pacific along the Americas (e.g., Mexico, Costa Rica; Dutton et al. 1999). Recent information on leatherbacks tagged off the west coast of the United States has also revealed an important migratory corridor from central California to south of the Hawaiian Islands, leading to western Pacific nesting beaches. Leatherback turtles originating from western Pacific beaches have also been found along the U.S. mainland (WPRFMC 2009a). They are regularly observed in offshore waters at the southeastern end of the Hawaiian archipelago (NMFS and USFWS 1998c).

Leatherback Sea Turtles in the MARA

There have been occasional sightings of leatherback turtles around Guam and in the pelagic waters of the CNMI (Eldredge 2003; NMFS and USFWS 1998c). During aerial surveys of Guam from 1989 to 1991, 2.6 percent of the observed sea turtles were leatherbacks (NMFS and USFWS 1998c). However, the extent that leatherback turtles are present around Guam and CNMI is unknown (WPRFMC 2009b).

Leatherback Sea Turtles in the ASARA

In 1993, the crew of an American Samoa government vessel engaged in experimental longline fishing, pulled up a small freshly dead leatherback turtle about 5.6 km south of Swains Island. This was the first leatherback turtle seen by the vessel’s captain in 32 years of fishing in the waters of American Samoa (NMFS and USFWS 1998c). The nearest known leatherback nesting area to the Samoan archipelago is the Solomon Islands (Grant 1994).

Leatherback Sea Turtles in the WCPRA

There are no known reports of leatherback sea turtles in waters around the WCPRA, however, these waters are within the habitat, and migration routes, of leatherback turtles and therefore they may be present but unobserved due to the largely uninhabited nature of the WCPRA.

<u>Loggerhead Sea Turtle</u>

Loggerhead sea turtles (*Caretta caretta*) occur throughout the temperate and tropical regions of the Pacific, Atlantic, and Indian Oceans in a wide range of habitats. These include open-ocean, continental shelves, bays, lagoons, and estuaries (NMFS and USFWS 1998d). In the Pacific, loggerheads can be found throughout the tropical to temperate waters. However, their breeding grounds are restricted to a

number of sites in the North Pacific and South Pacific (NMFS and USFWS 2009). Loggerhead sea turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (Wynne and Schwartz 1999; Witherington et al. 2006). Under certain conditions, they may also scavenge fish (NMFS and USFWS 1998d). As they age, loggerheads begin to move into shallower waters, where, as adults, they forage over a variety of benthic hard- and soft-bottom habitats (reviewed in Dodd, 1988).

In September of 2011 NMFS and the USFWS determined that the loggerhead sea turtle is composed of nine DPS listed as threatened or endangered. In the Pacific Ocean (and within the PIFSC research areas) two were named: the North Pacific Ocean population and the South Pacific Ocean population; both are listed as endangered. As of yet there is no critical habitat associated with these DPS (76 FR 58868).

Loggerheads face threats on both nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges. The main anthropogenic threats impacting loggerhead nesting habitat include the destruction and modification of coastal habitats worldwide. Beachfront lighting, placement of erosion control structures and other barriers to nesting, vehicular and pedestrian traffic, sand extraction, beach erosion and pollution, beach sand placement, removal of non-native vegetation and planting of non-native vegetation all represent serious threats to loggerhead nesting habitat (NMFS and USFWS 2009).

Loggerhead Sea Turtles in the HARA

Loggerheads in the North Pacific are opportunistic feeders that target items floating at or near the surface, and if high densities of prey are present, they will actively forage at depth (Parker et al. 2002). In general, during the last 50 years, North Pacific loggerhead nesting populations have declined 50–90 percent (Kamezaki et al. 2003 as cited in WPRFMC 2009a). The occurrence of loggerhead sea turtles in the HARA is rare. There have only been four records of loggerhead sea turtles in the HARA; they most likely drifted or traveled to the area from Mexico to the east or Japan to the West (NMFS and USFWS 1998d).

Loggerhead Sea Turtles in the MARA

There are no known reports of loggerhead turtles in waters around the MARA (WPRFMC 2009b).

Loggerhead Sea Turtles in the ASARA

There are no known reports of loggerhead turtles in waters around the ASARA (Tuato‘o-Bartley et al. 1993).

Loggerhead Sea Turtles in the WCPRA

There are no known reports of loggerhead turtles in waters around the WCPRA, however, these waters are within the habitat, and migration routes, of loggerhead turtles and therefore they may be present but unobserved due to the largely uninhabited nature of the WCPRA.

Olive Ridley Sea Turtles

Olive ridley sea turtles (*Lepidochelys olivacea*) migrate annually between pelagic foraging areas and coastal nesting areas. Trans-Pacific ships have observed olive ridley sea turtles over 2,400 miles (4,000 km) from shore. They are globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian Oceans. In the Eastern Pacific, they occur from Southern California to Northern Chile. In the eastern Pacific, arribadas (massive synchronized nesting events) occur from June through December on certain beaches on the coasts of Mexico, Nicaragua, and Costa Rica and on a single beach in Panama (NOAA 2013c). It is theorized that young olive ridley sea turtles move offshore and occupy areas of surface-current convergences to find food and shelter among aggregated floating objects until they are

large enough to recruit to the nearshore benthic feeding grounds of the adults, similar to the juvenile loggerheads mentioned previously (WPRFMC 2009a).

Potential threats to olive ridley sea turtles include marine pollution, oil and gas exploration, lost and discarded fishing gear, changes in prey abundance and distribution due to commercial fishing, habitat alteration and destruction from fishing gear and practices, agricultural runoff, and sewage discharge (NMFS and USFWS 2007b).

Olive Ridley Sea Turtles in the HARA

Occurrences of olive ridley sea turtles in the HARA are rare, but sightings have increased in the last few decades (NMFS and USFWS 1998e). Olive ridley sea turtles have been incidentally caught in the western Pacific longline fishery operating near the Hawaiian Islands (NMFS and USFWS 1995). More recently, Polovina et al. (2004) tracked 10 olive ridley sea turtles caught in the Hawai‘i-based longline fishery. The only known nesting ground in the U.S. was a single observed nesting on the island of Maui in the HARA (Balazs and Hau 1986 in NMFS and USFWS 1998e).

Olive Ridley Sea Turtles in the MARA

There are no known reports of olive ridley turtles in waters around the MARA (WPRFMC 2009e).

Olive Ridley Sea Turtles in the ASARA

Olive ridley turtles are uncommon in American Samoa, although there have been at least three sightings. A necropsy of one recovered dead olive ridley found that it was injured by a shark, and may have recently laid eggs, indicating that there may be a nesting beach in American Samoa (Utzurrum 2002).

Olive Ridley Sea Turtles in the WCPRA

There are no known reports of olive ridley turtles in waters around the PRIA however, these waters are within the habitat, and migration routes, of olive ridley turtles and therefore they may be present but unobserved due to the largely uninhabited nature of the PRIA (WPRFMC 2009d).

3.2.5 Invertebrates

Invertebrates found within the PIFSC research areas include numerous species of cnidarians (particularly corals), crustaceans, mollusks, echinoderms, porifera (sponges), and bivalves. The below sections discuss the threatened and endangered species (Section 3.2.5.1), species targeted by PIFSC surveys (Section 3.2.5.2), and other species that may be incidentally caught (Section 3.2.5.3). It is important to note that many of these invertebrate species comprise EFH as part of hard bottom structures underlying the waters and associated biological communities (e.g. corals).

3.2.5.1 Threatened and Endangered Species

NMFS published a final rule in September 2014 to list 20 species of corals as threatened under the ESA (79 FR 53852, 10 September 2014). Fifteen of the 20 ESA-listed coral species may occur within PIFSC research areas (Table 3.2-8). Brief descriptions are given for each of these species including habitat, distribution, and threats. No listed corals occur in Hawai‘i. Other listed coral species may also occur in these research areas but have not yet been reported so the species in each area may change as more reliable information becomes available. There are conflicting geographic distributions for some of the ESA-listed Indo-Pacific coral species (Luck 2013, Veron 2014). However, the below occurrences are based on best available information analyzed in 79 FR 53852. Critical habitat was undeterminable at the time of listing for the below corals (79 FR 53852). Designation of critical habitat is being considered in a separate rule-making process.

Table 3.2-8 Occurrence of Threatened Corals in the Four PIFSC Research Areas

Scientific Name	HARA	MARA	ASARA	WCPRA
Acropora globiceps		X	X	X
Acropora jacquelineae			X	
Acropora lokani[1]				
Acropora pharaonis[1]				
Acropora retusa			X	X
Acropora rudis[1]				
Acropora speciosa			X	X
Acropora tenella[1]				
Anacropora spinosa[1]				
Euphyllia paradivisa			X	
Isopora crateriformis			X	
Montipora australiensis[1]				
Pavona diffluens[1]				
Porites napopora[1]				
Seriatopora aculeata		X		

1. Has not been conclusively reported in any PIFSC research area, but may be encountered

Acropora globiceps

Acropora globiceps colonies are small and compact, with the size and appearance of branches depending on the degree of exposure to wave action. This species is distributed from the oceanic west Pacific to the central Pacific as far east as the Pitcairn Islands. It occurs on upper reef slopes, reef flats, and adjacent habitats at depths from 0 to 8 meters (NOAA 2014e). Based on results from Richards et al. (2008) and Veron (2014), the absolute abundance of this species is likely at least tens of millions of colonies.

Acropora jacquelineae

Acropora jacquelineae colonies consist of flat plates up to 1 m in diameter. This species is distributed mostly in the Coral Triangle area. There are also confirmed records in eastern Micronesia, and it has been identified by two coral scientists in American Samoa *Acropora jacquelineae* occurs on subtidal walls, ledges, and shallow reef slopes at depths from 10 to 35 meters (NOAA 2014e). The total population size of *Acropora jacquelineae* is estimated at 31,599,000 colonies (Richards et al. 2008).

Acropora lokani

Acropora lokani colonies consist of horizontal main branches that are robust and usually diverge. Upright branchlets diverge from main branches. Upright branchlets are short and diverge from main branches. This species is distributed mostly in the Coral Triangle area, with confirmed records in eastern Micronesia and Fiji as well. *Acropora lokani* is found in upper and mid-reef slopes and lagoon patch reefs at depths

from 8 to 25 meters (NOAA 2014e). The total population size of *Acropora lokani* is estimated at 18,960,000 colonies (Richards et al. 2008).

<u>*Acropora pharonis*</u>

Acropora pharonis colonies are large horizontal tables or irregular clusters of interlinked contorted branches. This species is likely distributed along the African east coast, western and central Indian ocean islands, the Red Sea, Persian Gulf and east towards India. *Acrophora pharonis* is found at least in upper-reef slopes, mid-slope terraces and lagoons at depths from 5 to 25 meters (NOAA 2014e). Total population size is unknown but according to (Richards et al. 2008) and Veron (2014), absolute abundance is likely greater than millions of colonies.

<u>*Acropora retusa*</u>

Acropora retusa colonies consist of flat plates with short thick digitate branchlets. This species is widely distributed in the western Indian Ocean, the east coast of India, and from Vietnam east to the Pitcairn Islands. *Acropora retusa* occurs in shallow reef slopes and back-reef areas, such as upper reef slopes, reef flats, and shallow lagoons at depths from 0 to 5 meters (NOAA 2014e). Based on results from Richards et al. (2008) and Veron (2014), the absolute abundance of this species is likely in the millions.

<u>*Acropora rudis*</u>

Acropora rudis colonies consist of large, tapered, prostate branches that can reach a maximum size of 50 cm. This species is distributed in the central and eastern Indian Ocean from the Maldives to the western-most portion of Indonesia. Although not conclusively reported, *Acropora rudis* may also occur in areas surrounding New Caledonia and the Samoas. Acropora rudis occurs in lower reef crests and upper reef slopes at depths from 3 to 15 meters (NOAA 2014e). The absolute abundance of this species is at least millions of colonies.

<u>*Acropora speciosa*</u>

Acropora speciosa colonies form thick cushions or bottlebrush branches with large and elongate axial corallites. This species is distributed from Indonesia to the Marshall Islands in the western and central Pacific Ocean. This species also occurs in the Maldives in the Indian Ocean and at least one site in French Polynesia. Acropora speciosa occurs on lower reef slopes and walls at depths from 12 to 30 meters. It is often associated with clear water and high Acropora diversity (NOAA 2014e). The total population size of *Acropora speciosa* is estimated at 10,942,000 colonies (Richards et al. 2008).

<u>*Acropora tenella*</u>

Acropora tenella colonies are horizontal and platy, with flattened branches extending outwards. This species is distributed mostly in the Coral Triangle area, with confirmed records in southern Japan, Micronesia, and the Marshall Islands. This species is found on lower reef slopes and shelves in mesophotic areas at depths of 40 to 70 meters (NOAA 2014e). The total population size of *Acropora tenella* is estimated at 5,207,000 colonies (Richards et al. 2008).

<u>*Anacropora spinosa*</u>

Anacropora spinosa colonies consist of compact branches tapering from less than 10 mm in diameter. This species is likely distributed almost exclusively in the Coral Triangle area, with confirmed records in southern Japan. *Anacropora spinosa* is found in upper and mid-reef slopes, lagoons on reefs, and non-reef areas at depths from 5 to 15 meters (NOAA 2014e). The total population size of *Anacropora spinosa* is unknown but likely numbers at least millions of colonies (Richards et al. 2008).

Euphyllia paradivisa

Euphyllia paradivisa colonies consist of branching separate corallites. This species is distributed mostly in the Coral Triangle area, but is confirmed to occur in American Samoa. This species is found in environments protected by wave action on upper reef slopes, mid-slope terraces, and lagoons at depths of 2 to 25 meters (NOAA 2014e). Based on results from Richards et al. (2008) and Veron (2014), the absolute abundance of this species is likely at least tens of millions of colonies.

Isopora crateriformis

Isopora crateriformis forms flattened solid encrusting plates that may reach over a meter in diameter. This species is distributed within the Coral Triangle area and some western Pacific waters, including New Caledonia, the Samoas, and the Marshall Islands. This species predominantly occurs in shallow, high-wave energy environments, including reef flats and lower reef crests, and upper reef slopes. *Isopora crateriformis* has also been reported from low tide to at least 12 meters in depth, and may occur in the mesophotic zone below 50 meters (NOAA 2014e). Based on results from Richards et al. (2008) and Veron (2014), the absolute abundance of this species is likely at least millions of colonies.

Montipora australiensis

Montipora australiensis colonies consist of irregular columns and thick plates. This species is likely distributed in the western Indian Ocean and in the western Pacific from Malaysia to Vanuatu and Southern Japan to northern Australia. *Montipora australiensis* occurs at depths from 2 to 30 meters on upper reef slopes, lower reef crests, and reef flats. It also probably occurs in other habitats including mid-slopes (NOAA 2014e). Based on results from Richards et al. (2008) and Veron (2014), the absolute abundance of *Montipora australiensis* is unknown but is likely at least millions of colonies.

Pavona diffluens

Pavona diffluens colonies are submassive, and consist of knobs that protrude from an encrusting base. This species is distributed along part of the east African coast, the Red Sea, and the northwestern Indian Ocean (NOAA 2014e). Although not conclusively reported, *Pavona diffluens* may also occur from the Marianas Islands and American Samoa (Kenyon et al. 2010). This species occurs in at least upper reef slopes, mid-slopes, lower reef crests, reef flats, and lagoons at depths of 5 to 20 meters (NOAA 2014e). The absolute abundance of this species is at least millions of colonies.

Porites napopora

Porites napopora colonies have irregular clumps of tapered branches which are irregularly fused. This species is likely distributed mostly in the Coral Triangle area and adjacent areas of the South China Sea, southern Japan, and Micronesia. *Porites napopora* occurs in upper reef slopes, mid-slopes, lower reef crests, reef flats and lagoons at depths from 3 to 15 meters (NOAA 2014e). Absolute abundance of *Porites napopora* is unknown but is likely at least millions of colonies (Richards et al. 2008).

Seriatopora aculeata

Seriatopora aculeata colonies have thick, short, tapered branches that are usually fused in clumps. This species is distributed mostly in the Coral Triangle area, but also occurs in adjacent areas in the western Pacific from the Mariana Islands down to New Caledonia. This species occurs in a wide range of habitats on the reef slope and back-reef, including upper reef slopes, mid-slope terraces, lower reef slopes, reef flats, and lagoons at depths of 3 to 40 meters (NOAA 2014e). Based on results from Richards et al.

(2008) and Veron (2014), absolute abundance of *Seriatopora aculeata* is likely at least millions of colonies.

Threats to ESA-Listed Corals

NMFS identified nine threats to be the most important to the current or expected future extinction risk of reef-building corals: ocean warming (bleaching), disease, ocean acidification, trophic effects of fishing, sedimentation, nutrients, sea-level rise, predation, and collection and trade (79 FR 53852). Susceptibility of a coral species to the above threats can vary greatly between and within taxa, depending on the biological processes and characteristics of each coral species. Details on the species-specific or genera-specific threat susceptibilities of the above ESA-listed corals include:

- *Acropora* spp. – bleaching caused by irregularly warm water, predation by corallivorous species, damage from sedimentation, slow recovery from disease (white-band) or bleaching due to fragmentation as dominant form of reproduction, heavily collected and traded for aquariums
- *Anacropora* spp. – Moderate succeptibility to bleaching due to ocean warming and moderate vulnerability to disease and ocean acidification
- *Euphyllia* spp. – high susceptibility to bleaching events
- *Isopora crateriformis* – high susceptibility to bleaching events at a global scale, but reportedly tolerates high temperatures in shallow back-reef pools in American Samoa
- *Montipora* spp. – High succeptibility to ocean warming and moderate vulnerability to disease and ocean acidification
- *Pavona* spp. – susceptible to bleaching by irregularly warm water, predation by corallivorous species (e.g. crown-of-thorns seastar)
- *Porites* spp. – Moderate succeptibility to disease and ocean acidification
- *Seriatopora* spp. – highly susceptible to bleaching events, heavily traded for aquariums (although rare for *S. aculeata*)

3.2.5.2 Target Species

Target species are those invertebrates which are managed for commercial and recreational fisheries and are collected by PIFSC surveys for research purposes.

As detailed in Section 3.21, species within the jurisdiction of the WPRFMC are grouped into MUS or multi-species Complexes for which annual catch limits are set. Invertebrate MUS targeted by PIFSC research activities include crustacean MUS, precious corals MUS, and coral reef ecosystem MUS PHCRT.

Table 3.2-9 displays a list of target invertebrate species collected during research activities throughout the PIFSC research areas. The stock status for all invertebrate MUS are either unknown or not overfished. The proceeding paragraphs provide descriptions of the biology and distributions of these species.

Table 3.2-9 Target Invertebrate Species in the PIFSC Research Areas

Common Name	Scientific Name	Stock/Area	PIFSC Surveys
CRUSTACEAN MUS			
Spiny lobster	*Panulirus marginatus*	HARA	lobster surveys
Slipper lobster	*Scyllarides squammosus*	HARA	lobster surveys
Ridgeback slipper lobster	*Scyllarides haanii*	HARA	lobster surveys
Chinese slipper lobster	*Parribacus antarcticus*	HARA	lobster surveys
CORAL REEF ECOSYSTEM MUS - PHCRT			
Stony corals	*Acanthastrea* spp.	ASARA	Pacific Reef Assessment and Monitoring Program (RAMP)
	Acropora spp.	ASARA, WCPRA	RAMP
	Astreopora spp.	ASARA	RAMP
	Coscinaraea spp.	ASARA	RAMP
	Echinophyllia spp.	WCPRA	RAMP
	Favia spp.	ASARA	RAMP
	Galaxea spp.	ASARA	RAMP
	Goniopora spp.	ASARA	RAMP
	Hydnophora spp.	ASARA	RAMP
	Leptoseris spp.	WCPRA	RAMP
	Montipora spp.	ASARA, WCPRA	RAMP
	Mycedium spp.	ASARA	RAMP
	Pavona spp.	ASARA, WCPRA	RAMP
	Platygyra spp.	ASARA	RAMP
	Porites spp.	MARA, ASARA, WCPRA	RAMP
	Turbinaria spp.	ASARA	RAMP
Brain corals	*Cyphastrea* spp.	WCPRA	RAMP
	Echinopora spp.	ASARA	RAMP
	Favites spp.	ASARA	RAMP
	Goniastrea spp.	ASARA	RAMP
	Leptastrea spp.	ASARA, WCPRA	RAMP
Ahermatypic corals, lace corals	*Stylaster* spp.	ASARA, WCPRA	RAMP
	Distichopora spp.	WCPRA	RAMP
Mushroom corals	*Fungia* spp.	ASARA	RAMP
Blue corals	*Heliopora* spp.	ASARA	RAMP
Fire corals	*Millepora* spp.	MARA, ASARA, WCPRA	RAMP
Cauliflower corals	*Pocillopora* spp.	WCPRA	RAMP
Sun corals	*Tubastraea* spp.	WCPRA	RAMP

Spiny and Slipper Lobsters

Mature spiny lobsters inhabit protected waters on rocky substrate, under rocks, or within rock crevices (WPRFMC. 2009a). Juvenile and mature P. marginatus are not found in separate habitat areas apart from one another, unlike other species of Panulirus (Macdonald and Stimson 1980; Parrish and Polovina 1994). Spiny lobsters in the southwest area of the Pacific Ocean are associated with coral reef habitats that provide shelter and a diversity of food items (Pitcher 1993). Spiny lobsters are nocturnal predators that move onto the reef flats in the evening to forage.

The general life cycle of spiny and slipper lobsters includes external or internal egg fertilization that hatch into larvae after 30-40 days (MacDonald 1986; Uchida and Uchiyama 1986). The planktonic larvae stage varies depending on species and geographic range, but typically lasts from 6 to 12 months (WPRFMC 2009a). Oceanographic processes such as eddies and currents generally retain lobster larvae within island areas (Johnson 1968). Spiny lobster larvae can be transported up to 2,000 miles by strong ocean currents (MacDonald 1986).

Corals and Sponges

Corals and sponges can exist within three types of ecosystems: (1) shallow coral reef ecosystems; (2) mesophotic coral ecosystems; and (3) deep sea coral ecosystems. Shallow coral reef ecosystems are generally confined to the upper euphotic zone, with maximum reef growth and productivity occurring between 5 and 15 meters (Hopely and Kinsey 1988). Mesophotic coral ecosystems are typically found at depths from 30-40 meters to over 150 meters in tropical and subtropical regions. Mesophotic coral ecosystems are light-dependent, and considered to be an extension of shallow coral reef ecosystems (Blyth-Skyrme et al. 2013). Deep-sea coral ecosystems lack zooxanthellae and occur below the euphotic zone (Grigg 1993). Mesotrophic and deep-sea coral ecosystems may overlap in tropical and subtropical regions.

Shallow Coral Reefs Ecosystems

Shallow coral reef ecosystems are the tropical rain forests of the oceans, in that they attract and concentrate a vast number of reef-dependent species, creating rich biodiversity. Coral reefs consist of carbonate rock structures at or near sea level that contain viable populations of reef-building corals. The symbiotic relationship between coral polyps and algal cells, known as zooxanthellae, is a key feature of reef-building corals. The zooxanthellae are able to photosynthesize and provide much of the coral polyp's nutritional requirements. Most corals also actively feed on zooplankton or dissolved organic nitrogen in the water. As a result of the coral polyps' symbiotic relationship with photosynthetic zooxanthellae, coral reefs generally do not occur below 100 meters (Hunter 1995). Primary production is mainly attributed to benthic microalgae, macroalgae, zooxanthellae, and other symbiotic bearing invertebrates (Levington 1995). The Indo-Pacific region (which includes all of PIFSC research areas) is host to approximately 700 described species of coral (Brainard et al. 2011).

Mesophotic Coral Ecosystems

As an extension to shallow coral reefs, mesotrophic coral ecosystems likely have biological, physical, and chemical connectivity with these reefs and associated communities, as well as unique fish and invertebrate assemblages. Mesotrophic coral ecosystems can provide refuge for shallow and mid-depth species and a numerous depth-restricted species of fishes, invertebrates, algae, and a lower diversity of coral (Hinderstein et al. 2010).

Deep Sea Coral Ecosystems

Deep-sea corals are a taxonomically and morphologically diverse collection of organisms distinguished by their occurrence in deep oceanic waters (50 m to over 200 m). The calcified skeletons of certain

branching stony coral species form large reef-like structures in deep water. Gorgonians, gold corals, and black corals often have branching tree-like forms and either occur singly or form thickets of many colonies. The three-dimensional features formed by many deep sea corals provide habitat for numerous fish and invertebrate species and, like shallow-water tropical corals, appear to enhance the biological diversity of many deep-sea ecosystems (NOAA 2010a).

Precious corals are a select group of deep sea corals commercially harvested for the jewelry trade. Precious corals from all areas are slow growing with low rates of mortality and recruitment. As a result of this characteristic, precious corals take longer than other corals to recover from exploitation. Precious coral MUS potentially caught in sufficient quantities to warrant management or specific monitoring by NMFS and the WPRFMC are summarized in Table 3.2-10. There are currently minimal harvests of precious coral species throughout the PIFSC region.

Table 3.2-10 Occurrence of Precious Coral MUS in the Four PIFSC Research Areas

Common Name	Scientific Name	HARA	MARA	ASARA	WCPRA
Pink coral/red coral	*Corallium secundum*	X	X	X	X
Pink coral/red coral	*Corallium regale*	X	X	X	X
Pink coral/red coral	*Corallium laauense*	X	X	X	X
Gold coral	*Gerardia* spp.	X	X	X	X
Gold coral	*Narella* spp.	X	X	X	X
Gold coral	*Calyptrophora* spp.	-	X	X	-
Bamboo coral	*Lepidisis olapa*	X	X	X	-
Bamboo coral	*Acanella* spp.	-	X	X	-
Black coral	*Antipathes dichotoma*	-	X	X	X
Black coral	*Antipathes grandis*	-	X	X	X
Black coral	*Antipathes ulex*	-	X	X	X

Sponges

Sponges can occur in all three of the above coral reef ecosystems. Identified sponge species total 23 surrounding the HARA, 20 at the WCPRA, and 110 near the MARA (Waddell 2005).

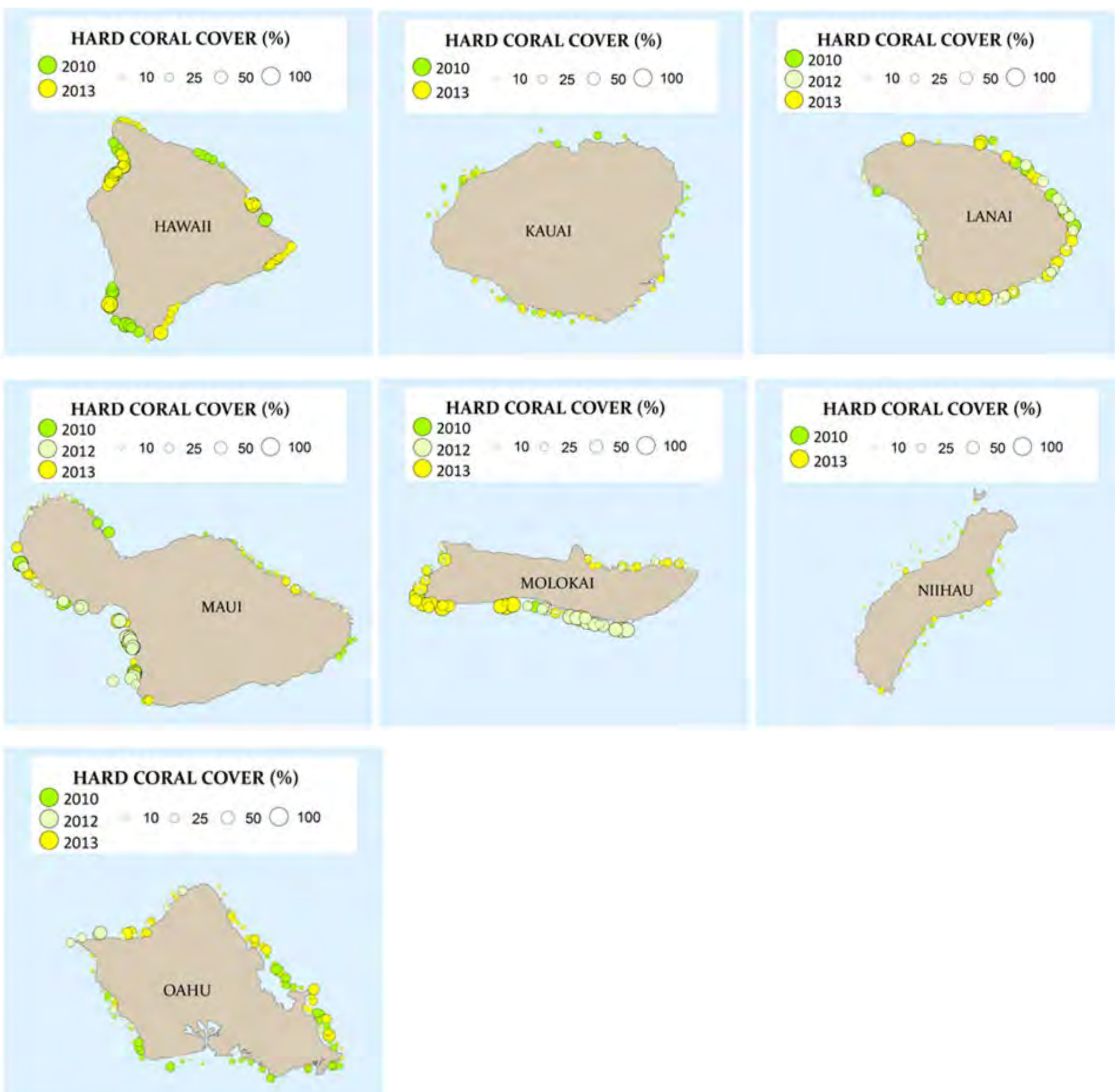
A potentially invasive sponge species, the keyhole sponge (*Mycale armata*) has become abundant is some areas where it has grown at a sufficient rate to overgrow native dominant corals. The coral killing sponge, *Terpios hoshinota* has been observed near the islands Guguan and Uracas of the MARA. *T hosinota* is an encrusting sponge that is able to overgrow hard corals on a large scale (Waddell 2005).

Threats to Coral Ecosystems

General threats to coral reefs throughout the PIFSC research areas include bleaching, diseases, storms, coastal development, runoff, and pollution, tourism and recreation, fishing, coral trading, vessel groundings, marine debris, invasive species, security training activities, offshore oil and gas exploration (Waddell 2005).

<u>Corals of the HARA</u>

The total potential area of coral reef in the Hawaiian Archipelago is approximately 2,826 km^2 within a 10 fathom contour, and 20,437 km^2 within a 100 fathom contour (Rohmann et al. 2005). Figure 3.2-3 displays the percent cover of hard corals surrounding the major islands of the HARA. The condition of coral reefs within the Hawaiian Archipelago range from fair to excellent. Many coral reefs threatened by continued population growth, overfishing, urbanization, runoff, and coastal development (NOAA 2005). Coral reef diseases are present in the Hawaiian Archipelago, including documented outbreaks of Montipora White Syndrome in Kāneʿohe Bay, Oʿahu (USGS 2012a) and cyanobacterial infection of coral on the north shore of Kaua‘i (USGS 2012b). A baseline study of 18 sites around the island of O‘ahu found an average of 0.95 percent of diseased coral colonies (WPRFMC 2009a). Mesotrophic corals have been documented throughout the Hawaiian Archipelago, with peak coral cover between 50 to 60 meters in the MHI and 30 to 40 meters in the NWHI (Rooney et al. 2010). Deep sea corals in the Hawaiian Archipelago (*Corallium secundum, Corallium lauuense, and Gerardia* sp.) have been observed from 350 to 500 meters, with densities from 13 to 63 colonies per 100 m^2 (Parrish 2007).



Source: Heenan et al. 2014.

Figure 3.2-3 Percent of Hard Coral Cover Surrounding the Populated Islands of the HARA

Corals of the MARA

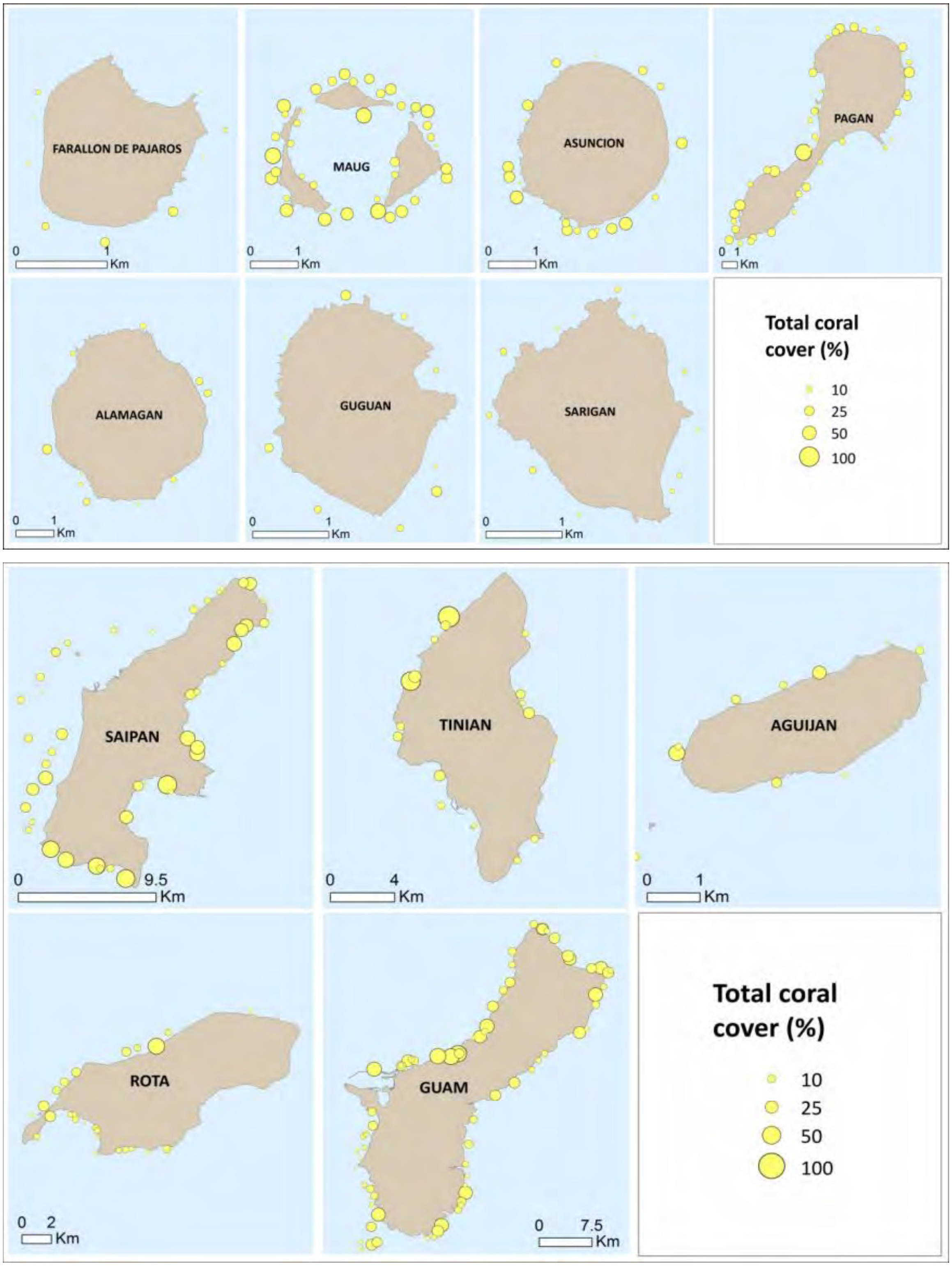
Corals of the MARA include the CNMI and Guam.

Corals of CNMI

The total coral reef area around the CNMI is estimated at 124 km^2 within a 10 fathom contour, and 476 km^2 within a 100 fathom contour, with the majority of coral reefs in the older southern islands (Eldredge 1983; Rohmann et al. 2005). Most of the coral reefs in the southern islands of the Marina Archipelago appear to be in good condition with the exception of a few heavily populated areas where coral reefs are degraded by human activities (Starmer et al. 2005). Coral reefs of the northern islands are also considered to be in good condition, likely due to isolation from human population centers (Birkeland 1997).

Corals of Guam

The estimated potential coral reef area surrounding the island of Guam is 108 km^2 within a 10 fathom contour and 276 km^2 within a 100 fathom contour (Rohmann et al. 2005). Reef health in Guam varies by geography; reefs on the southwestern part of the island are generally in poor condition, whereas reefs on the northern part of the island are in better condition. This geographical difference is likely due to increased development, public access to reefs, and river discharge at the southern part of the Island (WPRFMC 2009b). Figure 3.2-4 displays the percent cover of hard corals surrounding the islands of the MARA.

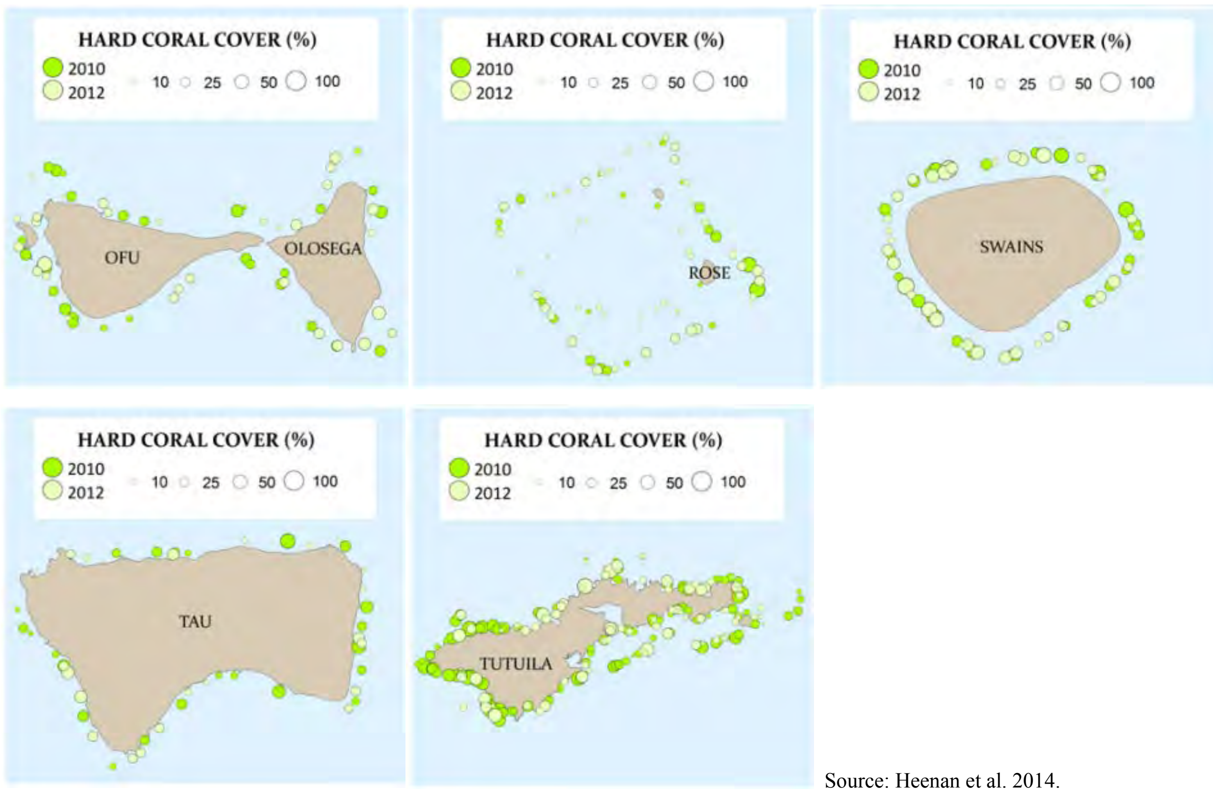


Source: PIFSC 2014a,b.

Figure 3.2-4 Percent of Hard Coral Cover Surrounding the Populated Islands of the MARA

Corals of the ASARA

The estimated area of potential coral reef at American Somoa is 53 km^2 within a 10 fathom contour and 464 km^2 within a 100 fathom contour (Rohmann et al. 2005). The coral reefs on the north side of the main island (Tutuila) and nearby Aunu'u are in good condition. However, some areas of Tutuila have lower coral cover than elsewhere, likely due to increased sedimentation (Green 2002). Figure 3.2-5 displays the percent cover of hard corals surrounding the ASARA.

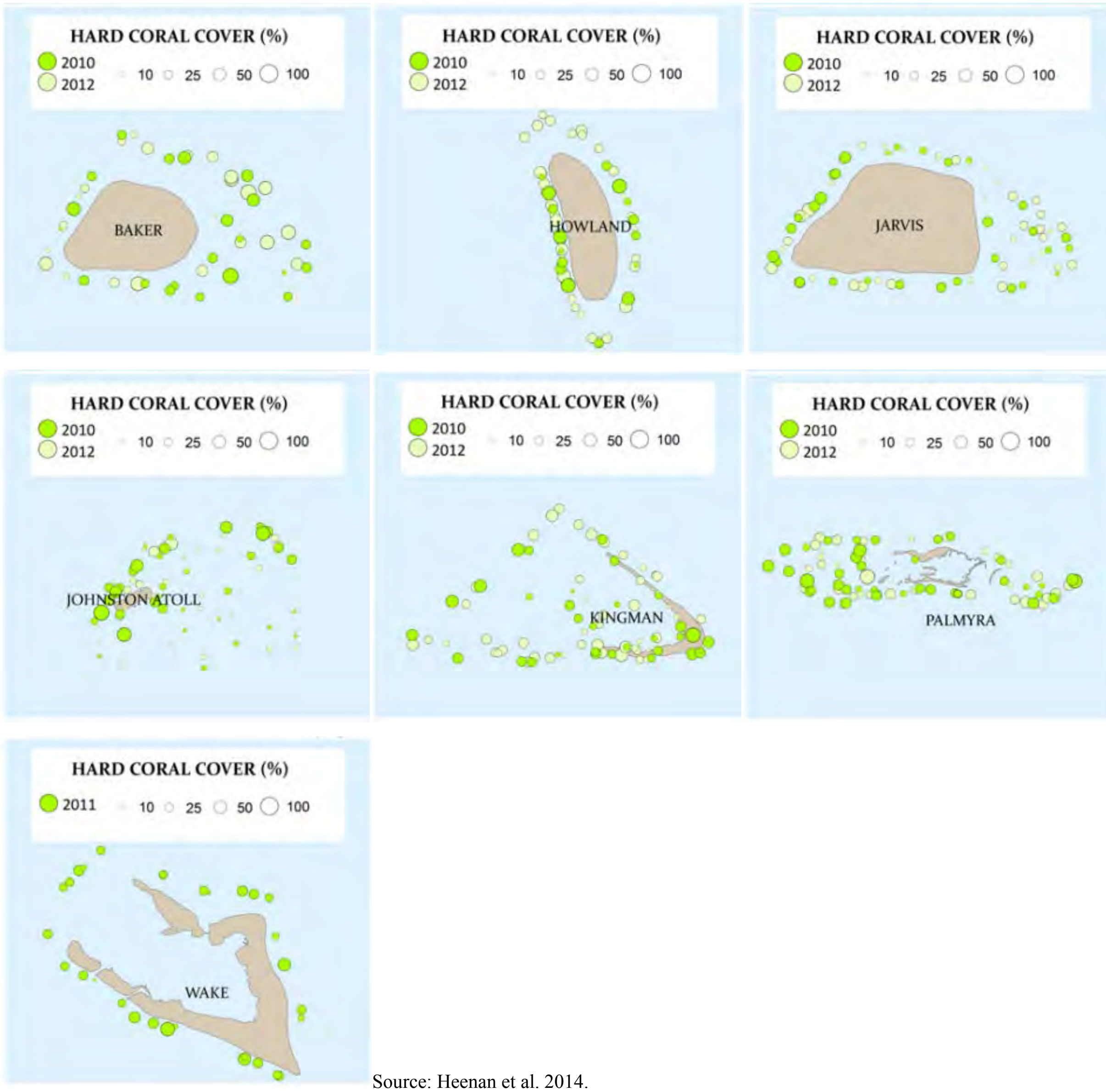


Source: Heenan et al. 2014.

Figure 3.2-5 Percent of Hard Coral Cover Surrounding the Populated Islands of the ASARA

Corals of the WCPRA

The estimate area of potential coral reef at the WCPRA is 253 km^2 within a 10 fathom contour and 436 km^2 within a 100 fathom contour (Rohmann et al. 2005). Coral reefs near the WCPRA are generally healthy and productive (WPRFMC 2009d). However, coral reefs around the islands of Baker, Howland, Jarvis, Kingman, and Palmyra are currently recovering from recurrent mass bleaching events that occurred around 2001 and 2010 (Maragos et al. 2008, Vargas-Ángel et al. 2011). Figure 3.2-6 displays the percent cover of hard corals surrounding the WCPRA.



Source: Heenan et al. 2014.

Figure 3.2-6 Percent of Hard Coral Cover Surrounding the Populated Islands of the WCPRA

3.2.5.3 Other Species

The following species in Table 3.2-11 are not listed as threatened or endangered under the ESA, nor are they regularly collected by PIFSC research surveys. However, these species may be encountered during PIFSC research surveys and caught in small numbers. Incidental catch of these species may also occur through trawl, hook-and-line, longline, trap, or gillnet surveys. All of the below species are coral reef ecosystem MUS PHCRT.

Table 3.2-11 Other Invertebrate Species Found within the PIFSC Research Areas

Common Name	Scientific Name	HARA	MARA	ASARA	WCPRA
Kona crab	*Ranina ranina*	X	X	X	X
Deepwater shrimp	*Heterocarpus* spp.	X	X	X	X
Day octopus	*Octopus cyanea*	X	X	X	X
White-striped octopus	*Octopus orantus*	X	X	X	X
Green snails	*Turbo* spp.	X	X	X	-
Featherduster worm	Family Sabellidae	X	-	-	-
Sea cucumbers and urchins	Phylum Echinodermata	X	X	X	X
Black lipped pearl oyster	Pinctada margaritifera	X	X	X	X
Giant clam	*Tridacna gigas*	-	X	X	X
Organpipe corals	*Tubipora* spp.	-	X	X	X
Lace corals	Family Stylasteridae	X	X	X	X
Hydroid corals	Family Solanderidae	X	X	X	X
Small and large coral polyps	Various species	X	X	X	X
Soft corals and gorgonians	Various species	X	X	X	X
Anemones	Order Actinaria	X	X	X	X
Soft zoanthid corals	Order Zoantharia	X	X	X	X
Sea snails	*Trochus* spp.	X	X	X	X
Sea slugs	Opistobranhcs	X	X	X	X
Other bivalves	Various species	X	X	X	X
Other crustaceans	Various species	X	X	X	X
Sea squirts	Tunicates	X	X	X	X
Sponges	Porifera	X	X	X	X
Segmented worms	Various species	X	X	X	X
Seaweed	Various algae species	X	X	X	X
Limpets	*Cellana sp.*	X	X	X	-

3.3 SOCIAL AND ECONOMIC ENVIRONMENT

Activities associated with fisheries research have several implications for the social and economic environment potentially affected by PIFSC fisheries research. The following Sections describe the importance of select cultural resources in the study region (Section 3.3.1), background information regarding PIFSC (Section 3.3.2), commercial fisheries of Hawaiʻi (Section 3.3.3), non-commercial fisheries of Hawaiʻi (Section 3.3.4), fishing communities of Hawaiʻi (Section 3.3.5), economic aspects of commercial and non-commercial marine fisheries in American Samoa, Guam, and the Commonwealth of the Northern Marianas (Section 3.3.6), and PIFSC operations (Section 3.3.7).

3.3.1 Cultural Importance of Resources

Cultural resources may be defined as historic properties, landscapes, cultural items, archaeological resources, sacred sites, traditional knowledge, or collections of materials subject to protection under federal regulations. This section is provided as a brief overview of cultural resources found within the designated PIFSC research areas.

Marine resources are of cultural importance to many indigenous persons residing in the areas of interest. These areas include: the HARA, MARA, and the ASARA. Although the WCPRA is presently uninhabited (with the exception of permanent presence on Wake Atoll and occasional presence on Palmyra Atoll and Johnston Atoll), it too assumes importance to certain culture groups in the Pacific. Described below are ways in which people have traditionally interacted with marine resources in the various archipelagos, and any important cultural relationships that have developed over time in association with these resources.

The most culturally important resource considerations associated with any island environments in the Pacific is the human relationship with marine life and use of marine resources for sustenance. Notably, three of the four resource areas covered within the PIFSC region are officially designated as "fishing communities, where said communities are defined as being substantially engaged in the harvest or processing of fishery resources to meet social and economic needs" (Allen and Bartram 2008). On April 19, 1999, NMFS approved identification of American Samoa, the Northern Mariana Islands, and Guam as fishing communities. The HARA is the only area in which the designation of fishing community was thought to be too general, and it was suggested that the agency work to identify smaller fishing communities within HARA and that each of the populated islands in the Hawaiian Archipelago be designated as fishing communities (Allen and Bartram 2008). The following sections outline the information used to identify culturally important resources within each of the PIFSC research areas.

3.3.1.1 Hawaiian Archipelago Research Area (HARA)

Traditionally, every aspect of life in Hawaiʻi was influenced by the natural surroundings of the island environment. Polynesian voyagers discovered the Hawaiian Islands, and their descendants have now inhabited the islands for thousands of years. Indigenous Hawaiians are known as kanaka maoli. The system of beliefs embraced by many kanaka maoli holds that everything, whether in the sky, land, or sea is laʻa or sacred. Within the traditions of the ancient Hawaiians fishing, fish ponds, and agricultural zones provided food for aliʻi (royalty) and commoners alike. Fishponds were a particularly important component of the ancient food production system, as was gleaning along the reef and shoreline, and fishing in the nearshore zone and deep sea. Fishing, small-scale agriculture and, to a lesser extent use of fish ponds, remain culturally important practices for many indigenous Hawaiians today.

Many marine resources retain cultural importance among contemporary Hawaiians. These include a wide variety of fish species, sea turtles, sharks, rays, and other creatures. Some species assume particular importance as ʻaumakua, or family gods. These take on the shape of animals, including sharks, octopus, cowries, and other creatures of sea and land.

Green, hawksbill, and olive ridley sea turtles are the subjects of rich traditional importance throughout the Pacific islands, including Hawai'i. The eggs, red meat, and viscera of sea turtles were eaten and esteemed by native inhabitants for many centuries (NMFS and USFWS 1998a). The shell and bones of the hawksbill sea turtle were used for a wide variety of ornamental and practical uses, including tools (Johannes 1986 as cited in NMFS and USFWS 1998b). Modern laws preclude harvest of turtles in Hawai'i, but interest in the traditional pursuit and consumptive use of the creatures continues to be expressed by many indigenous residents. Additional information regarding the cultural importance of sea turtles in the Pacific Islands can be found in Tauto'o-Bartley et al. (1993), Balazs (1982, 1983a, 1983b, 1985), Hiatt (1951), Johannes (1981), Lessa (1962), Tobin (1952), and Tobin et al. (1957), among others.

The nature of relationships between humans and sharks varies depending on geographic location in the HARA, the species or type of shark, and the context in which the descriptions are made (NOAA 2012d). Sharks have long been revered as influential spirits by Native Hawaiians. Sharks have also been fished for food, to acquire teeth for weapons and tools, and skin for drum heads and ceremonial uses (Taylor 1993 as cited in NOAA 2012d). Additional information regarding the historical and cultural importance of sharks within the HARA can be found in Taylor (1993).

In addition to the cultural role of marine resources, many ocean and coastal sites are of cultural and historic importance to Native Hawaiians. There are also a variety of marine protected areas in the HARA, several of which include provisions that allow for traditional use of marine resources (see Section 3.1.2.3). The Papahānaumokuākea Marine National Monument is particularly important, and some 140 archaeological sites have been documented around the Monument. The islands of Nihoa and Mokumanamana, both within Papahānaumokuākea Marine National Monument, are listed on the National Register of Historic Places (NOAA 2008). A wide variety of submerged cultural artifacts and properties have been identified around the HARA. These include: heiau (ancient Hawaiian temples or shrines), other prehistoric sites, historic shipwrecks, downed airplanes, and various other historic sites. There can be no doubt that additional cultural resources have yet to be found and would likely be documented in various nearshore zones around the islands probably buried above the high tide line.

3.3.1.2 Mariana Archipelago Research Area (MARA)

The MARA includes the Commonwealth of the Northern Mariana Islands (CNMI) and the Territory of Guam. Initial human occupation of the region occurred at least 3500 years ago after skilled mariners discovered the region during voyages of unprecedented distance. Fishing hooks, spear points, sinkers, lures, and the remains of a variety of fish species have been recovered from archeological sites around the region. This is indicative of extensive human reliance on the region's marine resources following initial colonization (Amesbury and Hunter-Anderson 2003, Amesbury 2006).

A Jesuit mission was established in the Marianas in 1668, initiating a long period of social change among descendants of the original seafaring settlers. These descendants were known as Chamorro, a term deriving from the indigenous *chamorri*, meaning "of high caste." Typhoons and tsunami events in the Caroline Islands led the indigenous seafaring people known as Refaluwasch to immigrate to the Mariana Archipelago during the early 19th century. Sometimes called Carolinians, members of this culture group migrated primarily to Saipan, where they continue to perpetuate a unique Micronesian language and way of life. Contemporary residents of Chamorro and Refaluwasch ancestry retain certain traditional values and concepts relating to the marine environment. In the context of fishing and community life, such values are expressed in ways that include extensive consumption and sharing of seafood in extended family settings, with special emphasis on consumption of seafood during religious festivals, weddings, funerals, christenings, and various holidays.

The Guam National Wildlife Refuge and the Marianas Trench MNM are the principal marine protected areas in the MARA. (NOAA 2013a) Both areas are of cultural importance to indigenous and other

residents of the region and provide important opportunities for traditional fishing activities and related cultural practices.

3.3.1.3 American Samoa Archipelago Research Area (ASARA)

Islands in the Samoa Archipelago were discovered and settled by Polynesian voyagers at least 3,000 years ago (Kirch 2000). Fishing and small-scale agricultural pursuits sustained the settlers throughout many centuries across the Samoa Islands. The eastern islands would eventually be administered as a U.S. Territory. The western islands are now known as the Independent State of Samoa. As has been the case for many centuries, harvest and distribution of marine resources have traditionally been organized through hierarchical political arrangements in village settings across the islands. Strong adherence to traditional social and cultural norms and pursuit and consumptive use of seafood have long been central aspects of Fa‘a Samoa or the Samoan way of life. Localized management of marine resources is particularly important in this context; this is typically accomplished through direct oversight of fishing activities near the village in question. Nearshore and coral reef fisheries are of fundamental sociocultural and dietary importance for many American Samoans. It has become clear that establishment of marine protected areas in the region requires the extensive involvement of local community leaders (Levine and Allen 2009).

The Rose Atoll MNM is of cultural importance to indigenous and other residents of American Samoa and also provides important opportunities for traditional fishing activities and related cultural practices. For example, the atoll is known to Samoans, who have periodically visited over the past millennium, as “Nu‘u O Manu” (“Village of seabirds”). It is believed that Polynesians have harvested at Rose Atoll for millennia and several species, including the giant clam, were used for cultural celebrations and events (74 FR 1577).

3.3.1.4 Western and Central Pacific Research Area (WCPRA)

As described in Section 3.1.1.4, The Western and Central Pacific Research Area (WCPRA) consists of Johnston, Palmyra, and Wake Atolls; Kingman Reef; and Baker, Howland and Jarvis Islands. Midway Atoll (in the HARA), Johnston Atoll, and Wake Atoll are of strategic significance to U.S. military forces.

Although the islands and atolls of the WCPRA are remote from large population centers, each has been important to humans over the millennia. Archaeologists have discovered a variety of prehistoric structures, stone paths and pits on exposed lands across this remote region. There is also evidence of human activity during the historic era, including basic exploration, extraction of guano for fertilizer, whaling, pirating, and various military actions. Jarvis and other islands were strategically colonized during World War II, but the settlements were eventually abandoned. The USFWS and the Department of the Army now manage natural resources on the various islands and atolls (see Section 3.1.2.3). On September 25, 2014, the PRIMNM was expanded from 50 nm to 200 nm for Jarvis Island, Wake Atoll, and Johnston Atoll. This expansion of Monument boundaries to the full extent of each EEZ has the potential to affect pelagic fishing activities in the region, most of which are conducted by the Hawai‘i-based longline fleet.

3.3.2 PIFSC Region Background

PIFSC is headquartered in Honolulu, Hawai‘i, and has field offices located in Pago Pago, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. The Pacific Islands Region's jurisdiction includes activities in both domestic and international waters, with a focus on managing fisheries based off Hawai‘i, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the PRIAs (Kingman Reef; Howland, Baker, and Jarvis islands; and Johnston, Midway, Palmyra, and Wake atolls) (NOAA 2013d). Federal fisheries in the western Pacific region are managed by the WPRFMC and NMFS under five fishery ecosystem plans. In addition to management oversight

provided by the WPRFMC and NMFS, pelagic fish species such as bigeye and yellowfin tunas are also managed by two regional fishery management organizations. The Western and Central Pacific Fisheries Commission (WCPFC) is active in the western and central Pacific Ocean, and the Inter-American Tropical Tuna Commission (IATTC) is active in the eastern Pacific Ocean. Species under the purview of the WCPFC and IATTC migrate across international boundaries and require coordinated management between countries with fishing interests in the Pacific Ocean (NMFS 2012).

PIFSC conducts field and laboratory research to help conserve and manage the region's living marine resources in compliance with the Magnuson-Stevens Fishery Conservation and Management Act of 1996, the Marine Mammal Protection Act of 1972, and the Endangered Species Act of 1973. The 1996 amendments to the MSA require assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities (NMFS 2007). The MSA states:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

NMFS conducts community studies and develops statistical methodologies and economic models for identifying and describing communities substantially engaged in fishing. This information is ultimately utilized by fishery managers, whose decisions balance the needs of a variety of fisheries communities and users. PIFSC research surveys occur both inside and outside the U.S. EEZ, and span across multiple ecological, physical, and political boundaries (NOAA 2014f).

As discussed in Chapter 1, NOAA participates in the LME approach to marine resources management. Sixty-four LME's have been identified around the world's coastal margins. PIFSC research activities occur in the Insular Pacific-Hawaiian LME. Briefs have been developed about each LME that typify the regions (Sherman and Kempel 2009). One of the five modules considered in the LME management model are socioeconomic metrics. Indexes have been developed to analyze marine activities and management. These include estimates of industrial activity, including shipping and oil; aquaculture, and tourism. A socioeconomic index, which represents a region's economic and institutional resources available to manage LME resources, has been developed, and is shown in Table 3.3-1 (Hoagland and Jin 2006). In general, a higher Marine Industry Activity Index indicates an increased management requirement, and a higher socioeconomic index indicates higher levels of resources available to manage the LME.

Table 3.3-1 Pacific-Hawaiian Large Marine Ecosystems Ranked by Socioeconomic Index

Large Marine Ecosystem (LME)	World Rank	Socioeconomic Index	Fishery & Aquaculture Index	Tourism Index	Ship and Oil Index	Marine Industry Activity Index
Insular Pacific-Hawaiian	16	93.9	17.438	57.893	43.969	41.448

Source: Hoagland and Jin 2006

Pacific Island fishing communities are dependent on or engaged in a variety of commercial and non-commercial fisheries. PIFSC conducts community studies about cultural traditions, local knowledge, and socioeconomic values associated with marine resource use and conservation in Pacific Island communities and thereby generates sufficient information with which to evaluate the social and economic

impacts of management options and regulatory decisions on all segments of society. Research is conducted by the Socioeconomics Program (NOAA 2014f).

The Socioeconomics Program undertakes numerous studies to examine and document fishing community characteristics. For example, the group reported baseline socioeconomic and fishing information with regard to Guam in 2008, (Allen and Bartram 2008), American Samoa in 2009 (Levine and Allen 2009), and the Commonwealth of the Northern Mariana Islands in 2012 (Allen and Amesbury 2012). NMFS also provides *Fishing Communities of the United States* (NMFS 2009) which estimates community engagement and dependence on managed fisheries around the nation. Factors included in the estimations include commercial market conditions, non-commercial fishing expenditures and levels of participation, key species, and community profiles. The profiles are developed using data regarding participation in commercial and non-commercial fisheries, residence patterns of the fishermen, the distribution of processing and support sector facilities, and various other information.

3.3.3 Commercial Fisheries of Hawai‘i

Fisheries Economics of the United States 2012 analyzed data for Hawai‘i through 2012 (NMFS 2014b). The commercial fisheries vary from shore-based algae (*limu*) harvesting by hand, to large vessel-based fisheries, such as the high seas pelagic longline fishery (WPFIN 2013a). Commercial fishing (i.e., selling catches or providing charter fishing services) in Hawai‘i requires purchasing an annually renewable commercial marine license.

In 2011, there were 4,096 licensed commercial fishers in the Main Hawaiian Islands (WPacFIN 2013a). Fishermen earned a total of $92 million from the commercial harvest in 2012, landing over 29 million pounds of finfish and shellfish. Tunas comprised 73 percent of landings revenue ($67 million) as well as 63 percent of total landings (19 million pounds). Swordfish ($6.7 million), mahimahi ($4.3 million), moonfish ($2.9 million), and marlin ($2.4 million) also contributed to landings revenue. Lobsters commanded the highest ex-vessel price in 2011, with an average annual price of $10.39 per pound (NMFS 2014b). Table 3.3-2 shows landings and revenue data of bigeye tuna for 2007 to 2012 for the Hawai‘i area.

In 2012, Hawai‘i’s seafood industry generated $855 million in sales impacts, $262 million in income impacts, and approximately 11,000 full- and part-time jobs (NMFS 2014b). Table 3.3-3 shows Hawai‘i landings data. While not as high in poundage of fish and shellfish landed, the port of Honolulu ranks in the top tier of revenues among U.S. ports.

Table 3.3-2 Commercial Landings, Revenue, and Top Species for Hawai'i 2007-2012

All Species			Top Species					
Year	**Pounds**	**Revenue**	**Pounds**	**Revenue**	**Price per Pound**	**Top Species**	**Top Species Percent of All Species (Pounds)**	**Top Species Percent of All Species (Revenue)**
HAWAI'I								
2007	28,934,161	$75,689,863	12,875,412	$41,973,244	$3.26	Bigeye Tuna	44.50%	55.45%
2008	30,651,522	$84,876,949	13,373,442	$49,674,933	$3.71	Bigeye Tuna	43.63%	58.53%
2009	26,906,045	$71,202,455	10,750,161	$39,365,990	$3.66	Bigeye Tuna	39.95%	55.29%
2010	28,068,656	$84,043,763	13,059,807	$50,859,560	$3.89	Bigeye Tuna	46.53%	60.52%
2011	29,289,341	$91,564,734	12,879,550	$53,110,037	$4.12	Bigeye Tuna	43.97%	58.00%
2012	31,047,571	$112,299,781	13,963,977	$64,659,092	$4.63	Bigeye tuna	44.98%	57.58%

NMFS 2014c

http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings-with-group-subtotals/index

Table 3.3-3 Hawai'i Landings 2006 – 2012

Year	U.S. Rank (by pounds)	Port	Millions of Pounds	Millions of Dollars	US Rank (by dollars)
2006	38	Honolulu, HI	20.9	$54.60	4
2007	28	Honolulu, HI	24.2	$64.30	6
2008	29	Honolulu, HI	26	$73.30	5
2009	29	Honolulu, HI	22.3	$59.40	8
2010	31	Honolulu, HI	23.5	$71.60	9
2011	36	Honolulu, HI	22.8	$83.00	11
2012	34	Honolulu, HI	27.1	$101.10	5

Source: (NMFS 2014d,e)

3.3.4 Non-Commercial Fisheries of Hawai‘i

Non-commercial fisheries of Hawai‘i include recreational, subsistence, and traditional fishing practices. In 2012, non-commercial anglers in Hawai‘i took an estimated 1.5 million fishing trips. Key non-commercial species included blue marlin, mahimahi, goatfishes, trevallys and other jacks, scad, skipjack tuna, smallmouth bonefish, snappers, wahoo, and yellowfin tuna. Scads (bigeye and mackerel) were the most frequently harvested species group (608,000 fish). As is typical in Hawai‘i, the vast majority of recreationally captured fish are ultimately consumed rather than released (NMFS 2014b).

NMFS estimates non-commercial fishing activity based on a variety of data sources. For Hawai‘i, data is partially derived from mail and phone surveys, with contacts sampled from saltwater and freshwater fishing licenses. NMFS uses an input-output economic model to generate metrics for assessing the contributions of fishing to the economy as per expenditures related to marine non-commercial fishing. These impacts are shown in shown in Table 3.3-4 and summarized below.

Total angler expenditures on non-commercial fishing in Hawai‘i were $285 million in 2011. Non-commercial fishing in Hawai‘i contributed approximately 2,900 full-time and part-time jobs to the state’s economy, generated $311 million in output (sales), $186 million to the state’s gross domestic product, and $119 million in personal and proprietors’ income. Federal, state, and local governments received $52 million in taxes derived from statewide non-commercial fishing activity in 2011 (Lovell et al. 2013).

Table 3.3-4 Total Economic Impacts Generated from Non-Commercial Fishing in Hawai‘i in 2011

	Expense ($1,000)	Economic Contribution				Taxes ($1,000)
		Employment (Jobs)	Income ($1,000)	Value Added ($1,000)	Output ($1,000)	
Hawai‘i	$284,912	2,861	$118,815	$186,196	$310,782	$52,219

Source: Lovell et al. 2013

3.3.5 Fishing Communities of Hawai‘i

NMFS has identified each of the main inhabited islands as fishing communities (NMFS 2009). These include Hawai‘i (2010 pop. 185,079), Kaua‘i (pop. 66,921), Lana‘i (pop. 3,135), Maui (pop. 144,444), Moloka‘i (pop. 7,345), Ni‘ihau (pop 170), and O‘ahu (pop. 953,207) (US Census 2010, 2012). Certain fishing activities are somewhat localized in sub-areas of the islands. Per capita income for the U.S. was $27,915 by 2011, and $29,203 for the state. The poverty rate for the U.S. in 2011 was 14.3 percent, and in the state of Hawai‘i, it was 10.2 percent. The overall unemployment rate for the state was 6.4 percent, as compared to 9.6 nationwide. Demographics vary widely across the islands, however. Although there is some overlap in the data between island and county statistics, it is evident that the poverty rate on the Island of Hawai‘i reaches 15.8 percent. Per capita income on Kaua‘i and Maui surpass $60,000, while the island of Hawai‘i is $25,573 (US Census 2012).

Honolulu is the home port for the Hawai‘i-based longline fleet, the most wide-ranging and productive commercial fleet in the U.S. Pacific Islands. The longline fleet is divided into two fisheries: the shallow-set and deep-set. The shallow-set fishery targets swordfish near the ocean surface, while the deep-set targets bigeye and yellowfin tunas. The shallow-set fishery has approximately 18 participants, while the deep-set fishery has approximately 128 participants (79 FR 77919). Fishing comprises a relatively small component of the state’s total economy, but is critically important in an absolute sense to participating individuals and families. Distinctions between commercial and non-commercial are sometimes indiscernible, as commercial fishing licenses are inexpensive, allowing fishers to sell part of their catch.

Charter fishing and related forms of recreation contribute to the state's tourism economy. Non-commercial fishing is an important part of the Hawaiian culture, and sharing of seafood among family and friends are particularly important local traditions (NMFS 2009).

3.3.6 Economics and Fisheries of the U.S. Insular Areas

3.3.6.1 American Samoa

American Samoa is an unincorporated territory of the United States. The territory is located 2,300 miles southwest of Hawai'i. It is made up of seven islands: Tutuila, Aunu'u, the Manu'a group (Ta'u, Olosega, and Ofu), Rose Island, and Swains Island. Tutuila is the largest island (Levine and Allen 2009). The 2010 population of the territory was 55,519 persons, with an unemployment rate of 9.2 (US Census 2012).

American Samoa's economy is driven in large part by the American Samoan government, which receives various subsidies and grants from the U.S. government, and a tuna cannery on the main island of Tutuila. Tuna canning is the largest private-sector source of employment in American Samoa, and it drives many aspects of the economy. Until 2009, StarKist Samoa, the largest tuna cannery in the world, produced more than 60 percent of American Samoa's canned tuna, while Chicken of the Sea produced the remaining 40 percent (Levine and Allen 2009). On September 30, 2009, Chicken of the Sea closed its American Samoa cannery. In January 2015, Tri-Marine International opened a new cannery in American Samoa (Pacific Islands Development Program 2015).

Pago Pago is home port for a fleet of large commercial vessels operating outside the American Samoa EEZ. These vessels deliver albacore to the region's canneries. The territory is exempt from the Nicholson Act, which prohibits foreign ships from landing catches in U.S. ports. American Samoa products can also enter the United States duty-free if less than 50 percent of market value is derived from foreign sources (Levine and Allen 2009).

During 2011, fisheries monitoring programs identified 40 active commercial fishing vessels in American Samoa - 36 homeported on Tutuila and 4 in the Manuʿa Islands. Many of these vessels participated in more than one fishery, and 27 of the Tutuila boats (including 23 vessels which were over 50 feet in length) did at least some longlining. Of the 40 total boats, 20 participated in the troll and bottomfish fisheries and 3 were used in other forms of fishing activity, including spearfishing. Essentially all of the longlining was based out of Tutuila, where the majority of the catch was offloaded to the cannery (WPFIN 2013b). For 2011, commercial fishers landed 7,395,871 pounds of fish, generating revenue of $8,737,679. The catch was dominated by albacore tuna, which accounted for 5,098,823 pounds and $5,943,777 in revenue (WPFIN 2013b).

Tourism plays a limited role in the American Samoa economy. Nearshore fishing is undertaken largely for purposes of subsistence. Extensive fish and shellfish are harvested by local residents from reef areas adjacent to the island villages (Levine and Allen 2009). As in Hawai'i, cultural, subsistence, and recreational forms of fishing can be difficult to clearly distinguish.

3.3.6.2 Commonwealth of the Northern Mariana Islands (CNMI)

The CNMI is a group of 14 islands in the western Pacific Ocean that is recognized as an unincorporated territory in political union with the United States, as described in the covenant (Public Law 94-241) that was enacted March 24, 1976. In 2010, the CNMI had a population of 53,883 persons and an unemployment rate of 8.1 percent (US Census 2012). Saipan, Tinian, and Rota in the southern arc are the largest islands in CNMI, followed by Pagan and Agrihan in the northern arc. The southern islands are much more densely inhabited. The U.S. EEZ surrounding CNMI covers 292,712 mi^2. The CNMI EEZ abuts Guam's EEZ to the south and Japan's EEZ to the north (Allen and Amesbury 2012).

The chief domestic commercial fishery of CNMI is mainly a small boat, troll fishery. Most of the boats are 12- to 24-ft, outboard-powered, runabout-type vessels that make trolling trips of generally a day or less in duration. A few larger boats have been used in recent years for bottomfishing around the islands north of Saipan. A small charter fleet also exists. Trolling is the most common fishing method, but bottomfishing and reef fishing are also popular. Reef fishes make up a major portion of the total commercial catch and are an important component of the local diet. The majority of the domestic catch is consumed locally (WPFIN 2013c) Commercial fishers landed 217,092 pounds of fish, with revenues of $503,821. The largest catch was skipjack tuna, at 58,420 pounds and $113,308 in revenue (WPFIN 2013c).

The most frequently caught fish around Saipan in 2010 were reef-associated (caught by 54 percent of the anglers), followed by shallow-water bottomfish (23 percent) and reef invertebrates such as octopus, shellfish and crabs (14 percent). The median monthly catch was 40 pounds per person. Saipan anglers reported that 70 percent of their catch was consumed by themselves and immediate family, with another 20 percent consumed by extended family and friends. Only 8 percent of the catch was sold, not surprising given that the anglers had social and cultural reasons for fishing, rather than economic motivations (Allen and Amesbury 2012).

3.3.6.3 Guam

Guam is the southernmost island of the Mariana Archipelago. It has been an unincorporated U.S. territory since 1898. Although it is the largest island in Micronesia, Guam is only 209 mi^2. The EEZ is approximately 82,400 mi^2, and lies adjacent to the CNMI and Federated States of Micronesia EEZs.

Guam's economy has been dominated by tourism and the U.S. military (Allen and Bartram 2008). The 2010 population of Guam was 159,358 persons. The 2012 unemployment rate was 8.2 percent (US Census 2012).

Fishing activities on Guam occur in both the neashore and pelagic zones. Offshore fishing typically involves 1 or 2-day troll and bottomfish trips. These usually originate from one of the three principal harbors located on the west coast and southern tip of the island. Inshore fishing is usually conducted without the use of a boat and consists mostly of nearshore casting, throw-netting, and spearfishing. There are three sources of fish in Guam's commercial market: (1) full-time commercial fishers; (2) part-time commercial fishers; and (3) subsistence or recreational "expense" fishers who frequently sell portions of their catch to help defray costs. Licenses are not required to sell fish on Guam, nor are there any reporting requirements for those selling fish (WPFIN 2013d).

While commercial fisheries have made a relatively minor contribution to Guam's economy, the area historically has functioned as a major point of seafood transshipment and resupply (Allen and Bartram 2008). Guam commercial fishers landed 265,483 pounds of fish and shellfish in 2011, with revenues of $677,765. The largest catch by weight was mahimahi, at 53,649 pounds, with revenues of $118,238. Parrotfishes, at 37,247 pounds, with revenues of $120,584, brought in more revenue than any other catch (WPFIN 2013d).

The people of Guam, including various immigrant communities, continue to depend on fishing and locally caught seafood to reinforce and perpetuate cultural traditions such as community sharing of food (Allen and Bartram 2008).

3.3.7 PIFSC Operations

Research-related spending directly generates jobs and income, and benefits businesses in the private economy by expenditures on research-related equipment. PIFSC is headquartered in Honolulu, Hawai'i. PIFSC is responsible for scientific research on living marine resources that occupy marine and estuarine habits of the western Pacific Ocean. The PIFSC annual budget from fiscal year 2010-2012 averaged about

$29.2 million and supported a staff of 222 researchers, technical personnel, and administrative employees, including a mixture of federal and non-federal staff (Pooley 2013).

PIFSC research contributes to local economies through operational support of NOAA vessels and contracted vessels (fuel, supplies, crew wages, shoreside services), operational costs of research support facilities (utilities, supplies, services), and employment of researchers who live in nearby communities.

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4.1 INTRODUCTION AND ANALYSIS METHODOLOGY

This chapter presents an analysis of the potential direct and indirect effects of the alternatives on the physical, biological, and social environments consistent with Section 1502.16 of the Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations (40 Code of Federal Regulations [CFR] Part 1500) and NOAA Administrative Order 216-6 (Environmental Review Procedures for Implementing the National Environmental Policy Act). Four alternatives have been brought forward for detailed analysis (see Chapter 2):

- The No Action/Status Quo Alternative, where fisheries and ecosystem research programs conducted and funded by PIFSC would be performed as they were over the past five years. This is considered the No Action Alternative for ongoing programs under NEPA.
- The Preferred Alternative, where PIFSC would conduct some new research activities and implement new protocols intended to mitigate impacts to protected species in addition to those described under the Status Quo Alternative.
- The Modified Research Alternative, where PIFSC would conduct fisheries and ecosystem research with scope and protocols modified to minimize risks to protected species.
- The No Research Alternative, where PIFSC would no longer conduct or fund fieldwork in marine waters for the fisheries and ecosystem research considered in the scope of this Programmatic Environmental Assessment (PEA).

In addition to a suite of fisheries and ecological research conducted or funded by PIFSC as the primary federal action, the first three alternatives would also include promulgation of regulations and subsequent issuance of Letters of Authorization (LOAs) under Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) for the incidental, but not intentional, taking of marine mammals as the secondary federal action.

As was discussed in Chapter 1 of this DPEA, the National Marine Fisheries Service (NMFS) is fundamentally a science-based agency, its primary mission being the stewardship of living marine resources through science-based management. The first three alternatives evaluated in this DPEA would enable PIFSC to collect scientific information that otherwise would not be fully replaced by other sources, while the fourth alternative considered would not enable the collection of such information and data essential for the science-based management of living marine resources. In NMFS view, the inability to acquire such scientific information would ultimately imperil the agency's ability to meet its mandate to manage living marine resources. Similar concerns apply specifically to the conservation and management of protected species, their habitats, and other marine ecosystem components. However, several plausible scenarios (such as federal budget cuts, legal actions against NMFS, or natural disasters affecting PIFSC facilities) could potentially result in the discontinuation or severe curtailment of the PIFSC fisheries and ecosystem research activities for a period of time. The No Research Alternative therefore allows NMFS to examine the effects on the human environment of discontinuing federally funded fisheries and ecosystem research in the PIFSC research areas.

4.1.1 Impact Assessment Methodology

The authors of the sections in this chapter are subject matter experts. They developed a discussion of the effects of each alternative on each resource type based on best professional judgment; relying on the collective knowledge of other specialists in their respective fields, and the body of accepted literature.

The impact assessment methodology consists of the following steps:

1. Review and understand the proposed action and alternatives (Chapter 2).

2. Identify and describe:
   a. Direct effects that would be "caused by the action and occur at the same time and place" (40 CFR § 1508.8(a)), and
   b. Indirect effects that would be "caused by the action and (would occur) later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR § 1508.8(b)).
3. Compare the impacts to the baseline conditions described in Chapter 3 and rate them as major, moderate, or minor. In order to help consistently assess impacts and support the conclusions reached, the authors developed a criteria table that defines impact ratings for the resource components (Table 4.1-1). The criteria provide guidance for the authors to place the impacts of the alternatives in an appropriate context, determine their level of intensity, and assess the likelihood that they would occur. Although some evaluation criteria have been designated based on legal or regulatory limits or requirements (see description of criteria for marine mammals below), others are based on best professional judgment and best management practices. The evaluation criteria include both quantitative and qualitative analyses, as appropriate to each resource. The authors then determine an overall rating of impacts to a given resource by combining the assessment of the impact components.

As described in Section 1.4, the reason an EA is developed is to determine whether significant environmental impacts could result from a proposed action and to inform the decision about whether an Environmental Impact Statement needs to be developed. If no significant impacts are discovered, NMFS can document its decision on the proposed action with a Finding of No Significant Impact. The assessment methodology described in this section is consistent with NOAA Administrative Order 216-6, which provides guidance on how the agency should make determinations of significance in NEPA documents.

Table 4.1-1 Criteria for Determining Effect Levels

Resource Components	Assessment Factor	Effect Level		
		Major	Moderate	Minor
Physical Environment	Magnitude or intensity	Large, acute, or obvious changes that are easily quantified	Small but measurable changes	No measurable changes
	Geographic extent	> 10% of project area (widespread)	5-10% of project area (limited)	0-5% of project area (localized)
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Biological Environment	Magnitude or intensity	Measurably affects population trend	Population level effects may be measurable	No measurable population change
		For marine mammals, mortality and serious injury greater than or equal to 50% of PBR[1]	For marine mammals, mortality and serious injury between 10% and 50% of PBR	For marine mammals, mortality and serious injury less than or equal to 10% of PBR

Resource Components	Assessment Factor	Effect Level		
		Major	Moderate	Minor
	Geographic extent	Distributed across range of a population	Distributed across several areas identified to support vital life phase(s) of a population	Localized to one area identified to support vital life phase(s) of a population or non-vital areas
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Social and Economic Environment	Magnitude or intensity	Substantial contribution to changes in economic status of region or fishing communities	Small but measurable contribution to changes in economic status of region or fishing communities	No measurable contribution to changes in economic status of region or fishing communities
	Geographic extent	Affects region (multiple states)	Affects state	Affects local area
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible

1. Potential Biological Removal (PBR).

4.1.2 Impact Criteria for Marine Mammals

The impact criteria for the magnitude of effects on marine mammals have been developed in the context of two important factors derived from the MMPA. The first factor is the calculation of Potential Biological Removal (PBR) for each marine mammal stock. The MMPA defined PBR at 16 U.S.C. § 1362(20) as, "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." PBR was intended to serve as an upper limit guideline for anthropogenic mortality for each species. Calculations of PBR are stock-specific and include estimates of the minimum population size, reproductive potential of the species, and a recovery factor related to the conservation status of the stock (e.g., whether the stock is listed under the Endangered Species Act (ESA) or depleted under the MMPA). NMFS and USFWS are required to calculate PBR (if possible) for each stock of marine mammals they have jurisdiction over and to report PBR in the annual marine mammal stock assessment reports (SARs) mandated by the MMPA. The PBR metric has been used extensively to assess human impacts on marine mammals in many commercial fisheries involving mortality and serious injury (M&SI) and is a recognized and acceptable metric used by NMFS Office of Protected Resources in the evaluation of commercial fisheries incidental takes of marine mammals in U.S. waters as well as for other sources of mortality such as ship strikes.

The second factor is the categorization of commercial fisheries with respect to their adverse interactions with marine mammals. Under Section 118 of the MMPA, NMFS must classify all U.S. commercial fisheries into one of three categories based on the level of marine mammal M&SI that occurs incidental to each fishery, which it does in the List of Fisheries (LOF) published annually. Category III fisheries are

considered to have a remote likelihood of or no known incidental M&SI of marine mammals. Category II fisheries are those that have occasional incidental M&SI of marine mammals. Category I fisheries are those that have frequent incidental M&SI of marine mammals. A two-tiered classification system is used to develop the LOF, with different thresholds of incidental M&SI compared to the PBR of a given marine mammal stock.

However, the LOF criteria is primarily used for managing commercial fisheries based on their actual levels of marine mammal M&SI and is not necessarily designed to assess impacts of projected takes on a given marine mammal stock. Because the analysis of direct impacts of PIFSC research on marine mammals in this DPEA is based on projected takes rather than actual takes, we use a similar but not identical model to the LOF criteria.

In spite of some fundamental differences between most PIFSC research activities and commercial fishing practices, it is appropriate under NEPA to assess the impacts of incidental takes due to research in a manner similar to what is done for commercial fisheries for two reasons:

- PIFSC research activities are similar to many commercial fisheries in the fishing gear and types of vessels used, and
- PIFSC research plays a key role in providing the scientific data that are used by managers to regulatecommercial fisheries.

As part of the NEPA impact assessment criteria (Table 4.1-1), if the projected annual M&SI of a marine mammal stock from all PIFSC fisheries and ecosystem research activities is less than or equal to 10 percent of PBR for that stock, the effect would be considered minor in magnitude for the marine mammal stock, similar to the LOF's Category III fisheries that have a remote likelihood of M&SI with marine mammals with no measurable population change. Projected annual M&SI from PIFSC research activities between 10 and 50 percent of PBR for that stock would be moderate in magnitude for the marine mammal stock, similar to the LOF's Category II fisheries that have occasional M&SI with marine mammals where population effects may be measurable. Projected annual M&SI from PIFSC research activities greater than or equal to 50 percent of PBR would be major in magnitude for the marine mammal stock, similar to the LOF's Category I fisheries that have frequent M&SI with marine mammals which measurably affect a marine mammal stock's population trend. Note that NEPA requires several other components to be considered for impact assessments (see Table 4.1-1); the magnitude of impact is not necessarily the same as the overall impact assessment in a NEPA context.

In the MMPA LOA application, PIFSC estimated takes for each marine mammal stock are grouped by gear type (e.g., trawl gear and longline gear) with the resulting take request not apportioned by individual research activities (e.g., by survey). This precludes impact analysis at the individual activity or project level within the DPEA.

The contribution of PIFSC research activities to overall impacts on marine mammals will be aggregated with past, present, and reasonably foreseeable future impacts on marine mammals from commercial fisheries and other factors external to PIFSC research activities in the Cumulative Effects analysis in Chapter 5. NMFS will report all sources of M&SI in the annual marine mammal stock assessment reports (SARs), including any incidental M&SI takes that may occur from any of the FSCs. The cumulative effects analysis will use the same impact assessment criteria and thresholds as described in Table 4.1-1, only they will be applied to collective sources of M&SI and other types of impacts on marine mammals.

4.1.3 Impact Criteria for Cultural Resources

PIFSC fisheries and ecosystem research activities have the potential to affect cultural resources both directly and indirectly. This section identifies possible impacts of PIFSC fishery research on cultural resources as outlined under the proposed alternatives.

Section 106 of the NHPA requires that NMFS identify cultural resources that may be impacted by a federal undertaking, and seeks to protect those resources that are listed, or are eligible for listing, on the National Register of Historic Places (NRHP). The NHPA regulations at 36 CFR Part 800 identify a consultative process to determine site eligibility, to evaluate potential impacts, and to identify impact avoidance or mitigation actions. PIFSC initiated the Section 106 process on April 29, 2014 with the State Historic Preservation Offices (SHPOs) and Native Hawaiian Organizations (NHO) to identify historic properties of religious or cultural importance that may be affected by the proposed alternatives within the Area of Potential Effects (APE).

The APE for this project encompasses the marine waters of the Pacific Island Region (i.e., the waters around the State of Hawaiʻi, the Commonwealth of the Mariana Islands, Guam, American Samoa, and the Pacific Remote Island Areas, including the high seas) as outlined in Section 3.1. The APE includes the open ocean waters between the islands listed above as well as the near-shore waters. However, the APE does not include any uplands or beach areas above the high tide line as none of the research activities subject to this DPEA takes place in these areas (see Figure 3.1-2). For example, the activities of the Marine Debris Research and Removal Survey primarily target derelict fishing gear in-water and attached to the reef, though it can include marine debris that has washed ashore but located below the high tide line. Access to the marine waters would be from existing ports, docks, and boat ramps. To date, NMFS has received one response from a stakeholder in Guam and no additional historic properties of religious or cultural importance were identified within the APE. Cultural resources have been described here as either historic or contemporary. A historic cultural resource refers to significant sites listed on the NRHP as well as potential shipwrecks, burial sites, or fishponds of past documented cultural importance that could be affected. Contemporary cultural resources refer to more currently practiced cultural traditions typically in relation to the human relationship with marine resources, and may have a basis in historic cultural practices.

4.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1 – NO ACTION/STATUS QUO ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 1 – the No Action/Status Quo Alternative on the physical, biological, and social environment. Under this Alternative, fisheries research programs conducted and funded by PIFSC would be performed as they have been over the previous five years. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all Resource Componentsevaluated under Alternative 1 is presented below in Table 4.2-1.

Table 4.2-1 Status Quo Alternative Summary of Effects

Resource	Physical Environment	Special Resource Areas and EFH	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
SECTION #	**4.2.1**	**4.2.2**	**4.2.3**	**4.2.4**	**4.2.5**	**4.2.6**	**4.2.7**	**4.2.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.2.1 Effects on the Physical Environment

Section 3.1.1 describes the physical environment within the PIFSC research area. This section describes the effects that PIFSC fisheries and ecosystem research activities may have on the physical environment. The potential effects of fisheries research activities on the physical environment would vary depending on the types of survey gear and other equipment used, but could generally include:

- Physical damage to benthic (seafloor) habitat
- Changes in water quality

4.2.1.1 Physical Damage to Benthic (Seafloor) Habitat

Physical damage to benthic habitat under the Status Quo Alternative could result from the deployment of stationary bottom-contact gear, and to a lesser extent as a result of SCUBA survey operations near coral reefs and coral coring. The Status Quo Alternative also has the beneficial effect of removing derelict fishing gear from the marine environment through activities of the Marine Debris Research and Removal Survey.

Bottom-contact fishing gear and instruments historically used in PIFSC fishery research activities includes lobster traps, hook-and-line bottom fishing, RAMP photo-transects and stereo-video instruments (e.g., BRUVs, BotCam) that temporarily touch or rest directly on the seafloor. In addition, ARMS, ADCPs, BMUs, CAUs, STRs, HARPs, PUCs, RAS, SEAFET/SAMIs, and EARs are either temporarily fixed or anchored to the benthic substrate (Table 2.2-1; also see Appendix A for description of gear types). Temporary anchors (i.e., weights) are used for the BotCam and HARP. These anchors are either two links of three-inch-diameter steel anchor chain, approximately 25-pound steel plates, or concrete masonry blocks. Under rare circumstances, these anchors are not recovered with the instrument. Deployment of stationary bottom-contact gear could result in furrowing and smoothing of small areas of the seafloor, as well as the displacement of rocks and boulders (including coral skeletons), and such damage can increase with multiple contacts in the same area (Morgan and Chuenpagdee 2003; Stevenson et al. 2004). For all of these gear types, direct physical disturbance is typically limited to the point of

anchorage or footprint of the gear. The footprint of a single lobster trap is approximately 0.75 m^2 and consists of a 0.98 x 0.77 x 0.30-m molded polyethelne cage. The footprint of a BRUV is approximately 0.05 m^2 and consists of a 12 mm diameter galvanized steel pipe in a rectangular shape of 1.26 x 0.86 m. The footprint of RAMP visual surveys, including transect lines and photo-transects, is limited to a few square cms per sampling location. ARMS and ADCPs are secured to the substrate using stainless steel stakes or two 81 x 8 x 5-cm weights each. BMUS and CAUs are attached to a single 1.25 x 30-cm stainless steel stake and installed into the substrate while avoiding corals. STRs are each anchored with two 3-lb coated weights and strapped to a dead portion of the reef with cable ties. PUCs are anchored in weighted milk crates on a dead portion of reef. SEAFETs/SAMIs are similarly deployed with weighted anchors on a dead portion of reef. Weights and anchors associated with bottom-contact fishing gear may cause localized impacts to benthic habitat, and can physically damage fragile structure producing organisms such as corals (Macdonald et al. 1996, Eno et al. 2001). However, given the small area affected by stationary bottom-contact fishing gear, the geographic extent of impacts would be limited to less than 0.01 percent of the project area and would therefore be considered localized according to the criteria for determining effects levels, provided in Table 4.1-1.

PIFSC does not use bottom trawl or dredge equipment for any of its research programs under the Status Quo Alternative, and therefore, the impacts to physical habitat that could result from the use of bottom trawl or dredge equipment would not occur in the PIFSC research areas as a result of this alternative.

In general, physical damage to the seafloor would recover within several months through the action of water currents and natural sedimentation. PIFSC fishing gear accidentally lost while conducting surveys could damage benthic substrate, though the direct and indirect effects of lost PIFSC gear such as monofilament and braided polypropylene line on benthic substrates would likely be minor due to the minimal amounts of line typically lost during research (see discussion about potential impacts to corals in Section 4.2.7.1).

Impacts to epifauna, including removal or disturbance of corals and other organisms that produce structure, are discussed in section 4.2.7- Effects on Invertebrates. The removal or disturbance of such structure producing organisms would result in some direct and indirect impacts to the physical environment in the areas where PIFSC collects these organisms or deploys equipment that comes into contact with the seafloor. However, as described in Section 4.2.7, the overall direct and indirect impacts resulting from removal or disturbance of structure organisms would be minor in magnitude, and would involve less than 0.01 percent of the overall project area dispersed over a large geographic area. Although impacts to slow-growing organisms could take several months to recover, the frequency of such impacts would be occasional (or rare) and any resulting impacts to the physical environment would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.2.1.2 Changes in Water Quality

Fishing gear that contacts the seafloor could increase the turbidity of the water by resuspending fine sediments and benthic algae from the seafloor. Resuspension of fine sediments and turnover of sediment could also result in localized increases in the concentrations of dissolved organic material, nutrients, and trace metals in seawater near the seafloor (Stevenson et al. 2004).

Likewise, potentially adverse effects to benthic habitats resulting from discharge of contaminants from vessels used during research surveys are possible, but unlikely. If such effects were to occur, they would be infrequent, temporary, and localized. All NOAA and ocean going vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010b). MARPOL includes six Annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (International Maritime Organization IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V

specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). NOAA vessels and vessels contracted for the performance of PIFSC fisheries and ecosystem research activities are fully equipped to respond to emergencies, including fuel spills, and crew receive extensive safety and emergency response training. These precautionary measures help reduce the likelihood of fuel spills occurring and increase the chance that they will be responded to and contained quickly. Oil spill prevention training and equipment may be more variable on small boats and contracted fishing vessels used in research, although all vessels are required to comply with U.S. Coast Guard regulations on spills. Potential effects on the physical environment resulting from discharged or spilled materials are not gear type dependent and would be negligible to minor throughout the PIFSC research areas.

4.2.1.3 Conclusion

The effects of the Status Quo Alternative on the physical environment include potential changes to benthic habitat and changes in water quality near the seafloor. The geographic extent of any physical impacts to benthic habitats caused by PIFSC fisheries research activities would be limited to less than one one-hundredth of one percent of the total area in each of the four PIFSC research areas, and therefore would be considered minor in magnitude. These effects would certainly occur under the Status Quo Alternative. In general, physical damage to the seafloor would recover within several months. Impacts to slow-growing organisms that produce structure could take longer to recover, however the magnitude of such impacts would be very small given the minimal footprint of bottom-contact gear used by PIFSC and the mitigation measures in place to protect reef habitats. The potential for bottom-contact gear accidentally lost during a survey exists, but it is a remote possibility given the types of gear used. Adverse effects on water quality through accidental contamination from research activities are possible, but unlikely. If such effects were to occur, their intensity, extent, duration, and frequency would be minor. Other effects on water quality could result from the temporary resuspension of sediments and benthic algae; such impacts would be minor in magnitude, temporary in duration, and would be limited to areas near the seafloor.

The overall effects of the Status Quo Alternative on the physical environment would be minor in magnitude, dispersed over a large geographic area, and short-term or temporary in duration. In general, any measureable alterations to benthic habitat would recover within several months through the action of water currents and natural sedimentation. Overall impacts would be considered minor adverse according to the impact criteria in Table 4.1-1.

4.2.2 Special Resource Areas and EFH

Section 3.1.2 describes the special resource areas that occur in the same geographic areas as the PIFSC fishery research activities. This section describes the general types of effects that PIFSC fishery research activities under the Status Quo Alternative may have on the following categories of special resource areas:

- Essential Fish Habitat and Habitat Areas of Particular Concern
- Marine Protected Areas and National Marine Sanctuaries
- International Marine Protected Areas.

4.2.2.1 Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC)

Section 3.1.2.1 describes the areas designated as EFH within the PIFSC research areas. EFH applies to federally managed marine species in both state and federal jurisdictional waters throughout the range of the species within U.S. waters. Where a species' range extends beyond U.S. waters, EFH stops at the boundary. As described in Section 3.1.2.1, EFH includes hard bottom structures underlying the waters

and associated biological communities. These biological communities include corals, seagrass, algae, and mangroves. Effects to these biological communities under the Status Quo Alternative are evaluated in Section 4.2.7.

EFH are identified in fishery management plans (FMPs) and implemented by NMFS to facilitate long-term protection of EFH through conservation and management measures. There are five current FMPs for areas within the PIFSC research region. HAPC are discrete subsets of EFH that provide important ecological functions or are especially vulnerable to degradation. Table 3.1-2 summarizes the EFH and HAPC designations by Management Unit Species (MUS) in the Pacific Islands Region. The combined EFH includes all bottom habitats to a depth of 400 m and the water column to a depth of 1,000 m between the shoreline and outer limit of the EEZ.

PIFSC does not employ bottom trawl or dredge equipment within the HARA, MARA, ASARA, or WCPRA and the magnitude and geographic extent of direct impacts to EFH benthic habitat from other bottom-contact research gear would be minor according to the criteria in Table 4.1-1 (see discussion in Section 4.2.1). Given the small areas affected by PIFSC research activities within EFH and component HAPC areas, effects would be considered localized in geographic extent. Potential effects on EFH / HAPC from PIFSC research activities are also expected to be temporary in duration or short-term. Under the Status Quo Alternative, the overall effects of fisheries research on EFH would be considered minor adverse according to the criteria in Table 4.1-1.

Direct and indirect effects of PIFSC research activities on biological resources within EFH and component HAPC areas are most accurately captured in the assessments of species groups, which are evaluated in Sections 4.2.3-4.2.7.

4.2.2.2 Marine Protected Areas

Under the Status Quo Alternative, PIFSC research activities have the potential to affect Marine Protected Areas (MPAs) both directly and indirectly. As described in Section 3.1.2.3, MPAs within the PIFSC region include: U.S. Marine National Monuments; U.S. National Marine Sanctuaries; U.S. National Parks; U.S. Fish and Wildlife Refuges; Department of Defense Naval Defensive Sea Areas; as well as State and Territorial MPAs. Details of MPAs located within the U.S. EEZ, can be found in Section 3.1.2.4 or on the List of National System Marine Protected Areas (NOAA 2009). In addition, many foreign and international MPAs exist in the central and western Pacific; however, the MPAs in this region only encompass a small fraction of the area where PIFSC research surveys are conducted (see Section 3.1.2.3 and 3.1.2.4).

MPAs vary widely in the level and type of legal protection afforded to the sites' natural and cultural resources and ecological processes. Considering the wide range of conservation goals and varying degrees of legal protection associated with individual MPAs in the PIFSC research areas (see Section 3.1.2.4), it is impractical to assess the impacts of PIFSC research activities to those areas on a case-by-case basis. Locations of sampling sites are often randomized, varying from year to year, and impacts of research surveys within particular MPAs would vary substantially over space and time. In general, the impacts to each of the MPAs under the Status Quo Alternative are a subset of the impacts to specific physical, biological, and socioeconomic resources that are addressed in the resource specific sections of this DPEA.

Potential impacts to the below MPAs include the introduction of diseases to coral reef organisms and the spread of invasive species. Mitigation measures intended to mitigate adverse interations with protected species described in Section 2.2.1.5 would also mitigate adverse interaction between invasive species and MNMs. These measures include procedures to disinfect and clean equipment, gear, and small boats used in the field. Additionally, anti-fouling paint will be applied to the hull and bottom of NOAA vessels every two years. To further mitigate potential impacts, PIFSC does not plan to use partner or contract vessels to conduct work in any MPA.

U.S. Marine National Monuments

Marine National Monuments (MNM) are MPAs with special national significance, designated by Presidential Proclamation to set aside lands and waters of the United States for protection, and requires no public process. Four MNMs are located within the Pacific Islands Region (Figure 3.1 3) and include: Papahānaumokuākea MNM; Rose Atoll MNM; Marianas Trench MNM; and the Pacific Remote Islands MNM. As described in Section 3.1.2.3.1, the four MNM encompass marine water and submerged lands within the PIFSC research areas.

As part of the establishment of these MNM, the monuments contain conservation measures, restrictions of certain activities, and establishment of Reserve Preservation Areas around some islands, atolls, and banks where consumptive or extractive uses are prohibited. The Papahānaumokuākea MNM, which is currently co-managed by NOAA, USFWS, and the State of Hawaiʻi, has specific permitting requirements that need to be met before research activities can occur. The Monument permitting criteria is set forth in Proclamation 8031 and Monument Regulations at 50 CFR Part 404.11. Monument findings and review criteria must be met by applicants to ensure their proposed activities are consistent with Proclamation 8031 and the goals of the Monument Management Plan (NOAA 2015a). The three other monuments were created in 2009 and management is shared between NOAA and USFWS as described in the proclamations. Unlike Papahānaumokuākea MNM, permits are not required for scientific exploration or research activities conducted by or for the Secretaries of Interior or Commerce in monument waters (NOAA 2015b).

Under the Status Quo Alternative, PIFSC would conduct some research activities in monument areas, sanctuaries, or refuges; however, the research activities would be limited, minimally invasive, and extractive sampling would not occur to any considerable extent. Under Alternative 1 research activities occurring within the MNMs would be minimal. Possible PIFSC surveys conducted within the MNMs would include the Reef Assessment and Monitoring Program (RAMP) surveys in nearshore areas using non-invasive survey techniques techniques at randomized locations, as well as life history or other limited specimen collections of fish. The possibility of such surveys occurring within the MNMs is small, and any research activities occurring within these MNMs would meet established conservation measures and restrictions for the location. The Secretary of Commerce, through NOAA, has the primary management responsibility regarding management of marine areas and may permit certain scientific research efforts within the monuments. For all of the areas, fishery-related activities seaward from the 12-nautical mile refuge boundaries out to the 50-nautical mile monument boundary, and to the 200-nm boundary around Jarvis Island, Johnston Atoll, and Wake Atoll, are managed by NOAA. Regarding overlapping of federal jurisdictions, it should be noted that all Federal Monument regulations and restrictions are to be dominant over any other existing federal withdrawal, reservation, or appropriation (NOAA 2015).

Potential direct and indirect impacts of research activities under the Status Quo Alternative would be small but measureable, and would be considered minor to moderate in intensity. Impacts would be important in context as they would affect protected resources. The duration of such impacts would be temporary due to the transient nature of the impacts and short duration of research activities. The geographic extent of the impacts would be local to regional depending on the extent of RAMP surveys within MPA boundaries. As previously stated, RAMP survey locations are selected randomly, and can potentially occur within MPAs. Under Alternative 1 such activities would be minimally extractive, and would occur infrequently. The overall impacts to MNMs under the Status Quo Alternative would be negligible to minor and beneficial due to the survey data collected from PIFSC research surveys providing the scientific basis for fisheries management in the region.

U.S. National Marine Sanctuaries

National Marine Sanctuaries are MPAs with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities.

Within the PIFSC research areas there are two designated National Marine Sanctuaries (NMS), and include the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS), and American Samoa National Marine Sanctuary (ASNMS). Section 304(d) of the National Marine Sanctuaries Act (NMSA) requires interagency consultation between the NOAA Office of National Marine Sanctuaries and federal agencies taking actions that are "likely to destroy, cause the loss of, or injure a sanctuary resource." Sanctuary consultation requires the federal action agency to submit a "sanctuary resource statement," which describes the agency action and its potential effects on sanctuary resources. Sanctuary resource statements are not necessarily separate documents prepared by the federal agency, and may consist of documents prepared in compliance with other statutes such as the NEPA. The following analysis describes the potential effects of PIFSC research activities under the Status Quo Alternative on each of the potentially affected National Marine Sanctuaries within the PIFSC research areas, and provides the requisite information for a sanctuary resource statement pursuant to section 304(d) of the NMSA.

As described in Section 3.1.2.3.2, management of NMSs has been delegated to NOAA's Office of National Marine Sanctuaries by the Secretary of Commerce in accordance with The National Marine Sanctuaries Act of 2000 (NMSA). As part of the establishment of the NMSA, the sanctuaries adhere to conservation measures, restrictions of certain activities, and the prohibition of consumptive or extractive uses.

The purpose of NMSs is to protect specific marine species and their habitat, develop conservation management plans for the protection of marine resources, and also to manage human uses within the sanctuaries. As part of the management process for the sanctuaries, a management plan is used as a guiding document for conservation and management of marine resources. However, the sanctuaries management plan and designation document do not provide for the management of fishing operations (NOAA 2002). Regulations governing access and uses within the HIHWNMS can be found in 15 CFR Part 922 Subpart Q and J. Additionally, it should be noted that there have been proposed changes and regulatory revisions, by NOAA, to the new management plan for the HIHWNMS as part of a boundary and scope expansion for the HIHWNMS to change the name of the sanctuary as well as transition the sanctuary from a single-species management approach to an ecosystem-based management approach.

Several PIFSC fisheries research surveys occur partially within the boundaries of the NMSs within the PIFSC research areas, including sampling of pelagic stages of insular fish species; determining spawning dynamics of highly migratory species; marine debris research and removal; coral reef benthic habitat mapping; deep coral and sponge research; insular fish life history survey and studies; the Pacific Reef Assessment and Monitoring Program (RAMP); the cetacean ecology assessment; the Kona integrated ecosystem assessment cruise; bottomfish surveys; insular fish abundance estimation comparison surveys; gear and instrument development and field trials; lobster surveys; and some surface night-light sampling. Research and survey activities are discussed in more detail in Table 2.3-1.

The potential effects on NMSs resulting from PIFSC research under the Status Quo Alternative are similar or the same as those discussed for physical, biological, and socioeconomic resources elsewhere in this DPEA. These effects primarily involve potential adverse interactions with protected species, and the risk of accidental spills or contamination from vessel operation. While survey activities may occur within NMSs, these activities would have *de minimus* impacts on benthic habitats within sanctuaries because PIFSC does not use bottom-contact trawl equipment or other mobile bottom-contact research equipment within the sanctuaries. Stationary bottom-contact equipment that could potentially influence benthic habitat within NMSs are described in section 4.2.1. PIFSC does not conduct extractive sampling of fish or invertebrates in the water column within sanctuary boundaries. RAMP surveys could potentially occur within the NMSs and would occur in nearshore areas, generally with non-invasive survey techniques. The site selection process for these surveys is randomized so the possibility of such surveys occurring within the NMSs is variable. However, if these surveys were to occur, they may include extractive sampling of

corals within sanctuary boundaries but any such samples, if collected, would be very small (4 cm in diameter) and very small in number. Impacts would be limited to small geographic areas and would be temporary in duration. Impacts would dissipate rapidly upon completion of the research activity. Overall, the effects of Alternative 1 on biological populations, habitats, and biogeochemical cycles within NMSs would be of low intensity and limited due to the short duration of the surveys.

Near-surface and midwater trawl gear, as well as various plankton nets, water sampling devices, and acoustic survey equipment could result in temporary impacts to pelagic habitat within NMSs. Presence of pelagic sampling equipment may result in short-term disturbance or displacement of pelagic species within NMS. The duration of impacts to pelagic habitats within NMSs would generally not extend beyond the duration of the research activity. Effects of surveys on populations of individual species occurring within NMS are addressed in the species specific sections of this report.

PIFSC survey activities within NMS may result in adverse interactions with protected species, including marine mammals. Adverse interactions with marine mammals may include disturbance from vessels and active acoustic equipment and incidental take. Historically there have been limited amounts of interactions with protected species during research activities. Therefore, similar levels of interaction with protected species would be expected to result from the PIFSC research activities included under the Status Quo Alternative. Mitigation measures intended to mitigate adverse interactions with protected species are described in Section 2.2.1.

<u>U.S. National Parks</u>

National Park designations within the PIFSC research areas are located in nearshore areas or inland from the coast. Currently, most PIFSC research activities do not occur in nearshore locations, nor within National Park boundaries, and therefore, potential impacts to National Parks from the suite of research activities proposed under the Status Quo Alternative would be limited.

The National Park Service has jurisdiction over several National Parks and Historic Sites in the Pacific Islands Region that include marine waters within the scope of analysis. National Historic Parks within the PIFSC region are focused on preserving important cultural and historical sites, but within certain park's boundaries, ecologically important coral reefs and seagrass beds can potentially be found. The National Park Service manages these waters as MPAs, however, some research activities and fishing are allowed through their permitting process. Any potential direct or indirect impacts from the activities proposed under the Status Quo Alternative would be minor in intensity, temporary in duration, common in context, and localized to only those near-shore areas influenced by PIFSC research activities. If limited PIFSC survey activities occur in National Parks under the Status Quo Alternative, the overall potential impacts to National Parks within the PIFSC research areas would be negligible to minor.

<u>U.S. Fish and Wildlife Refuges</u>

As described in Section 3.2.2.3, there are nine individual NWRs throughout the Pacific Islands Region. The USFWS's primary objective with designated refuges is to conserve and manage fish, wildlife, and plant resources and habitats for the benefit of present and future generations. In many instances, designated NWRs occur within the boundaries of MNMs and in these instances, the regulations in place for MNMs supersede Refuge regulations.

Under the Status Quo Alternative, PIFSC research activities within the Pacific Islands Region NWRs would include the sampling of the pelagic stages of insular fish species and the spawning dynamics of highly migratory species (with the exception of Hawaiian Islands, Rose Atoll, and Midway NWRs); marine debris research and removal; coral reef benthic habitat mapping; deep coral and sponge research; insular fish life history survey and studies; the Pacific Reef Assessment and Monitoring Program (RAMP); the Cetacean Ecology Assessment (CEA); and some surface night-light sampling. Insular fish

abundance estimation comparison surveys would also occur in the Hawaiian Islands NWR, and lagoon ecosystem characterization would occur within the Palmyra Atoll and Wake Atoll NWRs.

Potential impacts from all surveys conducted within U.S. NWRs would be the same as those described for the MNMs and NMS. Under the Status Quo Alternative, direct and indirect impacts from PIFSC research activities within the refuge or on refuge regulations would continue at current levels and would be minor in intensity as only a small number of resources would be affected and the changes in resource character would be small, but potentially measureable. Impacts could occur to protected resources and therefore the impacted resources are considered important in context. Impacts would be localized and temporary in duration, with the majority of research activity occurring away from the NWRs. Overall the impacts to NWRs under the Status Quo Alternative would be minor.

State and Territorial MPAs

In addition to federally managed MPAs, there are a variety of local territories and state MPAs in the PIFSC research areas. As described and listed in Section 3.1.2.3, specific state and territorial MPAs within the PIFSC research area include Hawaiian MPAs as well as MPAs within American Samoa, Guam, the CNMI, and foreign or international locations. Most of these MPAs are small in size relative to the Marine National Monuments. Under the Status Quo Alternative, PIFSC research activities that occur within the listed state and territorial MPAs are limited and include nearshore surveys such as coral reef benthic habitat mapping and the randomized RAMP surveys.

PIFSC survey activities within state and territorial MPAs may result in impacts to special resources in the MPAs, but in most cases such impacts would be minimal. Interactions with special resource habitats may include disturbance from vessels and incidental take of protected species, but historically PIFSC fisheries research survey activities have not resulted in any takes of protected resources within MPA boundaries. This situation would be expected to continue under the Status Quo Alternative. Mitigation measures intended to mitigate the effects of interactions with protected species are described in Section 2.2.1 of this document.

Of the state and territorial MPAs, various Marine Life Conservation Districts (MLCDs) have been established to help conserve and replenish marine resources. As described in Section 3.1.2.3, eleven MLCDs have been established in Hawaiʻi, as well as various Fishery Management Areas (FMAs), with both being managed by the State of Hawaiʽi Department of Natural Resources, Division of Aquatic Resources. Potential impacts of PIFSC research activities to these MCLDs and FMAs would be minimal due to most research activities happening away from the shoreline. Overall, direct and indirect impacts to state and territorial MPAs under the Status Quo Alternative would be the same or similar to those of federally managed MPAs, but to a lesser extent due to the smaller number of research activities that occur within these MPAs.

4.2.2.3 Conclusion

PIFSC survey activities provide essential information related to the science-based management, conservation, and protection of living marine resources and ecosystem services within these areas. The information developed from PIFSC research activities is essential to the development of a broad array of fisheries, habitat, and ecosystem management actions taken not only by NMFS, but also by other federal, state, and international authorities. Science-based management of marine resources supported by PIFSC research activities included under the Status Quo Alternative would therefore result in beneficial effects on MPAs within the PIFSC research areass.

Potential adverse effects on special resource areas and EFH resulting from PIFSC research activities are expected to be localized in area or extent, short-term or temporary in duration, and result in no measurable changes to the physical environment. The overall direct and indirect effects of the Status Quo

Alternative on special resource areas and EFH are therefore considered minor adverse according to the criteria described in Table 4.1-1.

4.2.3 Effects on Fish

This section describes the effects of PIFSC fisheries and ecosystem research activities under the Status Quo Alternative on fish species in the PIFSC research areas of the HARA, MARA, ASARA, and WCPRA. The Status Quo Alternative includes PIFSC fisheries and ecosystem research as it has occurred over the past five years. The potential effects of research vessels, survey gear, and other associated equipment on fish species found in the research areas would include:

- Mortality from fisheries research activities
- Contamination from discharges
- Disturbance and changes in behavior due to sound sources

4.2.3.1 Mortality from Fisheries Research Activities

Direct mortality of fish could occur as a result of various fisheries and ecosystem research activities proposed under the Status Quo Alternative. Fish are caught in a variety of gear types, some of which involve experimental tests of gears designed to reduce incidental catch of non-target species or protected species. These surveys provide important data to determine biomass estimates, reproductive potential, and distribution of fish stocks, which are necessary for fisheries managers to maintain healthy populations and rebuild overfished or depressed stocks. PIFSC also conducts surveys to provide indices of juvenile abundance that are used to identify and characterize the strength of year classes before fish are large enough to be harvested by commercial or non-commercial fisheries. Stock assessments based on accurate abundance and distribution data are essential to developing effective management strategies.

The majority of fish affected by PIFSC research projects are caught and killed during the below surveys:

- Surface Night-Light Sampling Survey
- Mariana Resource Survey
- Insular Fish Life History Survey and Studies
- Longline Gear Research, Marlin Longline, and NWHI Surveys (discontinued surveys)

The capture rate of fish species in research surveys varies substantially within each research area, with higher numbers in samples from some areas and very low or no individuals collected in other samples. This variability in catch is used to determine species abundance and distribution. Concentrations of biomass and species richness depend on topographic features, water temperature and salinity, prey availability, and other habitat characteristics. Other PIFSC surveys (see Table 2.2-2) have a wide variety of research objectives. Some, such as video camera projects and SCUBA surveys, have no catch of fish. For these surveys, mortality and effects on fish species are non-existent.

The impact of mortality from fisheries research depends on the magnitude of the research catch relative to the overall biomass or population level of the species. Measuring these relative effects is difficult because there are many species for which total biomass estimates have fairly large confidence intervals so comparisons would also have a large range of relative uncertainty. For the purpose of assessing the magnitude of mortality effects in this DPEA, the amount of fish caught in PIFSC research is compared to two different metrics, depending on the species being reviewed. One is the comparison of research catch to commercial and recreational Annual Catch Limit (ACL). ACL requirements were implemented in the 2006 reauthorization of the Magnuson-Stevens Act as a standardized method to track and prevent overfishing. ACLs represent the maximum amount that non-commercial and commercial fishers are

allowed to catch of a species or species group during a pre-determined time period (usually a calendar year). ACLs are generally calculated to be less than the level of catch that a population can sustain prior to being declared overfished, which makes ACLs a useful metric for comparing PIFSC research catch to overall population strength.

However, ACLs are not required for all species. NMFS has not specified ACLs for most pelagic species because they are subject to international fishing agreements or have life cycles of less than a year (e.g., mahimahi). For these species, estimates of the amount caught in commercial and non-commercial fisheries are sometimes available. Non-ACL commercial and non-commercial harvest limits are also generally set at a fraction of theoretical stock biomass so the magnitude of research catches relative to overall population levels would be much less than what is indicated in the comparisons with landings. This DPEA does not attempt to analyze the effects of research mortality on each of the hundreds of species caught in the various surveys. Rather, to demonstrate the effects of research mortality on fish stocks, it analyzes only the effects on species that are caught most frequently in the surveys (average annual catch over 100 pounds) or those that are overfished.

In comparison to commercial fisheries-related mortality, mortality due to research activities occurs in small areas, with less intense effort, and sampling is usually not repeated in the same area, in contrast to commercial fisheries that focus primarily on areas of fish concentrations.

4.2.3.2 Disturbance and Changes in Behavior Due to Sound Sources

There are several mechanisms by which noise sources from research activities could potentially disturb fish and alter behavior, including the physical movement of marine vessels and fishing gear through the water, gear contact with the substrate, and operational sounds from engines, hydraulic gear, and acoustical devices used for navigation and research.

Noise from active acoustic devices used on vessels conducting fisheries research could potentially affect fish. The LOA application (Appendix C, Section 6.2) describes the types of acoustic devices used on PIFSC research vessels. Fish with a swim bladder (or other air bubble) that is near, or connected to, the auditory structures likely have the best hearing sensitivity among fish, with a presumed functional hearing range of approximately 200 hertz to 10 kilohertz (Mann et al 2001). These types of fish are likely to detect acoustic devices, but only if they are relatively near the source. Because vessels are usually moving while using acoustic gear, the source of potentially disturbing sounds would be localized and the behavioral response of fish would likely be limited to temporary avoidance behavior.

Globally, approximately 25,000 fish species have a swim bladder (or other air cavity) that is not near the ear. These species probably detect some pressure from large physical disturbances of the water or vessel traffic, but functional hearing is most likely in the 30 hertz to 500 hertz range (Popper and Fay 2011) and higher frequency acoustic devices used in research are unlikely to be audible. Any acoustical effect that is audible and that would cause avoidance disturbance, would be minor in intensity, occur over a local geographic extent, and the duration would be temporary.

Commercial vessel and fishing gear noise, and recreational vessel noise are common components of background (ambient) noise in the marine environment. At present, there are thousands of commercial fishing, transport vessels, and recreational vessels in the project areas that contribute to background vessel noise.

Potential disturbance and acoustic masking effects from research vessel noise under the Status Quo Alternative would likely be geographically localized, minimal in magnitude, and temporary in duration; this type of effect would be considered minor adverse for all fish species according to the impact criteria in Table 4.1-1.

4.2.3.3 Contamination from Discharges

Discharge from vessels, whether accidental or intentional, include sewage, ballast water, fuel, oil, miscellaneous chemicals, garbage, and plastics. Impacts to fish exposed to the discharge range from superficial exposure to ingestion and related effects. Even at low concentrations that are not directly lethal, some contaminants can cause sub-lethal effects on sensory systems, growth, and behavior of animals, or may be bioaccumulated (DOE 2008, NOAA 2010c).

All NOAA vessels and PIFSC vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010b). MARPOL includes six annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). In addition, all NOAA vessels are fully equipped to respond to emergencies, including fuel spills, and crew receive extensive safety and emergency response training. These precautionary measures help reduce the likelihood of fuel spills occurring and increase the chance that they will be responded to and contained quickly.

Discharge of contaminants from PIFSC vessels is possible, but unlikely to occur in the near future. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to fish would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination of fish would therefore be considered minor adverse.

As the potential effects of discharges, regulations governing discharges and the likelihood of discharges are universal throughout the PIFSC research areas, this type of potential effect on fish will not be discussed further in this analysis.

4.2.3.4 ESA-listed Species

The only fish species in the project area listed as threatened or endangered under the ESA is the scalloped hammerhead shark. As discussed in Section 3.2.1.1, there are six DPSs for the scalloped hammerhead shark, two of which occur in the PIFSC region: the Central Pacific DPS and the Indo-West Pacific DPS (see Figure 3.2-1 in Section 3.2.1).

Only four scalloped hammerhead sharks have been caught by PIFSC under the Status Quo Alternative, all of which belonged to the non ESA-listed Central Pacific DPS. Furthermore, all four of these captures were released alive with no resulting mortality. Given the lack of historical takes under the Status Quo Alternative, the potential for future takes is considered small and unlikely to affect the population of any ESA-listed scalloped hammerhead shark. The effects of the Status Quo Alternative are therefore considered minor adverse based on the criteria in Table 4-1.1.

4.2.3.5 Target and Other Fish Species

<u>Mortality from Fisheries Research Activities in the HARA</u>

Table 4.2-2 provides the average annual catch (by weight) of the most frequently caught and retained fish species under the Status Quo from PIFSC research surveys in the HARA. Most surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average or maximum weights were derived from a variety of sources (Brodziak 2012; Fishbase.org; Hawai‘i DAR 2014a; Williams and Ma 2013). These average annual research catches are compared to the most recently available ACLs or to commercial landings for those species without a currently established ACL. As discussed in Section 3.2.1.2, fishery-caught species within WPRFMC jurisdiction are grouped

into Management Unit Species (MUS) or a "multi-species complex" for which ACLs are set. Catch is therefore managed as a complex, in total, not by individual species.

For all research areas, research data is necessary for monitoring the status of stocks of conservation concern and to determine if management objectives for rebuilding those stocks are being met. Fisheries managers typically consider the estimated amount of research catch from all projects along with other sources of mortality (e.g., bycatch in other fisheries and predation) before setting commercial fishing limits to prevent overfishing of stocks or to help overfished stocks rebuild. The amount of fish that are likely to be caught in various research projects is often estimated and incorporated into the fishery management process during annual reviews of research proposals, which would continue to occur in the future under the Status Quo Alternative. These annual reviews would also determine whether the proposed projects were consistent with the NEPA analysis presented in the DPEA or whether additional NEPA analysis was required (see Section 2.3.5).

Table 4.2-2 indicates that, while mortality to fish species is a direct effect of the PIFSC HARA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial fisheries, which are just fractions of the total populations for these species. In all cases, research catch in the HARA represents much less than one percent of the ACL or commercial catch. For all target species in the HARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-2 Estimated Fish Caught under the Status Quo Alternative Compared to ACLs or Commercial Catch in the HARA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Average PIFSC catch per year under Status Quo (pounds)	2014 ACL (pounds)[B]	2013 Commercial catch (pounds)[C]	Average PIFSC catch compared to ACL or Commercial Catch (percentage)
Blue shark *(Prionace glauca)*	Not overfished	Pelagic MUS	597	N/A	138,423	0.43%
Amberjack *(Seriola spp.)*	Not overfished	Hawai'i Bottomfish MUS	292	193,423[D]	N/A	0.15%
Brown speckled eel (*Gymnothorax steindachneri)*	Unknown	Hawai'i CHCRT	238	142,282[D]	N/A	0.17%
Red snapper *(Etelis carbunculus)*	Not overfished	Hawai'i Deep 7 Bottomfish MUS	212	346,000[D]	N/A	0.06%
Sea bass *(Epinephelus quernus)*	Unknown	Hawai'i Deep 7 Bottomfish MUS	190	346,000[D]	N/A	0.05%

Species	Stock Status[A]	Stock Complex	Average PIFSC catch per year under Status Quo (pounds)	2014 ACL (pounds)[B]	2013 Commercial catch (pounds)[C]	Average PIFSC catch compared to ACL or Commercial Catch (percentage)
Undulated moray *(Gymnothorax undulates)*	Unknown	Hawai‘i CHCRT	189	142,282[D]	N/A	0.13%
Broadbill swordfish *(Xiphias gladius)*	Not overfished	Pelagic MUS	120	N/A	2,332,850	<0.01%
Silky shark *(Carcharhinus falciformis)*	Unknown	Pelagic MUS	102	N/A	138,423	0.07%
Striped marlin *(Tetrapturus audax)*	Subject to overfishing, overfished	Pelagic MUS	30	N/A	983,440	<0.01%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. 2014 ACL information from WPRFMC. Available online: http://www.wpcouncil.org/managed-fishery-ecosystems/annual-catch-limits/2014-acl-specification/

C. Commercial catch information compiled by Hawai‘i DAR and the Western Pacific Fishery Information Network. Available online: http://www.pifsc.noaa.gov/wpacfin/hi/dar/Pages/hi_data_3.php

D. This species is included in a MUS; catch is managed as a complex, in total, not by individual species. The ACL stated is for all species in the specified MUS.

Mortality from Fisheries Research Activities in the MARA

Table 4.2-3 provides the average annual catch (by weight) of the most frequently caught and retained fish species under the Status Quo from PIFSC research surveys in the MARA. Most surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average or maximum weights were derived from a variety of sources (Brodziak 2012; Fishbase.org; Hawai‘i DAR 2014a; Williams and Ma 2013). These average annual research catches are compared to the most recently available ACLs.

Table 4.2-3 indicates that, while mortality to fish species is a direct effect of the PIFSC MARA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial fisheries, which are just fractions of the total populations for these species. In most cases, research catch in the MARA represents much less than one percent of the ACL. For bicolor parrotfish, the average annual research catch is approximately 2.58 percent, respectively. While this catch represents a higher percentage of the ACL compared to other species, they still represent a very small fraction of the total population. For all target species in the MARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-3 Estimated Fish Caught under the Status Quo Alternative Compared to ACLs in the MARA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Average PIFSC catch per year under Status Quo (pounds)	2014 ACL (pounds)[B,C]	Average PIFSC catch compared to ACL (percentage)
Longtail snapper (*Etelis coruscans*)	Not overfished	MARA Bottomfish MUS	581	294,800[D]	0.20%
Bicolor parrotfish (*Scarus rubroviolaceus*)	Unknown	MARA CHCRT	351	32,433[D]	1.08%
Orangespine unicornfish (*Naso lituratus*)	Unknown	MARA CHCRT	255	77,586[D]	0.33%
Black jack (*Caranx lugubris*)	Not overfished	MARA Bottomfish MUS	180	294,800[D]	0.06%
Red snapper (*Etelis carbunculus*)	Not overfished	MARA Bottomfish MUS	138	294,800[D]	0.05%
Yellowtail snapper (*Pristipomoides auricilla*)	Not overfished	MARA Bottomfish MUS	115	294,800[D]	0.04%
Silver jaw jobfish (*Aphareus rutilans*)	Not overfished	MARA Bottomfish MUS	108	294,800[D]	0.04%
Bluefin trevally (*Caranx megalampys*)	Unknown	MARA CHCRT	103	66,889[D]	0.16%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. 2014 ACL information from WPRFMC. Available online: http://www.wpcouncil.org/managed-fishery-ecosystems/annual-catch-limits/2014-acl-specification/

C. ACLs are listed separately for the CNMI and Guam. The ACL stated is combined for both regions to represent all of the MARA.

D. This species is included in a MUS; catch is managed as a complex, in total, not by individual species. The ACL stated is for all species in the specified MUS.

Mortality from Fisheries Research Activities in the ASARA

Table 4.2-4 provides the average annual catch (by weight) of the most frequently caught and retained fish species under the Status Quo from PIFSC research surveys in the ASARA. Most surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average or maximum weights were derived from a variety of sources (Brodziak 2012; Fishbase.org; Hawai‘i DAR 2014a; Williams and Ma 2013). Table 4.2-2 compares these average annual research catches to the most recently available commercial landings.

Table 4.2-4 indicates that, while mortality to fish species is a direct effect of the PIFSC ASARA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial fisheries, which are just fractions of the total populations for these species. In all cases, research catch in the ASARA represents much less than one percent of the commercial catch. For all target species in the ASARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-4 Estimated Fish Caught under the Status Quo Alternative Compared to ACLs or Commercial Catch in the ASARA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Average PIFSC catch per year under Status Quo (pounds)	2014 ACL (pounds)	2013 Commercial catch (pounds)[B]	Average PIFSC catch compared to Commercial Catch (percentage)
Yellowfin tuna (*Thunnus albacares*)	Not Overfished	Pelagic MUS	480	N/A	901,323	0.05%
Wahoo (*Acanthocybium solandri*)	Unknown	Pelagic MUS	183	N/A	198,325	0.09%
Blue marlin (*Makaira mazara*)	Not Overfished	Pelagic MUS	120	N/A	67,557	0.18%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. Commercial catch information compiled by American Samoa DMWR and the Western Pacific Fishery Information Network. Available online: http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_menu.php

Mortality from Fisheries Research Activities in the WCPRA

Table 4.2-5 provides the average annual catch (by weight) of the most frequently caught and retained fish species under the Status Quo from PIFSC research surveys in the WCPRA. Most surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average or maximum weights were derived from a variety of sources (Brodziak 2012; Fishbase.org; Hawai‘i DAR 2014a; Williams and Ma 2013). These average annual research catches are compared to the most recently available commercial landings.

Table 4.2-5 indicates that, while mortality to fish species is a direct effect of the PIFSC WCPRA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial fisheries, which are just fractions of the total populations for these species. In most cases, research catch in the WCPRA represents much less than one percent of the commercial catch. For two species, thresher and silky sharks, the average annual research catch is approximately 1.05 percent and 2.31 percent, respectively. While this catch represents a higher percentage of the commercial compared to other species, they still represent a very small fraction of the total population. For all target species in the WCPRA, mortality from PIFSC

research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-5 Estimated Fish Caught under the Status Quo Alternative Compared to Commercial Catch in the WCPRA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed.

Species	Stock Status[A]	Stock Complex	Average PIFSC catch per year under Status Quo (pounds)	2012 Commercial catch (pounds)[B]	Average PIFSC catch compared to Commercial Catch (percentage)
Yellowfin tuna (*Thunnus albacares*)	Not Overfished	Pelagic MUS	1,650	2,610,273	0.06%
Silky shark (*Carcharhinus falciformis*)	Unknown	Pelagic MUS	102	4,409	2.31%
Thresher sharks (*Alopias* spp.)	Unknown	Pelagic MUS	300	28,660	1.05%
Bigeye tuna (*Thunnus obesus*)	Subject to overfishing, not overfished	Pelagic MUS	540	11,375,853	<0.01%
Broadbill swordfish (*Xiphias gladius*)	Unknown	Pelagic MUS	120	2,008,411	0.01%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. Commercial catch information from the Pelagic Fisheries of the Western Pacific Region 2012 Annual Report. Available online: http://www.wpcouncil.org/wp-content/uploads/2013/03/2012-Pelagics-Annual-Report_9-21-2014.pdf

4.2.3.6 Conclusion

PIFSC fisheries research conducted under the Status Quo Alternative could have effects on commercially and non-commercially targeted species, and non-managed fish species through mortality, disturbance, and changes in habitat.

No ESA-listed fish species have been caught by PIFSC under the Status Quo Alternative. Although four scalloped hammerhead sharks were incidentally caught, these belonged to the non ESA-listed Central Pacific DPS. All four of these captures were released alive with no resulting mortality.

For most species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to research surveys and projects is much less than one percent of ACLs or commercial harvest and is considered to be minor in magnitude for all species. For species which exceed one percent of ACLs or commercial harvest, catch is still small relative to the population of each species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities. Furthermore, only life history studies retain fish for otoliths and gonads; all other fish are sent back overboard. Disturbance of fish and benthic habitats from research activities would be temporary and minor in magnitude for all species. As described above, the potential for accidental contamination of fish habitat is considered minor in magnitude and temporary or short-term in duration. The overall effects of

the Status Quo Alternative on target fish would be minor in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-2.

In contrast to these adverse effects, PIFSC research also provides long-term beneficial effects on managed fish species throughout the Pacific Islands Region through its contribution to sustainable fisheries management. Data from PIFSC research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks. The beneficial effects of the time-series data provided by PIFSC research programs effects are especially valuable for long-term trend analysis for commercially harvested fish and, combined with other oceanographic data collected during fisheries and ecosystem research, provide the basis for monitoring changes to the marine environment important to fish populations.

4.2.4 Effects on Marine Mammals

Section 3.2.2 describes the marine mammals that are likely to overlap with fishery research activities in the four PIFSC research areas: HARA, MARA, ASARA, and WCPRA. This section describes the potential effects of PIFSC research activities on marine mammals under the Status Quo Alternative, including the mitigation measures that have been implemented in the past to reduce those effects (see Table 4.1-2 and Section 4.1.3 for the criteria used in the effects analysis discussed in this section). Because the secondary federal action considered in this DPEA is the promulgation of regulations and subsequent Letters of Authorization under Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA), this section provides more information and analysis for effects on marine mammals than is presented for the analysis of effects on other resources, consistent with the needs of the MMPA authorization process.

The potential effects of research vessels, survey gear, sonar and other active acoustic devices, and other associated equipment on marine mammals include:

- Disturbance and behavioral responses due to acoustic equipment
- Injury or mortality due to ship strikes
- Injury or mortality due to interaction with research gear
- Changes in food availability due to research survey removal of prey
- Contamination from discharges

The first part of the analysis in this section provides information regarding the mechanisms for these different types of effects. It also provides an analysis of some effects common to all four research areas. For some types of effects, the level of impact is similar for all species of marine mammals and the analysis is not repeated in the following subsections.

The second part of the analysis provides information regarding the effects of PIFSC research activities on marine mammal species, including information needed for the MMPA authorization process. An application for promulgation of regulations and issuance of Letters of Authorization (referred to as the LOA application) for incidental take of marine mammals must include estimates of the numbers of animals that may be taken by serious injury or mortality, harassment that has the potential to injure (Level A harassment takes), and harassment that has the potential to disturb (Level B harassment takes). The PIFSC LOA application (Appendix C) only concerns the Preferred Alternative because that is PIFSC's proposed action. However, the analysis of takes in the LOA application is based on a similar scope of research activities as the Status Quo Alternative (a few projects would not be continued and a few new projects would be added under the Preferred Alternative) and is therefore helpful in describing the potential effects of the Status Quo Alternative. For those marine mammal species where the effects of the

Status Quo are considered the same or very similar to the Preferred Alternative, analysis provided in the LOA application is summarized and referenced in this section. Where the scope of activities differs between the Status Quo and Preferred Alternatives, the analysis of effects from the LOA application are summarized and referenced in the Preferred Alternative (Section 4.3.4). The following analysis focuses on the types of research gear most likely to have adverse interactions with marine mammals.

4.2.4.1 Disturbance and Behavioral Responses due to Acoustic Equipment

Several mechanisms exist by which research activities have the potential to disturb marine mammals and alter behavior, including the physical presence of marine vessels and fishing gear combined with operational sounds from engines, hydraulic gear, and acoustical devices used for navigation and research. The impacts of anthropogenic noise on marine mammals have been summarized in numerous articles and reports including Richardson et al. (1995), NRC (2005), and Southall et al. (2007). Marine mammals use hearing and sound transmission to perform vital life functions. Sound (hearing and vocalization/ echolocation) serves four primary functions for marine mammals, including: 1) providing information about their environment, 2) communication, 3) prey detection, and 4) predator detection. Introducing sound into their environment could disrupt those behaviors. The distances to which anthropogenic sounds are audible depend upon source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the marine mammal (Richardson et al. 1995).

In assessing potential effects of noise, Richardson et al. (1995) suggested four criteria for defining acoustic zones of influence:

1. Zone of audibility – the area within which the marine mammal might hear the sound. Marine mammals, as a group, have functional hearing ranges of 10 hertz (Hz) to 180 kilohertz (kHz), with highest sensitivities to sound near 40 kHz (Ketten 1998, Kastak et al. 2005, Southall et al. 2007).
2. Zone of responsiveness – the area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound depend on: 1) acoustic characteristics of the noise source; 2) physical and behavioral state of animals at time of exposure; 3) ambient acoustic and ecological characteristics of the environment; and 4) context of the sound (e.g., whether it sounds similar to a predator) (Richardson et al. 1995, Southall et al. 2007). Temporary behavioral effects, however, often merely show that an animal heard a sound and may not indicate lasting consequences for exposed individuals (Southall et al. 2007). Recent analysis of potential causes of a mass stranding of 100 typically oceanic melon-headed whales (Peponocephala electra) in Madagascar in 2008 implicate a mapping survey using a high-power 12 kHz multi-beam echosounder (MBES) as a likely trigger for this event. Although the cause is equivocal and other environmental, social, or anthropogenic factors may have facilitated the strandings, the authors determined the MBES the most plausible factor initiating the stranding response, suggesting that avoidance behavior may have led the pelagic whales into shallow, unfamiliar waters (Southall et al. 2013).
3. Zone of masking – the area within which the noise may interfere with an animal's detection of other sounds, including communication calls, prey sounds, or other environmental sounds.
4. Zone of hearing loss, discomfort, or injury – the area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. NMFS considers exposure of marine mammals to this level of sound to be Level A harassment and has regulated some industrial and military activities to reduce the risk of such exposures.

The factors that may affect the response of a marine mammal to a given noise cannot be determined ahead of time. Therefore, during the MMPA authorization process, in lieu of having this information, NMFS uses a standardized noise level to help determine how many animals may be disturbed (harassed) by a

given activity. NMFS currently uses a sound threshold of 160 decibels (dB) referenced to one micro pascal (re 1μPa), for the types of sound produced by the active acoustic sources considered here, to determine the onset of behavioral harassment for marine mammals (Level B harassment takes) (NMFS 2005). Any animal exposed to impulse noises above this level is assumed to respond in a way consistent with the definition of a behavioral "take" under the MMPA, although NMFS acknowledges that some marine mammals may react to sounds below this threshold or may not react to sounds above this threshold.

PIFSC has been using a variety of sonar and other acoustic systems during its research cruises to characterize marine habitats and fish aggregations and to monitor gear deployments. This acoustic equipment sends pulses of sound into the marine environment which provide data as the sounds reflect back to the ship and are recorded (see Appendix A). The sounds produced by the predominant acoustic equipment used by PIFSC range from 30-200 kHz and from 190 dB to 237 dB re 1μPa (Appendix C, Section 6.2). The LOA application (Appendix C, Section 7.2) categorized these acoustic sources based on operating frequency and output characteristics. Category 1 active acoustic sources include short range echosounders and Acoustic Doppler Current Profilers (ADCPs). These have output frequencies >300 kilohertz (kHz), are generally of short duration, and have high signal directivity. Category 2 active acoustic sources include various single, dual, and multi-beam echosounders, devices used to determine trawl net orientation, and current profilers of lower output frequencies than category 1 sources. Output frequencies of category 2 sources range from 30 to 200 kHz, have short ping durations, and are usually highly directional for mapping purposes.

Although these acoustic systems have been used for years and may have been a source of disturbance for nearby marine mammals, no direct observations of disturbance have been documented, primarily because any such disturbance, if it occurred, would have taken place under water. For animals at the surface, it is very difficult to determine whether observed changes in behavior were caused by a given sound source or by the physical presence of the vessel. In many cases, it is likely to be a combination of visual and acoustic components that cause a disturbance. It may also be difficult to determine if an animal has actually changed its behavior to avoid a disturbance or if it is moving for other reasons (e.g., to pursue nearby prey). For these reasons, there have been no records or documentation of how many animals may have been disturbed by vessels and/or acoustic equipment during PIFSC research cruises.

NMFS regulations for implementing the MMPA distinguish between Level B harassment that causes behavioral changes in the affected marine mammals and Level A harassment that has the potential to cause injury. Animals exposed to intense sounds may experience reduced hearing sensitivity for some period of time following exposure. This change in hearing threshold is known as noise induced threshold shift (TS). The amount of TS incurred is influenced by the amplitude, duration, frequency content, temporal pattern, and energy distribution of the noise (Richardson et al. 1995, Southall et al. 2007). It is also influenced by the characteristics of the animal, such as the hearing range of the species, behavior, age, history of noise exposure, and health. The magnitude of TS generally decreases over time after noise exposure and if it eventually returns to zero, it is known as a temporary threshold shift (TTS). If the TS does not return to zero after some time (generally on the order of weeks), it is known as a permanent threshold shift (PTS). Sound levels associated with the onset of TTS are generally considered to be below the levels that will cause PTS, which is considered to be an auditory injury.

The current NMFS policy regarding Level A harassment is that cetaceans should not be exposed to impulsive sounds greater than 180 dB re 1 μPa and that pinnipeds should not be exposed to impulsive sounds greater than 190 dB re 1μPa (NMFS 2000). However, these criteria were established before information was available about minimum received levels of sound that would cause auditory injury in marine mammals. They are likely lower than necessary and are intended to be precautionary estimates above which physical injury may occur (Southall et al. 2007).

Southall et al. (2007) assessed the potential for discrete sound exposures to produce a TTS or PTS in marine mammals and concluded that, for the kinds of relatively brief exposures associated with transient sounds, such as the active acoustic sources used by PIFSC for research, received sound pressure levels in the range of approximately 180-220 dB re 1µPa are required to induce the onset of TTS levels for most pinnipeds and odontocete cetaceans. Southall et al. (2007) also provided some frequency weighting functions for different marine mammal groups to account for the fact that impacts of noise on hearing depend in large part on the overlap between the range of frequencies in the sound source and the hearing range of the species. Based on the Southall et al. (2007) results, Lurton and DeRuiter (2011) modeled the potential impacts (PTS and behavioral reaction) of conventional echosounders on marine mammals. They estimated PTS onset at typical distances of 10 to 100 meters for the kinds of acoustic sources used in fisheries surveys considered in this DPEA. Lurton and DeRuiter (2011) also emphasized that these effects would very likely only occur in the cone ensonified below the ship and that behavioral responses to the vessel at these extremely close ranges would very likely influence the probability of animals being exposed to these levels.

Animals are likely to avoid a moving vessel, either because of its physical presence or because of behavioral harassment resulting from exposure to the sound produced by active acoustic sources. It is unlikely that animals would remain in the presence of a harassing stimulus, absent some overriding contextual factor. Because of this likely avoidance behavior, as well as the source characteristics, intermittent pulsing and narrow cones of ensonification, PIFSC has determined that the risk of animals experiencing repetitive exposures at the close range or of the duration necessary to cause PTS is negligible. PIFSC therefore does not anticipate causing any Level A harassment by acoustic sources of marine mammals and the LOA application includes no such take estimates. Therefore, the potential for Level A impacts on marine mammals by acoustic sources will not be discussed further in this DPEA.

However, PIFSC anticipates that the use of active acoustic equipment in its research activities could cause Level B harassment of marine mammals. In its LOA application for the Preferred Alternative (Appendix C), PIFSC estimates the numbers of marine mammals that may be exposed to sound levels of 160 dB or above due to the use of acoustic sonars during research cruises (Level B harassment takes). The LOA take estimates do not include baleen whales because the operating frequencies of PIFSC acoustic sources only go down to 30 kHz, which is above the hearing range of baleen whales (Southall et al. 2007, Figure 4.2-1).

The LOA application used the operational conditions and scope of work conducted in the past five years to estimate what may occur in the future under the Preferred Alternative. The Preferred Alternative would eliminate five longline projects; however, similar research continues to be conducted and funded by PIRO through commercial fisheries partners. Any incidental takes resulting from this research are authorized under sections of the MMPA dealing with commercial fisheries and any incidental takes resulting from this research are considered to be a result of the commercial fishery; these potential takes are therefore not considered in the analysis of the Preferred Alternative in this chapter. The impacts of such surveys are included in the cumulative impacts analysis (Chapter 5).

As explained in the LOA application (Appendix C), the take estimates attempt to quantify a very dynamic situation that has a great deal of unavoidable uncertainty regarding the propagation of sound in the water and the distribution of marine mammals over very large areas. Estimating the insonified zone of sound generated by sonar gear and its propagation through water is complicated, especially considering that these sound sources are moving (on a vessel) through waters of different depths and properties (e.g., salinity and temperature) as well as varying bathymetric profiles, all of which affect sound transmission. The LOA application details the assumptions that were made about the source levels and acoustic properties of sonar pulses, the directionality of the sound, and propagation/attenuation properties that were used to calculate an ensonified zone considered loud enough to harass marine mammals. One part of the PIFSC Level B harassment take calculation used a model of sound propagation from typical sonar

equipment used during research to estimate the shape and dimensions of a typical ensonified zone ≥ 160 dB re 1 μPa, which was multiplied by the distance research ships travel with active sonar gear, to derive an estimated total volume ensonified to the Level B harassment take guidelines.

Another aspect of this Level B harassment take estimation process, subject to large uncertainty, is the distribution and abundance of marine mammals in the area. No species is distributed evenly throughout its range; they are typically patchy in distribution with strong seasonal variations and preferences for certain zones within the water column. Although some preferred habitats and general distributions are known, there is no way to know exactly how many animals will be in any area at any point in the future. Therefore, the estimation process uses the average density of each species within the different research areas to estimate how many animals may be affected within the ensonified volume. One refinement that has been built into the Level B harassment take model is the categorization of each marine mammal species according to its typical dive depth range, which affects the size of the ensonified zone they may be exposed to. The estimation process is admittedly subject to great uncertainty and there is no way to assess how "realistic" these estimates are in terms of the number of animals that would be disturbed by the activity. However, the development of the Level B harassment take model was conservative in the sense that assumptions were made that would tend to overestimate the size of the ensonified volume and the number of animals affected (Appendix C, Section 6.2). The estimated take numbers of different species in the different research areas were calculated for the five-year authorization period and take into account the typical schedule of conducting major surveys in the different research areas on alternate years, with the HARA being covered on a more frequent basis than the other areas.

This DPEA (and the LOA application) must also assess what the likely biological effects may be for these estimated Level B harassment takes by acoustic sources. The LOA application (Appendix C, Section 7.2) provides an analysis of the potential effects of acoustic equipment used in PIFSC research on marine mammals (and other species). The analysis in this DPEA is a summary of the LOA application analysis and will be provided in the subsections on cetaceans and pinnipeds because of their different hearing ranges and frequencies used for communication, which determines what the effects of different acoustic equipment might be. This effort to examine the biological importance of acoustic disturbance requires knowledge about whether animals can perceive the sonar signals, their potential reactions to various types of sounds, and the conditions under which particular sound sources may lead to biologically meaningful effects (i.e. interference with feeding opportunities or critical social communication). Unfortunately, many key aspects of marine mammal behavior relevant to this discussion are very poorly known. Most of the data on marine mammal hearing and behavioral reactions to sounds comes from relatively few captive, trained animals and likely does not reflect the diversity of behaviors in wild animals. Some behavioral reactions, if they occur in one or more species, could substantially reduce the numbers of animals exposed to high sound levels (e.g., swimming away from an approaching ship before sound levels reach the 160 dB level). Industrial projects such as seismic exploration for oil and gas and pile driving in relation to coastal developments are typically required to monitor marine mammal behavioral responses in relation to percussive industrial sounds, but there have been few efforts to document behavioral responses to acoustic equipment commonly used in fisheries research.

4.2.4.2 Injury or Mortality due to Ship Strikes

The Pacific Islands Region includes shipping lanes, active ports, and vessel traffic. Vessel collisions with marine mammals, or ship strikes, can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds (Knowlton and Kraus 2001). Large whales, such as fin whales, are occasionally found draped across the bulbous bows of large ships upon arriving in port. Massive propeller wounds can be immediately fatal. If more superficial, the whales may survive the collisions (Silber et al. 2009). Jensen and Silber (2003) summarized large whale ship strikes world-wide and found that most collisions occurred in the open ocean involving large vessels. Commercial fishing vessels were responsible for four of 134 records (3 percent), and one collision (0.75 percent) was reported for a research vessel. Vessel

speed appears to be a key factor in determining the frequency and severity of ship strikes, with the potential for collision increasing at ship speeds of 15 knots (kts) and greater (Laist et al. 2001, Vanderlaan and Taggart 2007). In the relatively few recorded cases of ship strikes at speeds below 15 kts, the chance of mortality declines from approximately 80 percent at 15 kts to approximately 20 percent at 8.6 kts (Vanderlaan and Taggart 2007).

There have been more than 80 confirmed contacts between vessels and whales in Hawaiian waters over the past 40 years and three quarters of those cases have occurred in the last decade. In 2009, there were two incidents of research vessels that were not affiliated with PIFSC fisheries and ecosystem research coming into contact with a humpback whale's pectoral flipper while conducting research; the vessels were moving at less than 5 kts and no injuries were observed (Bradford and Lyman 2015). In 2011, a research vessel, also not affiliated with PIFSC fisheries and ecosystem research, struck a breaching whale while traveling at 26 kts. The whale was observed for some time following the incident and did not show signs of injury; in accordance with NMFS' criteria for assessing injury, the injury was categorized as serious and assigned a value for PBR of .20 (Bradford and Lyman 2015). However, PIFSC is not requesting any take due to ship strikes as it is assumed that these events were rare occurrences that are very unlikely occur in the next five years and that little can be done to mitigate the chances of a future occurrence other than the standard monitoring and avoidance procedures already in place.

Areas with high densities of whales and high vessel traffic (e.g., Hawaiian Islands Humpback Whale National Marine Sanctuary) have put mandatory ship speed restrictions in place to reduce the risk of ship strikes. The State of Hawai'i passed legislation regulating the speed of its high-speed interisland ferry as well as putting mitigation measures in place, such as marine mammal observers, requiring the use of night vision equipment and bow mounted cameras to detect whales, a 500 meter safety zone, and limiting the discharge of wastewater (Seattle Times 2007). Reducing the co-occurrence of whales and vessels may be the only sure way to reduce ship strikes, but this is not always feasible (Silber et al. 2009).

Transit speeds during PIFSC fisheries and ecosystem research cruises vary from 6-14 kts, but average 10 kts. Vessel speed during active sampling is typically 2-4 kts, due to sampling design, but these much slower speeds essentially eliminate the risk of ship strikes.

Given the relatively slow speeds of research vessels, the presence of bridge crew watching for obstacles at all times (including marine mammals), and the small number of research cruises, ship strikes with marine mammals during the research activities described in this DPEA would be considered rare in frequency, localized in geographic scope, and unlikely to occur within the next five years. The potential for PIFSC fisheries research vessels to cause serious injury or mortality to any cetaceans or pinnipeds due to ship strikes are considered minor adverse throughout the four PIFSC research areas using vessel types and protocols currently in use. Since ship strikes are unlikely to occur, this potential effect of research will not be discussed further in the analysis that follows.

4.2.4.3 Injury or Mortality Due to Interaction with Research Gear

Entanglement and capture in fishing gear is a significant source of human-caused injury or mortality for some marine mammals. Although not always as immediately fatal as ship strikes, entanglements can lead to prolonged weakening or deterioration of an animal (Knowlton and Kraus 2001). This is particularly true for large whales; small whales, dolphins, porpoises, and pinnipeds are more likely to die when entangled.

Commercial and non-commercial fisheries in the Pacific Islands regions covered in this DPEA with known bycatch of marine mammals include those using pelagic longlines, other hook-and-line gears, gillnets, traps and pots, and trawls (Carretta et al. 2015). Further details regarding specific fisheries and marine mammal bycatch will be discussed when considering cumulative effects (Section 5.5). Several of these gear types are employed during PIFSC fisheries research surveys, including midwater trawls and

longline gears as well as instruments that are attached to floats and anchors by lines that may entangle marine mammals (Appendix A).

The 1994 amendments to the MMPA tasked NMFS with establishing monitoring programs to estimate mortality and serious injury of marine mammals incidental to commercial fishing operations and to develop Take Reduction Plans (TRPs) in order to reduce commercial fishing takes of strategic stocks of marine mammals below Potential Biological Removal (PBR). The False Killer Whale Take Reduction Plan (FKWTRP) was finalized in 2012 to reduce the level of mortality and serious injury of false killer whales in Hawaiʻi-based longline fisheries for tuna and billfish (77 FR 71260). Regulatory measures in the FKWTRP include gear requirements, prohibited areas, training and certification in marine mammal handling and release, and posting of NMFS-approved placards on longline vessels. PIFSC does not conduct fisheries and ecosystem research with longline gear within any of the exclusion zones established by the FKWTRP.

There is no documented history of marine mammals being injured or killed due to entanglement or other interactions with fishing gear during PIFSC fisheries and ecosystem research activities. Under the Status Quo Alternative, PIFSC has implemented a set of mitigation measures to reduce the risk of interacting with marine mammals (and other protected species) during fisheries and ecosystem research, as described in Section 2.2.1.

Most of the mitigation measures rely on visual monitoring and detection of marine mammals near the vessel or fishing gear. There are many variables that influence the effectiveness of visual monitoring at any one time, including the lighting, sea state, and the capabilities of the person assigned to watch. Therefore, it is impossible to determine an overall measure of effectiveness and quantify how many animals may have been avoided with visual monitoring, as compared to having no monitors. It is also difficult to scientifically determine the effectiveness of gear modifications because potential interactions would occur underwater and out of sight. The value of implementing some mitigation measures is therefore based on general principles and best available information, even if their effectiveness at reducing takes has not been scientifically demonstrated.

The MMPA authorization process requires the applicant (PIFSC) to estimate how many marine mammals may be captured or entangled in the future under the proposed set of conditions. As is the case for Level B harassment takes by acoustic sources, the LOA application (Appendix C, Section 6.1) describes the methodology used to estimate the species and numbers of animals that may be taken by Level A harassment and mortality or serious injury (M&SI) during future research, conducted under the Preferred Alternative. Since there have been no takes of marine mammals during PIFSC fisheries and ecosystem research in the past, the LOA application requests combined Level A and M&SI takes for the five-year authorization period on the basis of analogy with take in commercial and non-commercial fisheries using gears similar to those used in research. This methodology has been used in order to account for a precautionary amount of potential take in the future.

The LOA application estimates of take are based on the scope of research and mitigation measures proposed under the Preferred Alternative. However, as was the case with the Level B harassment take analysis, the estimates of Level A harassment/M&SI takes in the LOA application are relevant to the discussion of effects from the Status Quo Alternative because they are based on a similar level of research effort in the same areas and with the same gears used during the Status Quo; the estimated future takes in research gears described in the LOA will be reported in this section as potential effects of conducting future research under the Status Quo Alternative. Gear types and other scientific equipment that have no history of takes or adverse interactions with marine mammals and are very unlikely to result in takes in the future (e.g., small-mouthed nets designed to sample plankton and larval fish, CTD rosettes, and ROVs), are not discussed further in this DPEA.

4.2.4.4 Changes in Food Availability due to Research Survey Removal of Prey

Prey of marine mammals varies by species, season, and location and, for some marine mammals, is not well documented. There is some overlap in prey of marine mammals in the Pacific Islands Regions and the species sampled and removed during PIFSC fisheries and ecosystem research surveys although removals of species commonly eaten by marine mammals are relatively low.

Prey of sei whales and blue whales are primarily zooplankton, which are sampled in minute quantities by PIFSC fisheries research, so the likelihood of research activities changing prey availability is negligible. Humpback whales do not feed within the PIFSC region of fisheries and ecosystem research, so there is no effect. There may be some minor overlap with sperm whale prey (squid), but this is expected to be minor due to the very small amounts of squid removed through fisheries and ecosystem research (i.e., hundreds of pounds). There may be some minor overlap with monk seal prey and the RAMP Survey and Insular Fish Abundance Estimation Comparison Survey removals of a variety of reef fishes. For example, in the main Hawaiian Islands, the majority of coral reef fish sampling is at the periphery of monk seal foraging habitat and is a tiny fraction of what is taken by monk seals or by apex predatory fish or non-commercial fisheries (Sprague et al. 2013; Kobayashi and Kawamoto 1995). In the case of false killer whale consumption of tunas, mahi, and ohno, there may be some minor overlap with research removals in the deep-set longline research. However, the removal by PIFSC fisheries and ecosystem research, regardless of season and location, is minor relative to that taken through commercial fisheries. For example, commercial fisheries catches for most pelagic species range from the hundreds to thousands of metric tons, whereas the catch in similar fisheries and ecosystem research activities typically range from the hundreds to thousands of pounds in any particular year (see Sections 4.2.3 and 4.3.3).

In contrast to these minor adverse effects, PIFSC research also provides long-term beneficial effects on managed fish species throughout the Pacific Islands Region through its contribution to sustainable fisheries management, with associated beneficial effects on marine mammal prey species.

In summary, PIFSC fisheries research removals of marine mammal prey are minor in magnitude, highly localized, temporary in effect, and unlikely to affect the availability of prey to any marine mammals under the Status Quo Alternative.

4.2.4.5 Contamination from Discharges

Discharge from vessels, whether accidental or intentional, potentially includes sewage, ballast water, fuel, oil, miscellaneous chemicals, garbage, and plastics. Impacts to marine mammals in the vicinity of the discharge range from superficial exposure to ingestion and related effects. Even at low concentrations that are not directly lethal, some contaminants can cause sub-lethal effects on sensory systems, growth, and behavior of animals, or may be bioaccumulated (DOE 2008).

All NOAA vessels and PIFSC chartered vessels are subject to the marine pollution (MARPOL) regulations of 1973/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010b). MARPOL includes six annexes that cover the discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). Discharge of contaminants from PIFSC vessels is possible, but unlikely, and if it occurs, would be isolated in both time and location.

Discharge of contaminants from PIFSC vessels is possible, but unlikely to occur in the next five years. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to marine mammals would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination on

marine mammals would therefore be considered minor adverse. As the potential effects of discharges, regulations governing discharges, and the likelihood of discharges is universal across the three research areas, they will not be analyzed further in this DPEA.

4.2.4.6 ESA-listed Species

The endangered marine mammal species in PIFSC research areas include false killer whale - MHI insular stock, sperm whale, blue whale, fin whale, sei whale, humpback whale, North Pacific right whale – eastern north Pacific stock, and Hawaiian monk seal.

Disturbance and Behavioral Responses due to Acoustic Equipment

The LOA application (Appendix C) includes calculations of the number of marine mammals that may be exposed to sound levels at or above 160 dBs from all active acoustic devices used during PIFSC fisheries and ecosystem research activities. Those calculations include a number of assumptions and elements with large variables over time and space (e.g., the densities of marine mammals and the propagation of sound under different conditions). PIFSC believes this quantitative approach benefits from its simplicity and consistency with current NMFS guidelines on estimating Level B harassment by acoustic sources, but cautions that the resulting take estimates should be considered as overestimates of behavioral harassment from acoustic devices. The estimates are provided in Table 4.2-6 below, but a more complete discussion regarding the estimates can be found in Appendix C. The take numbers in Table 4.2-6 are for the five-year authorization period and take into account the typical schedule of conducting major surveys in the different research areas on alternate years, with the HARA being covered on a more frequent basis than the other areas.The likely impact on ESA-listed species from the different types of acoustic devices is discussed below.

The output frequencies of Category 1 active acoustic sources (short range echosounders, ADCPs) are >300 kHz and are generally short duration signals with high signal directivity (Appendix C, Section 6.2). The functional hearing range of baleen whales is 7 Hz-22 kHz, with highest sensitivity generally below 10 kHz, which is well below the frequency range of Category 1 sources, so they are less likely to be detected by blue, fin, sei, North Pacific right, or humpback whales (Figure 4.2-1). Sperm and false killer whales are in the mid-frequency hearing group with a range of 150 Hz-160 kHz, with highest sensitivity from 10-120 kHz. The functional underwater hearing range of pinnipeds is 75 Hz-75 kHz, with highest sensitivity from 1-30 kHz. The functional hearing ranges of these species also fall below the output frequency of Category 1 acoustic sources; effects are expected to be temporary, if they occur, and are considered minor adverse (see Figure 4.2-1).

Category 2 active acoustic sources (various single, dual, and multi-beam echosounder devices used to determine trawl net orientation and several current profilers) have frequencies of 12-200 kHz that are of short duration and are usually highly directional. These are unlikely to be heard by most baleen whales, but are within the range of hearing for sperm and false killer whales. Most Category 2 acoustic sources are also not likely to be audible to most pinnipeds. If detected, short term avoidance is the most likely response, which would tend to reduce the exposure of animals to high sound levels (Appendix C, Section 7.2).

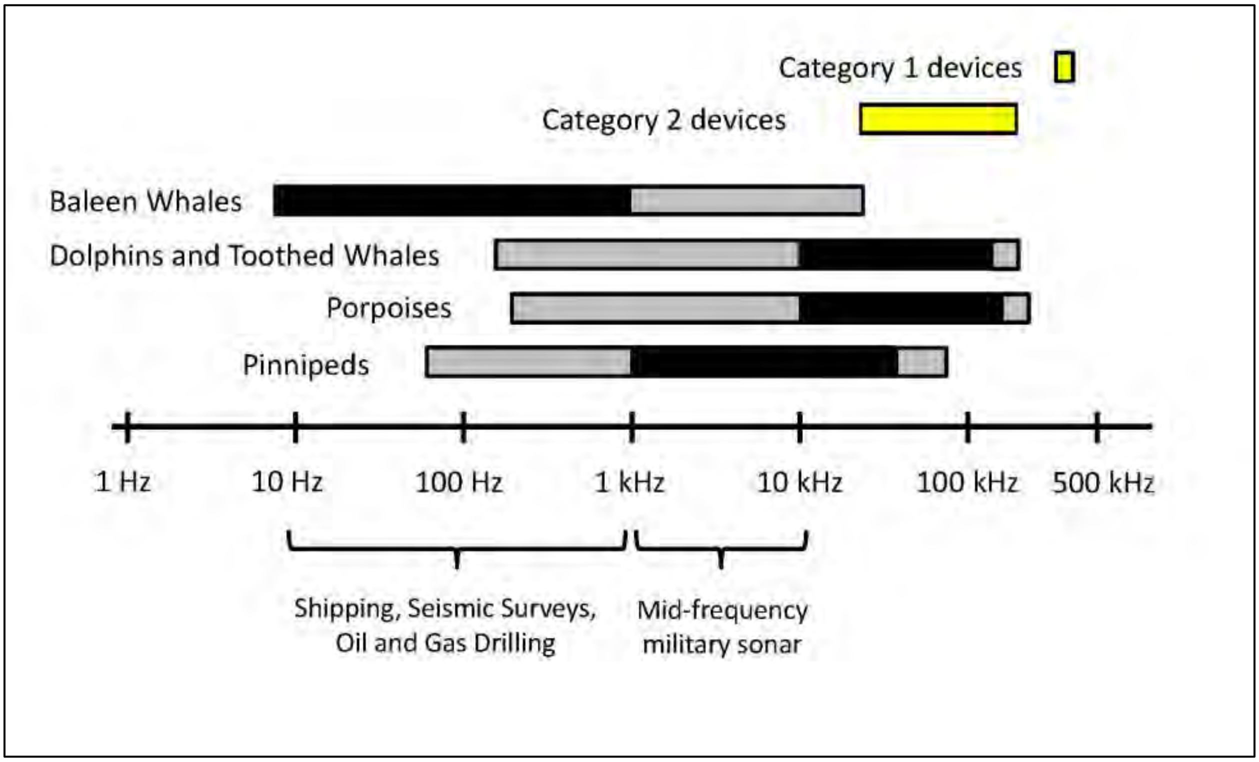

Figure 4.2-1 Typical Frequency Ranges of Hearing in Marine Mammals

Figure 4.2-1 shows hearing range for different marine mammal groups (gray and black bars) relative to the frequency outputs of the two categories of acoustic devices used in PIFSC fisheries and ecosystem research (yellow bars), as identified in Appendix C, Section 6.2. Black bars indicate the most sensitive hearing ranges of different marine mammals. Brackets indicate frequency ranges of several industrial sound sources as well as U.S. Navy mid-frequency active sonar for comparison. Data on hearing ranges is from Southall et al. (2007) and modified from DON (2008b).

The anticipated effects of active acoustic sources used during PIFSC fisheries research on threatened and endangered marine mammals is likely to occur infrequently, although they may occur over a large geographic area. Most of the frequencies are well above detection ranges for ESA-listed baleen whales, while Category 2 output overlaps with the hearing range of sperm and false killer whales. To date, there have been no reports or anecdotal observations of sounds from PIFSC research activities disturbing or causing behavioral changes in threatened or endangered species.

Vessel noise may affect large whales through masking of biologically important sounds, particularly for low frequency baleen whales (Clark et al. 2009). The biological significance of masking from vessel noise has not been demonstrated with empirical evidence for any species, but presumably the effects could include a decreased ability to detect sounds used in communication, predator avoidance, and orientation within their environment. However, the relatively small number of PIFSC research vessels is likely to only result in minimal and temporary effects from acoustic masking, as vessels pass through an area (Appendix C, Section 7.2).

The potential effects from the use of active acoustic devices during research activities would be small in magnitude, short-term in duration, and although they would be dispersed over a wide geographic area and certain to occur under the Status Quo Alternative, the overall impacts of acoustic disturbance to ESA-listed marine mammals throughout the PIFSC research area are likely to be minor adverse.

Table 4.2-6 PIFSC Estimated Five-year Level B Harassment Takes by Active Acoustic Gear for Each PIFSC Research Area

Note that take estimates of baleen whales are not provided due to the lack of overlap in their hearing range with the operating frequencies of PIFSC acoustic sources.

Species	HARA	ASARA	MARA	WPCRA	Total All Areas
Pantropical spotted dolphin	490	214	271	221	**1196**
Striped dolphin	525		74	237	**836**
Spinner dolphin	210	44	120	105	**479**
Rough-toothed dolphin	623	272	38	281	**1214**
Bottlenose dolphin	189	82	3	85	**359**
Risso's dolphin	1148		30	500	**1678**
Fraser's dolphin	442		252	199	**893**
Melon-headed whale	74		51	34	**159**
Melon-headed whale- Kohala stock	30				**30**
Pygmy killer whale	91		2	41	**134**
False killer whale	145	8	159	107	**419**
False killer whale- MHI insular	218				**218**
False killer whale- NWHI	339				**339**
Short-finned pilot whale	1931	836	227	841	**3835**
Killer whale	1	1	1	1	**4**
Sperm whale	451	195	175	197	**1018**
Pygmy sperm whale	705		416	307	**1428**
Dwarf sperm whale	1730	749	1020	754	**4253**
Blainville's beaked whale	208		123	91	**422**
Cuvier's beaked whale	73	31	43	32	**179**
Deraniyagala's beaked whale				32	**32**
Longman's beaked whale	753			328	**1081**
Unidentified *Mesoplodon*	458				**458**
Unidentified beaked whale	283	123	167	123	**696**
Hawaiian monk seal	79				**79**
Total all stocks	**11,199**	**2,556**	**3,172**	**4,515**	**21,442**

Disturbance and Behavioral Responses due to Proximity of Researchers

In addition to Level B take from acoustic disturbance, PIFSC seeks authorization of Level B harassment takes in the HARA due to the physical presence of researchers near haulouts used by Hawaiian monk seals (sandy beaches, rocky outcroppings, exposed reefs). During the RAMP coral reef monitoring surveys, PIFSC research involves nearshore diving, small boat work, and shallow water sampling. For example, during the RAMP coral reef monitoring surveys virtually all of the islands and atolls in the

HARA are circumnavigated by small boats (usually with divers in the water) once during the year. This circumnavigation is an approximation because the specific sampling locations are choosen based on a random sampling protocol. In addition, nearshore and shore-based research to assess and remove marine debris (primarily derelict fishing gear) is conducted at many locations where Hawaiian monk seals may be present. Often, when removing marine debris from shallow-water coral reefs, fish hiding in the debris may be flushed out and thus attract monk seals in the vicinity. PIFSC scientists are very aware of this situation and take precautions to avoid and minimize the chance of inadvertently disturbing monk seals, including reconnaissance of all beaches before approaching in skiffs or on foot (see mitigation procedures detailed in Section 2.2.1). However, there are numerous locations where Hawaiian monk seals may be resting adjacent to vegetation, or just emerging from the water onto the beach, and would not be immediately visible and where the options for alternate passage may be limited. Combined with the fact that this population is expanding in some PIFSC regions and that pinnipeds may haul out in new locations on a regular basis, it is essentially impossible for researchers to completely avoid disturbing monk seals as they travel around to conduct research.

Based on the locations of known haulouts (Baker and Johanos 2004, PIFSC 2014 a, b), PIFSC estimates the minimum population estimate for the Hawaiian monk seal population at about 1,182 animals. Not all of these seals haul out at the same time or at the same places, and therefore it is difficult to predict if any monk seals will be present at any particular research location at any point in time. Therefore, the only way to estimate the amount of Level B harassment would be to approximate the number of seals hauled out at any point in time across the HARA and the probability that a researcher would be close enough to actually disturb the seal.

The best estimate for the number of monk seals hauled out at any point in time is approximately one-third of the total population (Parrish et al. 2000). Therefore, assuming that all seals have an equal probability of hauling out anywhere in the archipelago, one-third of 1,182 is approximately 400 individual monk seals. Given that the two surveys with the highest probabilility of disturbing seals (i.e., RAMP and Marine Debris Research and Removal) systematically circumnavigate all the islands and atolls when they are conducted, we could estimate the annual maximum number of Level B harassment takes as 800 during years when these activities are conducted. Over the course of five years, this would be approximately 4000 potential disturbances if all the surveys took place every year at every location across the HARA. However, RAMP surveys occur in the HARA approximately twice every five years and Marine Debris Research and Removal Surveys are rarely funded to a level that would support complete circumnavigation of the HARA each year. In addition, sometimes during RAMP surveys the location of marine debris are identifed (and recorded), thus precluding the need for marine debris identification later (only removal). Therefore, the approximately 4000 potential disturbances over five years could be reduced by two-fifths to approximately 1600 potential disturbances over five years. Furthermore, not all small boat operations during these surveys are close enough to the shoreline to actually cause a disturbance (e.g., a seal may be hauled out on a beach in a bay but the shallow fringing reef may keep the small boat from getting within half a mile from shore). In addition, the researchers implement avoidance and minimization measures while carrying out the surveys. The approximately 1600 potential disturbances could realistically be reduced through avoidance or sheer geographical separation by one half. Therefore, the PIFSC is requesting 800 Level B disturbances of Hawaiian monk seals due to the physical presence of researchers in the HARA over the five-year authorization period.

Injury and Mortality due to Interaction with Research Gear

There have been no entanglements or takes of ESA-listed marine mammals in PIFSC fisheries research from NOAA vessels or NOAA chartered vessels. Table 4.2-7 includes estimates of the number of marine mammals that may be caught in research gear with resulting Level A harassment/M&SI takes based on takes in analogous commercial fisheries using gear similar to gear used in PIFSC fisheries and ecosystem research.

PIFSC is requesting Level A harassment/M&SI takes from two ESA-listed species, humpback whale (Central North Pacific stock) and sperm whale (Hawaiʿi stock). Both of these stocks are endangered under the ESA and thus, by definition, as depleted under the MMPA. PIFSC is requesting one take from each species in longline gear over the five-year authorization period (Table 4.2-7). These requests are based on documented takes of these species in commercial longline fisheries. In addition, PIFSC is requesting one take over the five-year authorization period for humpback whales that might get entangled in lines used to deploy research instruments (lines connecting floats and anchors, moorings, or instruments deployed over the side of a vessel). This take request is based on documented entanglement of humpback whales in lines associated with various gears using floats and anchors. The requested levels of take are well below 10 percent of PBR for each species (Table 4.2-7) and would be considered minor in magnitude according to the impact criteria described in Table 4.1-1. Given the mitigation measures in place to minimize potential interactions with marine mammals (Section 2.2.1), including the use of monitoring and the move-on rule for longline research, PIFSC considers the risk of actually taking either humpback or sperm whales in fisheies and ecosystem research gear to be remote and the take request represents a precautionary estimate of potential take. These takes, if they occurred, would likely be rare events and would have minor adverse impacts on each stock according to the impact criteria described in Table 4.1-1.

PIFSC considered the risk of interaction with marine mammals for all the research gears and instruments it uses but did not request incidental takes in research gears other than midwater trawls, longline, and instrument deployments. There is evidence that Hawaiian monk seals (and bottlenose dolphins) occasionally pursue fish caught on various hook-and-line gears (depredation of fishing lines) deployed in commercial and non-commercial fisheries across Hawaiʿi (Nitta and Henderson 1993, Kobayashi and Kawamoto 1994). This depredation behavior, which is documented as catch loss from the hook-and-line gear, may be beneficial to the marine mammal in providing prey but it also opens the possibility for the marine mammal to be hooked or entangled in the gear. PIFSC gave careful consideration to the potential for including incidental take requests for marine mammals in bottom handline (bottomfishing) gear although it has not had any marine mammal interactions in the past while conducting research with bottomfishing gear in the MHI.

Fisheries in state waters are not observed by independent, trained monitors and therefore few data exist on interactions with marine mammals. A recently published preliminary summary of self-reported catch loss data from the State of Hawaiʿi Commercial Marine License reporting system indicates that the number of catch loss incidents by monk seals and dolphins in the MHI may be increasing, but is still relatively rare (Boggs et al. 2015). The authors of the summary emphasize that the data received only cursory treatment and should not be viewed as comprehensive.

The population of monk seals in the MHI is relatively small (minimum abundance estimate in 2011 of 138 seals), but it is growing at approximately 6.5% per year (Caretta et al. 2015). No mortality or serious injuries of monk seals have been attributed to the MHI bottomfish handline fishery (Caretta et al. 2015). However, the same report (Caretta et al. 2015) notes: “In 2012, 16 Hawaiian monk seals were observed hooked, four of which died as a result of ingesting hooks. The remaining 12 were non-serious hookings, although 5 of these would have been deemed serious had they not been mitigated by capture and hook removal. Several incidents involved hooks used to catch ulua (jacks, Caranx spp.).” The hook-and-line rigging used to target ulua are typical of shoreline fisheries that are distinct from the bottomfishing gear and methods used by PIFSC during its fisheries and ecosystem research. Although there are some similarities between the shoreline fishery and the bottomfishing gear used by PIFSC (e.g., circle hooks), the general size and the way the hooks are rigged (e.g., baits, leaders, weights, tackle) are typically different and probably present different risks of incidental hooking to monk seals. Ulua hooks are generally much larger circle hooks than PIFSC uses because the targeted ulua are usually greater than 50 pounds in weight. Shoreline fisheries (deployed from shore with rod and reel) also typically use “slide bait” or “slide rigs” that allow the use of live bait (small fish or octopus) hooked in the middle of the bait. If a monk seal pursued this live bait and targeted the center of the bait or swallowed it whole, it could get

hooked in the mouth. PIFSC research with bottomfishing gear uses pieces of fish for bait that attract bottomfish but not monk seals. Monk seals could be attracted to a caught bottomfish but, given the length of the target bottomfish (averaging approximately 14 inches long; Boggs, personal communication), it is unlikely that a monk seal would be physically capable of swallowing the whole fish and therefore bites and tears at the caught fish (i.e., shreds the body of the fish while feeding). The risk of monk seals getting hooked on bottomfishing gear used in PIFSC research is therefore less than the risk of getting hooked on shoreline hook-and-line gears which are identified in the marine mammal stock assessment report (Caretta et al. 2015).

Given the mitigation measures the PIFSC intends to implement for bottomfishing research under the Preferred Alternative (see Section 2.3.1.3), PIFSC has concluded that the risk of marine mammal interactions with its research bottomfishing gear is not high enough to warrant an incidental take request for marine mammals in that gear in the LOA application. PIFSC intends to document potential depredation of its bottomfish research gear (catch loss) in the future, and increase monitoring efforts when catch loss becomes apparent, in an effort to better understand the potential risks of hooking to monk seals and other marine mammals.

Table 4.2-7 Requested Number of Potential M&SI and Level A Marine Mammal Takes in PIFSC Fisheries and Ecosystem Research

This table summarizes the PIFSC combined Mortality and Serious Injury (M&SI) and Level A harassment take request of marine mammal stocks by gear type (all areas combined). Instrument deployments involve moorings and floating instruments or other lines that may cause entanglements. All population estimates and Potential Biological Removal (PBR) values are from the most recent stock assessment reports (Carreta et al. 2015, Allen and Angliss 2015). Note that PBR is an annual measure of mortality while the LOA application estimates potential takes for the five-year period. The requested takes are shown as average annual takes that can be compared with PBR. The "undetermined dolphin" takes are assigned to each dolphin species for impact assessment purposes.

Common Name - Stock	Minimum Population Estimate	PBR	Potential M&SI and Level A Take Average per Year – All Research Areas Combined (total for five-year period)				
			Trawl Gear	Longline Gear	Instrument Deployment	Total Average Take Request – All Gears and Research Areas Combined	Total Annual Take Request as % of PBR Requested
Beaked whale, Blainville's - Hawaiʻi stock	1,088	11		0.2 (1)		0.2 (1)	1.8%
Beaked whale, Cuvier's - Hawaiʻi pelagic stock	1,142	11.4		0.2 (1)		0.2 (1)	1.8%
Bottlenose dolphin - Hawaiʻi pelagic stock	3,755	38	0.2 (1)	0.2 (1)	0.2 (1)	0.6 (3)	1.6%
Bottlenose dolphin – all stocks except above			0.2 (1)		0.2 (1)	0.4 (2)	NA
False killer whale - Hawaiʻi pelagic stock or unspecified stock [A]	935	9.4		0.2 (1)		0.2 (1)	2.1%
Humpback whale – Central North Pacific stock [B]	7,890	82.8		0.2 (1)	0.2 (1)	0.4 (2)	0.5%
Kogia spp. (Pygmy and dwarf sperm whale - Hawaiʻi stocks)	Unknown	Undetermined		0.2 (1)		0.2 (1)	NA
Pantropical spotted dolphin – all stocks [C]	11, 508	115	0.2 (1)	0.2 (1)	0.2 (1)	0.6 (3)	0.5%
Pygmy killer whale – Hawaiʻi stock	2,274	23		0.2 (1)		0.2 (1)	0.9%

Common Name - Stock	Minimum Population Estimate	PBR	Potential M&SI and Level A Take Average per Year – All Research Areas Combined (total for five-year period)				
			Trawl Gear	Longline Gear	Instrument Deployment	Total Average Take Request – All Gears and Research Areas Combined	Total Annual Take Request as % of PBR Requested
Risso's dolphin - Hawaiʿi stock	5,207	42		0.2 (1)		0.2 (1)	0.5%
Rough-toothed dolphin – Hawaiʿi stock	4,581	46	0.2 (1)	0.2 (1)	0.2 (1)	0.6 (3)	1.3%
Rough-toothed dolphin – all stocks except above				0.2 (1)	0.2 (1)	0.4 (2)	NA
Short-finned pilot whale - Hawaiʿi stock	8,782	70		0.2 (1)		0.2 (1)	0.3%
Sperm whale - Hawaiʿi stock [D]	2,539	10.2		0.2 (1)		0.2 (1)	2.0%
Spinner dolphin, all stocks [E]	355	3.3	0.2 (1)		0.2 (1)	0.4 (2)	12.1%
Striped dolphin, all stocks	15,391	154	0.2 (1)	0.2 (1)		0.4 (2)	0.3%

A - Strategic stock based on total M&SI exceeding PBR. PIFSC fisheries and ecosystem research would not occur within the ranges of other false killer whale stocks. "Unspecified stock" only occurs on the high seas.

B - Listed as endangered under the ESA. Request for take by potential entanglement in instrument deployment lines based on Bradford and Lyman (2015).

C – Information presented only for Hawaiʿi pelagic stock, which is the only stock with estimates of population and PBR.

D - Listed as endangered under the ESA.

E - Information presented only for the Oʻahu/4-Islands stock, which is the smallest stock for which population and PBR estimates are available. This is used to provide the most conservative impact assessment.

4.2.4.7 Other Cetaceans

This section describes impacts to non-ESA-listed cetaceans occurring within the PIFSC research areas (see species listed in Table 4.2-6 and Table 4.2-7).

Disturbance and Behavioral Responses due to Acoustic Equipment

The analysis of acoustic effects on these species is similar to that discussed for ESA-listed species above. Table 4.2-6 provides summaries of the numbers of each species that could be taken by acoustic disturbance during PIFSC research activities in PIFSC research areas. See Appendix C for a discussion about the derivation and concerns about the accuracy of these estimates. The likely impact on cetaceans from the different types of acoustic devices is discussed below.

The mid-frequency odontocetes have a functional hearing range of 150 Hz to 160 kHz, with highest sensitivity from 10-120 kHz. The high-frequency odontocetes have a functional hearing range of 200 Hz to 180 kHz, with highest sensitivity from 10-150 kHz. The output frequencies of Category 1 active acoustic sources (>300 kHz) are above the functional hearing range of baleen whales and cetaceans in the mid- and high-frequency hearing groups (Figure 4.2-3). Because they would not be able to hear them, cetaceans are not expected to be affected by Category 1 sound sources (Appendix C, Section 6.2).

Category 2 active acoustic sources are unlikely to be heard by most baleen whales, but are within the range of hearing for various odontocetes, especially the high frequency hearing beaked whales and dwarf and pygmy sperm whales. Some of these devices are used on trawl nets during fishing so their use is intermittent, localized and directional, and they are deployed on moving sources. The sounds could be loud to cetaceans in close proximity to the sound source but physical damage is unlikely, although TTS could occur if animals remained close to the source (tens to a few hundred meters) for prolonged periods (Appendix C, Section 6.2). The short duration of most research tows (< 30 minutes) should minimize that likelihood. If detected, short term avoidance is the most likely response (Appendix C, Section 6.2).

Potential disturbance from active acoustic equipment used during research would not have any measurable effect on the population of any cetacean and would therefore be considered minor in magnitude. Such disturbance is likely to occur wherever survey vessels use the equipment, but cetaceans would only be close enough to a vessel to be affected on a rare or intermittent basis and any behavioral changes would be temporary. The overall impact of active acoustic sound sources on non ESA-listed cetaceans throughout PIFSC research areas is therefore considered to be minor adverse according to the criteria in Table 4.1-2.

Injury or Mortality Due To Interactions with Research Gear

There has been no history of marine mammal takes in fisheries and ecosystem research gears by PIFSC research activities. Measures to mitigate the risk of adverse interactions with marine mammals are described in Section 2.2.1. The PIFSC LOA application (Appendix C) includes estimates of the potential number of marine mammals that may interact with research gear based on documented takes of species taken in analogous commercial fisheries, e.g., those operating in similar areas and using similar gear types (Table 4.2-7). Note that the LOA application does not request authorization to take all species of marine mammals that occur in the PIFSC research areas; only those species listed in Table 4.2-7 are considered to have a reasonable risk of adverse interactions with gear used for PIFSC fisheries and ecosystem research. PIFSC considers these estimates to be greater than what is likely to occur in the future, especially given the fact that none of these species have been taken in research gears in the past, the relatively small level of fishing effort during PIFSC fisheries and ecosystem research, and the mitigation measures in place to reduce potential interactions.

The take request includes takes of cetaceans in midwater trawl gear (Cobb or Isaacs-Kidd midwater trawls), longline gear, and by entanglement during instrument deployments (Table 4.2-7). For all gear types and stocks requested, the requests are for the minimal amount, one animal over the five-year

authorization period, although a number of stocks are requested in more than one gear. For almost all of these stocks, the total requested level of take from all gears, if it occurred, would be less than ten percent of PBR and would be considered minor in magnitude for each stock. The exception is for spinner dolphins. The combined take of two spinner dolphins (one in midwater trawl and one in instrument deployments) would be 12.1% of the Oahu/4-Islands stock's PBR if both takes occurred on this one stock and this level of take would be considered to be moderate in magnitude. However, since the request is for all stocks due to the spatial extent of the research, the uncertainty of stock boundaries, and possibility of encountering individuals from undescribed stocks, the impact would be more likely to be spread across more than one stock of spinner dolphin and the resulting impact would likely be of smaller magnitude.

There are several species for which the stock structure throughout the PIFSC research area has not been determined (e.g., bottlenose dolphin) or for which abundance and PBR values have not been determined. The impact of potential takes from these stocks relative to PBR is therefore not available.

PIFSC considered the risk of interaction with marine mammals for all the research gears it uses but did not request incidental takes in research gears other than trawls, longline, and instrument deployments. There is evidence that bottlenose dolphins occasionally pursue fish caught on various hook-and-line gears (depredation of fishing lines) deployed in commercial and non-commercial fisheries across Hawaiʿi (Boggs et al. 2015). However, PIFSC has concluded that the risk of marine mammal interactions with its research bottomfishing gear is not high enough to warrant an incidental take request for marine mammals in that gear in the LOA application (see section 4.2.4.6 above). PIFSC intends to document potential depredation of its bottomfish research gear (catch loss) in the future, and increase monitoring efforts when catch loss becomes apparent, in an effort to better understand the potential risks of hooking to bottlenose dolphins and other marine mammals.

<u>Conclusion</u>

The potential direct and indirect effects of PIFSC research activities on marine mammals have been considered for each of the four PIFSC research areas (HARA, MARA, ASARA, and WCPRA) and for all gear types used in research under the Status Quo Alternative. Given the very small amounts of fish and invertebrates removed from the ecosystem during scientific sampling, the dispersal of those sampling efforts over large geographic areas, and the short duration of sampling efforts, the overall risk of causing changes in food availability for marine mammals is considered minor adverse. Also, given the crew training, required emergency equipment, and adherence to environmental safety protocols on NOAA research vessels and NOAA chartered vessels, the risk of altering marine mammal habitat through contamination from accidental discharges into the marine environment is considered minor adverse.

All species may be exposed to sounds from active acoustic equipment used in PIFSC research in the four research areas, although several acoustic sources are not likely audible to many species. Those that are audible would likely cause temporary and minor changes in behavior for nearby animals as the ships pass through a given area. The potential for temporary threshold shifts in hearing is low for high frequency cetaceans (e.g., dolphins) and very low to zero for other species, particularly low frequency cetaceans (e.g., Mysticetes). The potential for hearing loss or injury to any marine mammal is essentially zero. Because of the minor magnitude of effects and temporary duration of acoustic disturbance, the overall effects of acoustic disturbance are considered minor adverse for all species throughout the PIFSC research areas.

PIFSC has never caught, hooked, or had marine mammals entangled in its fisheries research gear. However, incidental takes of marine mammals have occurred in commercial and non-commercial fisheries in the same areas as PIFSC research occurs and using gears similar to those used in research. PIFSC has used information on these analogous fisheries to make precautionary estimates of marine mammals that may be incidentally taken during future fisheries and ecosystem research. These Level A harassment and mortality and serious injury takes include three ESA-listed species and 13 non-listed

cetacean species, primarily by research using longline gear but also including research with midwater trawl gear and instrument deployments (potential entanglement in mooring lines or other lines). For almost all stocks for which PBR has been determined, the requested takes, if they occurred, would represent less than ten percent of PBR and would be considered minor in magnitude. The exception is for spinner dolphins. If all of the requested takes for spinner dolphin occurred on the Oahu/4-Islands stock, the takes would be 12.1% of PBR for this stock and would be considered moderate in magnitude.

Given the mitigation measures implemented under the Status Quo Alternative, the relatively small amount of fishing effort involved in PIFSC research, and the lack of takes in the past, PIFSC does not anticipate that the level of requested takes will actually occur in the future. The overall impact of the potential takes of these species, if they occurred, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

PIFSC also uses bottomfishing hook-and-line gear, bongo nets, baited traps, SCUBA gear, and other scientific instruments in the course of conducting fisheries and ecosystem research (Table 2.2-1) that are not considered to present reasonable risks of incidental takes of marine mammals and for which no take requests have been made in the LOA application.

In addition to Level B harassment takes for many species through acoustic disturbance, PIFSC is requesting Level B harassment takes for Hawaiian monk seals due to the physical presence of researchers in nearshore waters and beaches. Given the protocols for monitoring and avoiding interactions with monk seals, these potential takes would likely result in only temporary disturbance of small numbers of monk seals and adverse impacts would be minor.

The overall effects of the Status Quo Alternative on marine mammals would be minor to moderate in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.2.5 Effects on Birds

Section 3.2.3 describes the populations of birds that are likely to overlap with PIFSC fishery research activities in the HARA, MARA, ASARA, and WCPRA research areas. This section describes the effects of the Status Quo PIFSC research activities on seabirds. Seabirds occur throughout the year in all research areas concurrent with PIFSC research activities. The potential effects of research vessels, survey gear, and other associated equipment on seabirds include:

- Injury or mortality due to ship strikes and entanglement in gear
- Changes in food availability due to survey removal of prey and discards
- Contamination or degradation of habitat

4.2.5.1 Injury and Mortality Due to Ship Strikes and Entanglement in Gear

There are several potential mechanisms for PIFSC research activities to cause injury or mortality to seabirds. Many seabirds are attracted to fishing vessels in order to forage on bait, offal, discards, and natural prey disturbed by the fishing operation. This attraction to fishing vessels creates the opportunity for birds to inadvertently collide with cables or lines and other structures on the vessel, or to become entangled in the fishing gear. Bird strikes on commercial fishing vessels are probably most numerous at night and during storms or foggy conditions when bright deck lights can cause the birds to become disoriented (NMFS 2004). However, such bird strikes are relatively rare and can be difficult to detect. Currently, there are no recorded instances of bird injury or mortality resulting from PIFSC fisheries and ecosystem research activities.

Marine mammal biologists working with the PIFSC Hawaiian monk seal research program experienced an unusual interaction with Laysan finch, an ESA-listed species endemic to Laysan Island, while camping

and conducting monk seal research for extended periods of time on the island (USFWS 2014b). Laysan finch is a terrestrial species that is not likely to interact with marine research activities but it is apparently curious and regularly explores human encampments on the island. In May 2009, a small group of Laysan finches flew out to the NOAA Ship *Oscar Elton Sette*, which was transporting monk seal researchers from Laysan to other islands. Several of these birds flew down the smokestack and one bird perished. The birds may have been looking for food and water, which was scarce on the island. This incident was considered to be an anomaly (USFWS 2014b) and the potential for any such interactions with PIFSC fisheries and ecosystem research activities is considered remote.

Under the Status Quo Alternative, seabird injury or mortality could potentially occur as a result of ship strikes, however, based on the based on the infrequency of ship strikes in commercial fishing operations in the PIFSC research areas, and the absence of historic seabird injury or mortality resulting from PIFSC research activities, it is unlikely that any seabird mortality would occur as a result of ship strikes on PIFSC research vessels under the Status Quo alternative.

Mortality of seabirds in commercial fishing gear, especially longlines, is a major conservation concern for albatross, gulls, and other species that interact with commercial fishing vessels in the PIFSC research areas. Although it is possible for seabirds to interact with a wide range of fisheries and ecosystem research gear types, interactions between seabirds and pelagic longline gear have the potential to be particularly problematic. Diving birds are vulnerable to interaction with fishing gear near the surface as the gear is being deployed or retrieved. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear can pull the bird underwater. Seabirds that feed in areas where PIFSC conducts research using longline gear include Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), shearwaters, fulmars, boobies, and the endangered short-tailed albatross (*P. albatrus*). The introduction of safe-handling procedures for seabirds and measures to mitigate seabird bycatch have greatly reduced the frequency of interactions with seabirds, particularly with Laysan albatross and black-footed albatross. In 2000, NMFS estimated 2,433 seabird interactions occurred in the Hawai‘i commercial longline fisheries. Implementation of seabird safe-handling and mitigation measures after 2004 significantly reduced annual interactions, so that in 2013, NMFS estimated 180 total interactions with seabirds, a decrease of over 92% relative to pre-mitigation levels (NOAA Fisheries 2014). Credit for this successful reduction in interactions is mostly due to the commercial fishermen, who understand and implement the seabird mitigation requirements. The requirements include mandatory training in seabird identification, seabird deterrent fishing gear and techniques, and special handling and release of incidentally-caught seabirds.

Under the Status Quo Alternative, PIFSC would continue to conduct surveys using longline gear as part of the Pelagic Longline Hook Trials, Longline Gear Research, and Marlin Longline survey programs. Because longline research would be conducted in conjunction with commercial fisheries, operational characteristics (e.g., branchline and floatline length, hook type and size, bait type, number of hooks between floats) of the longline gear in Hawai‘i, America Samoa, Guam, the Commonwealth of the Northern Marianas, or EEZs of the Pacific Insular Areas would adhere to the requirements based on regulations of the Western Pacific Regional Fisheries Management Council (WPRFMC 2014). These requirements include the use of weighted branchlines, blue-dyed bait, and strategic offal discard practices, which would decrease the potential for adverse interactions with seabirds.

Currently, there are no recorded instances of any bird mortalities resulting from fisheries and ecosystem research activities conducted and funded by PIFSC, and likewise, no mortalities would be expected to occur as a result of activities proposed under the Status Quo Alternative. It is possible that seabird mortality could occur as a result of ship strikes or interaction with fishing gear, but it is likely that such adverse interactions with seabirds would be rare, and would affect small numbers of birds.

4.2.5.2 Changes in Food Availability

Under the Status Quo Alternative, PIFSC fisheries and ecosystem research activities could potentially affect seabirds through changing the abundance or distribution of their prey species. A recent study (Cury et al. 2011) examined data from the past 45 years and all of the world's oceans and found that reductions in prey abundance (small fish and invertebrates) to below one third of the maximum documented biomass results in substantial declines in seabird reproductive success. This response was common to all seabird species and and ecosystems examined in the Pacific, Atlantic, and Southern Oceans (Cury et al. 2011). Many factors influence the abundance and distribution of seabird prey and forage species, including oceanographic and weather fluctuations, and commercial fishing effort. Although it is difficult to demonstrate the indirect effects of fishing for other species and size classes on the availability of prey for seabirds, directed fishing on small schooling fish (e.g., sardines and anchovies) and invertebrates (e.g., krill) have played roles in driving seabird prey and forage populations below the "one third" limit in many areas (Cury et al. 2011).

Fisheries and ecosystem research activities proposed under the Status Quo Alternative may also have beneficial effects on seabirds by providing offal and discards as food for birds, representing sources of energy and nutrients that would otherwise be unavailable to birds. In some areas with intensive commercial fishing efforts, offal may provide a substantial portion of the total food consumed by scavenging species such as gulls (Tasker and Furness 1996). While scavenging may benefit individual birds, it also potentially places them in danger from entanglement and incidental interactions with fishing gear.

PIFSC fisheries and ecosystem research activities proposed under the Status Quo Alternative would remove very small quantites of potential food for seabirds. The dispersal of research effort over wide areas of sea and the relatively small number of research surveys over time makes it very unlikely that any measureable impacts to the abundance or distribution of seabird prey would occur as a result of research activities proposed under the Status Quo Alternative. This is especially true for the small size classes of fish and pelagic invertebrates favored by most seabirds because of their large biomasses and the minimal amounts taken in research samples (Sections 4.2.3 and 4.2.7). For the same reasons, the amount of food made available through research activities is unlikely to have more than temporary and highly localized beneficial effects on seabirds.

4.2.5.3 Contamination or Degradation of Habitat

For the same reasons described for fish (Section 4.2.3) and marine mammals (Section 4.2.4), potential effects on seabirds from accidental discharges of fuel or other contaminants from vessels engaged in PIFSC fisheries and ecosystem research activities are possible but unlikely. In the unlikely event that fuel, oil, or other contaminants are discharged, the volume of discharged material is likely to be small and the area of influence would be localized. Any potential effects to seabirds would be similarly short-term, localized, and would likely affect a small number of birds. The overall impact of accidental contamination of seabirds would therefore be considered minor adverse. This type of potential effect on seabirds will not be discussed further in this analysis.

One of the PIFSC research programs considered in this DPEA involves the removal of derelict fishing gear from shallow waters and beaches where various seabirds may forage, rest, or breed. Given the potential for birds to become entangled in such gear, the removal of derelict gear has beneficial effects on seabirds, especially diving species.

4.2.5.4 Conclusion

The effects of PIFSC-affiliated fisheries and ecosystem research on seabirds include the potential for injury and mortality in fishing gear and ship strikes, changes in food availability, and contamination or degradation of habitat. There have been no reported captures of seabirds in PIFSC research gear or

incidents of ship strikes in the past. Given the occurrence of seabird bycatch in commercial fisheries in the Pacific Islands Region, such effects could potentially occur in the future under the Status Quo Alternative but would likely be rare and minor in magnitude. For reasons similar to those described for marine mammals above, the overall risk of PIFSC fisheries research causing changes in food availability for seabirds or contamination in the marine environment is considered minor adverse, although there could be beneficial effects of derelict gear removal.

The overall effects on seabirds from PIFSC research activities under the Status Quo Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

4.2.6 Effects on Sea Turtles

Section 3.2.4 describes the populations of sea turtles that are likely to overlap with PIFSC fishery research activities in the HARA, MARA, ASARA, and WCPRA. This section describes the potential effects of PIFSC research activities on sea turtles under the Status Quo Alternative, including mitigation measures that have been implemented to reduce adverse effects.

Five species of sea turtles can be found within the PIFSC research areas: green, hawksbill, leatherback, loggerhead, and olive ridley sea turtles. All five species of sea turtles found in the Pacific Islands research areas are listed as threatened or endangered under the ESA. Direct and indirect effects of PIFSC research activities on sea turtles may include:

- Disturbances and changes in sea turtle behavior due to physical presence and sound sources
- Injury or mortality due to ship or small boat strikes and gear interactions
- Changes in food availability due to survey removal of prey
- Contamination or degradation of sea turtle habitat

Mitigation measures implemented under the Status Quo Alternative are intended to reduce the potential for adverse interactions with sea turtles, and are described in Section 2.2.1.

4.2.6.1 Disturbances and Changes in Behavior Due to Physical Presence and Sound Sources

There is a potential for research activities to negatively affect or disturb sea turtles and cause changes in behavior. Such effects could result from the physical presence of marine vessels and fishing gear, operational sounds from engines and hydraulic equipment, and active acoustic devices used for navigation and research.

Little is known about hearing in sea turtles, but the available information suggests that their underwater hearing capabilities are quite limited both in functional hearing bandwidth and in absolute hearing sensitivity. Electrophysiological studies on the acoustic sensitivity of the green sea turtle (*Chelonia mydas*) and loggerhead sea turtle (*Caretta caretta*) using auditory brainstem response techniques determined that the effective range of hearing of these species is within low frequencies (100 to 500 Hz) (Bartol and Ketten 2003) Additional data suggest that sea turtles probably have functional hearing sensitivity between about 100 Hz and 1.2 kHz (Ketten and Bartol 2005, Dow, Piniak, et al. 2012), which is well below the frequencies of active acoustic instruments used for PIFSC fisheries and ecosystem research (Appendix C, Section 6.2). Active acoustic instruments used by PIFSC for fisheries and ecosystem research generally operate at frequencies in the 18 – 200 kHz range, and the sounds generated by PIFSC active acoustic instruments are unlikely to be audible to sea turtles and therefore unlikely to have adverse effects on sea turtles. Based on the auditory capabilities of sea turtles, active acoustic sources used in PIFSC fisheries research operations are unlikely to be audible to sea turtles and therefore are unlikely to have adverse effects on sea turtles.

Sea turtles may be disturbed or displaced from their normal behavior or movements by passing vessels or fishing gear in the water. However, given the small number of research vessels and their dispersal over a wide area, behavioral disturbances resulting from PIFSC research activities proposed under the Status Quo Alternative would be isolated in geographic extent and short-term in nature, lasting only a few minutes as the research vessel passes. Such disturbances would not result in measureable changes to sea turtle foraging success or survival at the population level. Therefore, the effects would be minor adverse under the Status Quo Alternative using gear types and mitigation measures similar to those currently in use.

4.2.6.2 Injury or Mortality Due to Ship or Small Boat Strikes and Entanglement in Gear

The two main mechanisms for research activities to cause injury or mortality to sea turtles are ship or small boat strikes and entanglement in fishing gear. Sea turtles come to the surface to breathe, and also to rest, making them susceptible to ship strikes. However, there are no reported incidents of ship strikes with sea turtles by NMFS research vessels in the HARA, MARA, ASARA, or WCPRA research areas. As described in Section 2.2.1, vessel speeds are restricted on research cruises in part to reduce the risk of ship or small boat strikes with marine mammals and sea turtles. Transit speeds vary from six to ten kts, but average nine kts. Vessel speeds during active sampling are typically between two and four kts due to sampling design, and these slower speeds are assumed to minimize the risk of collisions with sea turtles. During nearshore small boat activities the potential for accidentally striking a sea turtle is slightly higher. Green and hawksbill sea turtles generally forage close to shore around the shallow fringing reefs of the PIR. When sea turtles swim to the surface to breathe, it can be difficult to spot them, especially if the sea surface is choppy. Given the relatively slow speeds of research vessels, the presence of dedicated marine species observers during survey activities, and the relatively low density of research activities dispersed over wide areas in the HARA, MARA, ASARA, and WCPRA, collisions with sea turtles are unlikely to result from the research activities considered under the Status Quo Alternative. Therefore, the effects of collisions with sea turtles are considered minor adverse throughout the HARA, MARA, ASARA, and WCPRA under the Status Quo Alternative using vessel types and mitigation measures similar to those currently in use.

There are no reported incidents of sea turtle entanglement in gear during PIFSC fisheries and ecosystem research activities conducted in the HARA, MARA, ASARA, or WCPRA. The potential direct mechanisms of interaction would include capture or entanglement in various nets, collisions with mobile gear, and getting hooked by longline fishing gear. The potential indirect mechanisms of interaction would include capture or entanglement in research fishing gear or instruments (in particular, monofilament) that were accidentally lost during a survey and ended up on a reef that then interacted with a sea turtle later in time. Several factors may explain the lack of previous sea turtle interactions with PIFSC fisheries and ecosystem research equipment in the PIFSC research areas, including configuration of the fisheries and ecosystem research equipment employed by PIFSC and the type and size of hooks and the bait used for longline surveys, as well as the spatial distribution of sea turtles in the areas where research gear is deployed, which may be related to the presence of prey sources, seasonal migration patterns, and oceanographic features. Potential mechanisms for sea turtle interactions with longline gear include entanglement in lines and being caught by hooks as a result of depredation by sea turtles on the bait or caught fish. These types of adverse interactions could potentially result in serious injuries or mortalities to sea turtles. Loggerhead and leatherback sea turtles have been identified as being at particular risk of population decline as a result of incidental take by longline pelagic fisheries (Lewison et al. 2004). However, there have been no recorded incidents of sea turtle interactions with PIFSC research longline gear in the HARA, MARA, ASARA, or WCPRA. Based on the lack of previous sea turtle interactions with fisheries and ecosystem research equipment in the PIFSC research areas, it is not anticipated that any sea turtles would be captured during the research proposed under the Status Quo Alternative.

Under the Status Quo Alternative, operational characteristics (e.g., branchline and floatline length, hook type and size, bait type, number of hooks between floats) of the longline gear in Hawai‘i, America Samoa, Guam, the Commonwealth of the Northern Marianas, or EEZs of the Pacific Insular Areas would adhere to the requirements based on regulations of the Western Pacific Regional Fisheries Management Council (WPRFMC 2014). Additionally, operational characteristics of longline research in non-WPRFMC areas of jurisdiction would adhere to the regulations of the applicable management agencies, including Western and Central Pacific Fisheries Commission (WCPFC), and Inter-American Tropical Tuna Commission (IATTC). Given the lack of historical interactions under the same conditions, the potential for future interactions is considered small and unlikely to affect any populations of sea turtles. The potential effects of longline surveys on sea turtle populations are therefore considered to be minor adverse based on the criteria in Table 4.1-1.

Mitigation measures implemented under the Status Quo Alternative would be intended to reduce the potential for adverse interactions with sea turtles. Operational procedures and monitoring methods described in Section 2.1.1 would include visual scans for sea turtles, and would preclude trawl and longline surveys in areas where turtles are observed. However, the efficacy of these mitigation measures may be limited by the fact that turtles in the water may be difficult to see. In summary, there have been no recorded incidents of sea turtle entanglement resulting from PIFSC fisheries and ecosystem research activities, and no reported interactions resulting in sea turtle mortality. Based on this information, there is potential for minor adverse effects to occur using gear types and mitigation measures currently in use; such effects would be rare and short-term in frequency and duration, and would not result in measurable changes to sea turtle population levels in any of the PIFSC research areas.

4.2.6.3 Changes in food availability due to survey removal of prey and forage species

PIFSC fisheries and ecosystem research activities proposed under the Status Quo Alternative are unlikely to have substantial effects on the availability of prey and forage species for sea turtles in the HARA, MARA, ASARA, and WCPRA research areas due to the relatively low spatial density of research activities within the research areas, and the small amounts of prey and forage species removed as a result of PIFSC research activities. Western Pacific leatherback turtles (*Dermochelys coriacea*) forage seasonally on dense aggregations of jellyfish off the west coast of the United States (Graham 2009). All life stages consume gelatinous organisms such as jellyfish and tunicates (USFWS Biological Technical Publication, BTP-R4015-2012). Several species of jellyfish are frequently caught as a result of PIFSC fisheries research activities, however, due to the extremely high densities of jellyfish encountered in leatherback foraging areas and the small amounts of biomass removed by PIFSC fisheries and ecosystem research activities, the removal of jellyfish as a result of PIFSC research would have egligible effects on the availability of jellyfish as a food source for leatherback sea turtles. Likewise, disturbance or removal of small amounts of marine plants and grasses by PIFSC research activities are unlikely to have any measureable effects on forage availability for Hawaiian green sea turtles (*Chelonia mydas*), which are known to feed on sea grasses and seaweeds (i.e., limu) (McDermid et al. 2015).

4.2.6.4 Contamination or Degradation of Habitat

The only potential mechanisms for PIFSC research activities to cause contamination or degradation of sea turtle habitat would involve accidental spills and discharges. All NOAA vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010b). MARPOL includes six annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations would avoid or minimize the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). Discharge of contaminants from NOAA vessels and PIFSC chartered vessels is unlikely. Any contamination or

degradation of sea turtle habitat resulting from PIFSC research activities proposed under the Status Quo Alternative would be isolated in both time and location, and would not result in measureable changes to sea turtle populations in the HARA, MARA, ASARA, and WCPRA. No measureable changes in contamination or degradation of sea turtle habitat are expected to result from PIFSC research activities. Such effects are unlikely and are therefore considered to be minor adverse based on the criteria in Table 4.1-1.

4.2.7 Effects on Invertebrates

This section describes the general types of effects of the Status Quo Alternative on invertebrate species. Many of these invertebrate species comprise EFH as part of hard bottom structures underlying the waters and associated biological communities (e.g. corals). The potential effects of research vessels, survey gear, and other associated equipment on invertebrates include:

- Physical damage to infauna and epifauna
- Directed take of coral specimens
- Mortality from Fisheries Research Activities
- Changes in species composition
- Contamination or degradation of habitat

4.2.7.1 Physical Damage to Infauna and Epifauna

Physical damage to infauna and epifauna under the Status Quo Alternative may occur during numerous PIFSC surveys through SCUBA operations, water sampling instruments, deployment of stationary bottom-contact gear, hook-and-line bottomfishing, marine debris removal, and coral coring. Infauna live in the seafloor or within structures that are on the seafloor and include clams, tubeworms, and burrowing crabs that usually construct tubes or burrows and commonly occur in deeper and subtidal waters. Epifauna, including mussels, crabs, starfish, sponges, and corals live on the surface of the seafloor or on structures on the seafloor such as rocks, reefs, pilings, or vegetation. They either attach to these surfaces or range freely over them by crawling or swimming. Fishing gear that contacts the seafloor can disturb infauna and epifauna by crushing them, burying them, removing them, or exposing them to predators, and thus can reduce complexity and species diversity (Collie et al. 2000, Morgan and Chuenpagdee 2003).

SCUBA operations related to surveys could potentially result in accidental contact between divers (fins or other diver gear) and coral, including ESA-listed species. However, the use of highly qualified divers, extensive dive training, and adherence to best practices designed to minimize unnecessary contact with live reef, diminish the likelihood of any potential incidental effects to coral.

Sea water samples are collected and analyzed for microbiological communities. When sea water is collected near the reef, the possibility exists that coral in the free swimming larval state may inadvertently be captured. However, due to the relatively low abundance of protected coral species in the action area, the fact that high concentrations of larval coral occur only during infrequent spawning events, and the small volumes of sea water sampled, the intensity of impacts to any coral species resulting from the collection of seawater samples would be negligible.

Deployment of stationary bottom-contact gear includes a variety of equipment (see Table 2.2-1) with the potential to crush, bury, remove, or expose invertebrates, including ESA-listed corals. This gear is either deployed temporarily (30 minutes to 24 hours) or longer-term (1-3 years). Temporary deployments include bottom traps, hook-and-line bottomfishing, photo-transects, stereo-video instruments (e.g., BRUVs, BotCam), and water samplers (PUCs and RAS) that rest directly on benthic substrate. These temporary deployments are done from the sea surface in ships or small boats and therefore there is

uncertainty where the gear will land (i.e., sandy substrate versus hard reef). Certain types of branching or laminar corals would be slightly more vulnerable than massive or encrusting morphologies to bottom-contact gear because contact could cause protruding pieces of these corals to break off rather than just cause damage at the physical contact point. Longer-term deployments include ARMS, ADCPs, BMUs, CAUs, STRs, HARPs, carbonate instruments (SEAFETs/SAMIs), and EARs that are either fixed or anchored to the benthic substrate. For all of these gear types, physical disturbance is limited to the point of anchorage or footprint of the gear. Because these longer-term deployments are installed by skilled SCUBA divers, the potential for adverse impacts to infauna or epifauna is very small. HARPs are not always deployed by divers, and are sometimes dropped in deep water with a small metal anchor. The deep water sites generally have a low density of epifauna or infauna and therefore survey gear is unlikely to have adverse impacts to infauna or epifauna.

The footprint of a single lobster trap is approximately 0.75 m^2 and consists of a 0.98 x 0.77 x 0.30-m molded polyethylene cage. The footprint of a BRUV is approximately 0.05 m^2 and consists of a 12 mm diameter galvanized steel pipe in a rectangular shape of 1.26 x 0.86 m. The footprint of BotCam is approximately 60 x 20 x 10 cm of steel anchor chain or steel plates, or 1 x 1 x 1 m of concrete blocks. The steel or concrete footprint of the BotCam is used to steady the stereo-video system during recording. Generally the weights are recovered with the BotCam, however, if the weights get snagged on the substrate or otherwise cannot be recovered safely, then an acoustic release is used to recover the instrument and the weights are left on the seafloor. ARMS and ADCPs are secured to the substrate using stainless steel stakes or two 81 x 8 x 5-cm weights each. BMUS and CAUs are attached to a single 1.25 x 30-cm stainless steel stake and installed into the substrate while avoiding corals. STRs, PUCs, and SEAFETs/SAMIs are each anchored with two 3-lb coated weights and strapped to a dead portion of the reef with cable ties. Given the very small areas affected by these stationary bottom-contact gears (<0.01% of the project area), the extent of the impacts would be considered local and the magnitude of impacts would be considered minor. The steel, concrete, or coated steel weights are environmentally benign and would have a minor impact to infauna or epifauna. The concrete would slowly breakdown into smaller and smaller concrete pieces, while the steel would slowly rust. Given the small size the weights and the unlikely event that a steel weight would be left on the seafloor, the addition of small amount of iron to the marine environment would be considered minor adverse.

Research fishing gear and instruments tethered to the surface can also accidentally be lost during surveys if it snags on the bottom and the line breaks. This gear (e.g., monofilament line, braided polypropylene line) can later end up getting caught on the fringing reefs that surround most of the islands. Once derelict fishing gear is caught on a reef, it begins a damaging cycle of: snagging coral colonies, dislodging pieces of coral heads during wave action, breaking free, and snagging a different part of the reef (Donohue et al. 2001, PIFSC 2010). The extent of adverse direct and indirect impacts will vary with the type and size of the derelict fishing gear. PIFSC does not use the most damaging types of gear (e.g., gill nets, bottom trawl nets).

During the Marine Debris Research and Removal Surveys, derelict fishing gear is cut, pulled, or both, off coral colonies. Using the protocol described in 2.2.1.5, the removal activities are designed to mitigate long-term adverse impacts to coral colonies. However, during removal activities, there are short-term and temporary adverse impacts when derelict fishing gear is removed. The impacts include breaking off of pieces of coral that are sometimes impossibly entangled in nets and line, and then removing them from the marine ecosystem. The long-term beneficial impact of removing derelict fishing gear from the marine ecosystem is to provide the space and light necessary for the coral colonies to grow and avoid entangling other marine species in the future.

Physical damage from coral coring would be limited in size to the area affected by the 4 x 100-cm drill bit used for collection of coral cores. Cores would be collected only from coral colonies of sufficient size and in good health. After extracting the core, an exact fit cement plug and underwater epoxy would seal the

hole created by removing the core, which would prevent invasion of the colony by bioeroding species and would facilitate coral tissue growth. These cement plugs provide a surface over which surrounding coral tissue can grow, and in many cases colonies show no sign of coring in the coral tissue within 6 months of extraction (PIFSC pers. comm. 2014). Therefore, physical damage from coral coring activities would be limited to small areas and would recover in a short period of time.

4.2.7.2 Directed take of coral specimens

Directed take of coral specimens under the Status Quo Alternative would occur during the Deep Coral and Sponge Research Survey and RAMP Survey (see Table 2.2-2).

The Deep Coral and Sponge Research Survey collect small pieces of coral for DNA samples, voucher specimens, and paleoclimate samples. DNA specimens are comprised of small pieces of coral less than 1 percent of the total colony size and a total weight of approximately 0.02 pounds per year. Voucher specimens may consist of an entire coral branch and total less than 1.1 pounds per year. Paleoclimate samples consist of the stem/branch close to the base of the coral and total less than 4.4 pounds per year. No ESA-listed corals would be collected during the Deep Coral and Sponge Research Survey. Together, these coral samples comprise a small percentage of the total population of coral colonies.

The RAMP Survey collects up to 500 samples per year of corals (including ESA-listed species), coral products, algae and algal products, and sessile invertebrates. The smallest possible fragments of corals are collected and typically consist of 3-cm pieces, but are occasionally larger. NMFS has conducted section 7 consultations related to the PIFSC RAMP Survey in the ASARA and WCPRA and issued a BiOp on the effects of these surveys on ESA-listed corals (NMFS 2015). The BiOp concluded that directed take and voucher specimens of Acropora jacquelineae, Acropora retusa, Acropora rudis, Acropora speciosa, Euphyllia paradivisa, Isopora crateriformis, and Pavona diffluens as part of the RAMP Survey in the ASARA and WCPRA is not likely to jeopardize the continued existence of any of these species. While this BiOp was only for RAMP surveys specifically within the ASARA and WCPRA, PIFSC will reinitiate consultations as necessary for any future research cruises in other research areas where protected corals occur (e.g. MARA). The overall impact from directed take of coral specimens would be considered minor adverse.

4.2.7.3 Mortality from Fisheries Research Activities

Mortality from fisheries research activities in the PIFSC research areas under the Status Quo Alternative would be limited to the above surveys which perform directed take of corals, and the Northwestern Hawaiian Islands Lobster Survey.

The impact of mortality from fisheries research depends on the magnitude of the research catch relative to the overall biomass or population level of the species. Measuring these relative effects is difficult because there are very few species for which total populations have been estimated with any degree of certainty. To assess the magnitude of mortality effects in this DPEA, the amount of invertebrates caught in PIFSC research is compared to the amount caught in commercial fisheries, which is well known. Because commercial harvest limits are set at a fraction of estimated population, the magnitude of research catches relative to overall population levels would be much less than what is indicated in the comparisons with commercial landings.

Total directed take of corals from the Deep Coral and Sponge Research Survey is less than 5.5 pounds per year under the Status Quo Alternative. Commercial harvest data of corals is only available for Hawaiʻi during 2012-2013, where average annual catch was 1,874 pounds. Research landings would therefore be less than 0.3 percent of commercial landings for all coral species taken during this research survey. Captured lobsters during the Northwestern Hawaiian Islands Lobster Survey are generally released alive, but some may be retained for additional research and nutritional analysis. This survey was most recently conducted from 2007 to 2009 and resulted in approximately 100 retained lobsters per year (spiny and

slipper lobsters). Commercial harvest of lobsters during this same time period averaged 9,553 pounds per year. With an average weight of approximately 1.5 pounds per individual (Uchida and Hida 1976), total research landings of lobsters account for 1.6 percent of commercial landings. A small variety of other invertebrates are collected ad hoc (e.g. urchins, sea cucumbers, sea stars), but total less than 100 individuals of each species per year.

Overall, the amounts of invertebrates removed as a result of PIFSC research activities under the Status Quo Alternative would be small relative to commercial catches and even smaller relative to the estimated populations of these invertebrates.

4.2.7.4 Changes in Species Composition

Massive removals of marine invertebrate species from an ecosystem could potentially alter community structure and predator-prey relationships at possibly unsustainable levels (Donaldson et al. 2010). Commercially important invertebrate species are managed under FMPs with the management intent to harvest at rates that promote optimal yield, with an increasing emphasis on taking ecosystem considerations into account when setting harvest levels. In commercial fisheries, bycatch is either returned to the sea or landed if it has adequate commercial value and is allowed by the appropriate FMP. Bycatch can be minimized through gear and operational modifications, including localized geographic or seasonal fishing closures.

Changes in the species composition of benthic invertebrates are likely affected most by bottom trawling gear than all other gear types. It is important to note that surveys conducted by PIFSC are limited to surface and midwater trawls, which do not directly interact with the benthos. No fishing gears would be intentionally dragged along the sea floor under any of the research alternatives. Deployments of the previously discussed stationary bottom-contact gear (e.g. lobster traps and ARMS) are not expected to alter species composition due to the small footprint created by these gear types.

4.2.7.5 Contamination or Degradation of Habitat

Fisheries research activities involving gear that contacts the sea floor can physically disturb benthic habitat used by invertebrate species. Such effects can include furrowing and smoothing of the sea floor (Morgan and Chuenpagdee 2003). Physical effects to the sea floor from bottom-contact fishing gear increases with increasing frequency, duration, and footprint size.

However, many research surveys conducted by PIFSC are stratified random designs, meaning the exact location of bottom-contact gear is randomly determined each year within an area of interest. Repeated gear deployments in the same location are rare or infrequent. The footprint of bottom-contact gear is also very small (see above discussion of physical damage to infauna and epifauna). Therefore, effects to invertebrate habitat from research surveys are expected to be minor in magnitude and short-term in duration, especially compared to the magnitude of habitat disturbance caused by commercial fishing operations.

The potential for research vessels to cause degradation of benthic and pelagic habitat through contamination would only be through accidental spills and discharges, which would likely be limited in magnitude, rare, and localized for the reasons described in Section 4.2.3.

4.2.7.6 Conclusion

PIFSC fisheries research conducted under the Status Quo Alternative could have direct and indirect effects on many invertebrate species through physical damage to infauna and epifauna, directed take of coral specimens, mortality, changes in species composition, and contamination or degradation of habitat.

For all invertebrate species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to research surveys and projects is less than two percent of commercial and non-

commercial harvest and is considered to be minor in magnitude for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities and the risk of altering benthic community structure would be minimal. Disturbance of animals and benthic habitats from research activities would be temporary and minor in magnitude for all species. As described in Section 4.2.1, the potential for accidental contamination of marine habitats from accidental spills from research vessels is considered unlikely and would be minor in magnitude and temporary or short-term in duration. The overall direct and indirect effects of the Status Quo Alternative on invertebrates would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

In addition to these minor adverse effects, the Status Quo Alternative would contribute to long-term beneficial effects on invertebrate species throughout the Pacific Islands Region through the contribution of PIFSC fisheries and ecosystem research. Specifically, the RAMP surveys support numerous management objectives, including monitoring ecosystem health, understanding the effects of climate change and ocean acidification, assessing ecological effects of fishing, prioritizing and planning conservation strategies, and detecting ecosystem shifts.

4.2.8 Effects on the Social and Economic Environment

Section 3.3 describes the interaction of PIFSC with the social and economic environment of the Pacific Island region. This section describes the effects of PIFSC-affiliated fisheries and ecosystem research conducted under the Status Quo Alternative on socioeconomic resources of the PIFSC research areas. Major factors that could be influenced by the PIFSC research program include:

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

4.2.8.1 Effects of the Status Quo Alternative on Cultural Resources

Under the Status Quo Alternative, PIFSC would continue existing research operations, at current levels and using current research methods. The Section 106 process is designed to help guide federal agencies in making decisions about the identification and treatment of cultural resources including shipwrecks, burial sites, and fish ponds. Known locations of shipwrecks, burial mounds, and fish ponds are typically found onshore, or away from research activity areas and are avoided based on best available information. As outlined in Section 2.1, PIFSC research activities would occur primarily away from shorelines with limited research activities occurring in the nearshore environment. As with current surveys, PIFSC research activities would avoid cultural or maritime heritage resources based on areas of known sites, including historic properties, shipwrecks, burial sites, and fish ponds. Activities occurring in the nearshore environment and in proximity to known cultural resources could potentially include randomized PIFSC surveys conducted as part of the Reef Assessment and Monitoring Program (RAMP) and marine debris research and removal efforts. As identified in Table 2.2-1, these research activities utilize survey techniques and activities unlikely to affect known cultural resources. Furthermore, the free divers and SCUBA divers used in these surveys to install instruments and carry out visual surveys are highly trained and proficient divers capable of avoiding known sites in the water, as well as sites that may appear to be historic sites. Due to the small number of cultural resources and limited research activities that occur in the nearshore environment, the Status Quo Alternative would have negligible effects on archaeological or cultural resources listed or eligible for listing on the National Register of Historic Places.

While not formally protected under Section 106, living marine resources can be of cultural importance to many indigenous persons residing in the Pacific Island Region and include the human relationship with marine life and use of marine resources for dietary or other purposes. Examples of culturally important marine resources within the PIFSC research areas include sea turtles and sharks. Further descriptions of potential impacts to these resources under the Status Quo alternative can be found in Section 4.2.4 for sea turtles and Section 4.2.3 for highly migratory species such as sharks. Mitigation measures and policies for avoiding impacts to marine resources can be found in Section 2.2.1. While historically there has been no turtle catch associated with PIFSC survey efforts, culturally important resources have the potential to be impacted by PIFSC research activities. These resources include contemporary cultural use areas used by designated fishing communities (see Section 3.3.1). The Status Quo Alternative has the potential to affect marine resources important to fishing communities; however, direct impacts would be minimal in magnitude, restricted to local geographic areas and temporary due to the intermittent duration of research activities. As an indirect beneficial effect, fisheries research would be used to inform forecasting future productivity and setting harvest limits, thus facilitating the long-term use of marine resources important to fishing communities.

The Status Quo Alternative assumes that potential direct adverse effects of PIFSC would continue to occur infrequently and would not be located near identified historic properties and to a limited extent in areas with contemporary cultural use. Therefore, research activities would continue to affect a large geographical area, but any potential impacts would be local, low intensity, and not expected to impact historic and contemporary cultural resources important to Pacific Island peoples. Overall, the Status Quo Alternative would have negligible to no direct or indirect effect on historical properties or contemporary cultural resources with at most minor beneficial direct and indirect effects on cultural resources and contemporary cultural practices within the affected environment.

4.2.8.2 Collection of Scientific Data used in Sustainable Fisheries Management

The PIFSC fisheries research program has the most potential to affect the social and economic environment through its contribution to the fisheries management process. The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act, establish a collaborative fisheries management process with key roles for NMFS. Under the MSA, FMPs must contain conservation and management measures which prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery. The MSA defines optimum yield as:

A. The amount of fish which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
B. Is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
C. In the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Among other considerations, FMPs must also contain provisions to conserve essential fish habitat, minimize bycatch and the mortality of bycatch, and provide for the sustained participation of fishing communities while minimizing adverse economic impacts on them, to the extent practicable and consistent with conservation aims and requirements. In carrying out Congress's mandate under the MSA, NOAA Fisheries is responsible for ensuring that management decisions involving fishery resources are based on the highest quality, best available scientific information on the biological, social, and economic status of the fisheries.

Under the Status Quo Alternative, the long-term, standardized resource surveys conducted by PIFSC and its cooperative research partners, as summarized in Table 2.2-1, provide a rigorous scientific basis for the

development of fisheries stock assessments and federal fishery management actions in the Pacific Island region. The extended time-series of data helps identify trends that inform fisheries management planning. This information is essential to establishing annual species-specific sustainable harvest limits on an optimal yield basis.

Many of the Status Quo research surveys also provide important comparative information on open, managed, and closed fishing areas, such as the differences between recovery rates, biodiversity, and species density that is vital to assessing the success of fisheries management measures. PIFSC fisheries research also provides information on ecosystem characteristics that is essential to management of commercial fisheries. Climate change and increase in ocean acidification have the potential to impact the population and distribution of marine species. Long-term, predictable marine research provides information on changes to and trends regarding the marine ecosystem that must be considered by fisheries managers. In addition to the long-term PIFSC research surveys, short-term research projects conducted by cooperative research partners, as described in Table 2.2-2, address strategic issues important to the commercial fishing industry, such as the development and monitoring of current and emerging fisheries, habitat characterization and conservation, development of ecosystem management methods, and ways to reduce bycatch of non-target species. The scientific information provided by PIFSC is therefore used not just for current management decisions, but also to conserve resources and anticipate future trends, ensure future fishing utilization opportunities, and assess the effectiveness of the agency's management efforts.

Scientific data provided through the long-term and short-term fisheries research conducted and associated with PIFSC has played an important role in the development of fisheries and conservation policies through informing the fisheries management process.

4.2.8.3 Economic Support for Fishing Communities of Hawai'i and Pacific Island Territories

One of the ways PIFSC research activities support the social and economic environments is through its role in providing the science used by regulators to manage the commercial and non-commercial fisheries in the Pacific Island region. Within the PIFSC research regions, the HARA makes up the largest economic base. In 2012, commercial anglers in Hawaiʿi earned $92 million from their commercial harvest, landing over 27 million pounds of finfish and shellfish. In 2012, commercial fishermen in the Pacific Island region, including the areas of the HARA, MARA, ASARA, and WCPRA, landed 31 million pounds of fish, earning $112 million in landings revenue. Overall in 2011, Hawai'i's commercial fishing and seafood industry generated $694 million in sales impacts, $213 million in income impacts, and approximately 8,600 full- and part-time jobs (NMFS 2012). In that same period, 87,000 recreational anglers took 1.4 million trips. Overall, recreational fishing in Hawai'i generated 2,861 thousand jobs, $284,912 thousand in expense, $118,815 thousand in income, and $186,196 thousand in value added (Table 3.3-4).

Social and economic data collection and analysis in the Pacific Islands allows for determination of the relative social and economic impacts of a set of proposed management alternatives. This type of information is also important for compliance with Executive Order (EO) 12898 on environmental justice, which directs agencies to assess actions that may disproportionately affect low income and minority populations. Where conservation outcomes are similar, NMFS attempts to choose alternatives with the most positive or, at a minimum, least negative social and economic impact on fishermen, the fishing industry, related shoreside industries, and fishing communities.

Another way PIFSC contributes to the social and economic environments is through direct expenditures on fisheries research. While breakdowns for each of the individual research areas budgets and employment statistics outside of the HARA are not currently available, PIFSC's annual budget fluctuates, but has averaged around $29.2 million for fiscal year 2010-2012 (Pooley 2013). However, data is available for the territories of American Samoa, CNMI, and Guam with total revenues for these regions being estimated at around $9.9 million altogether (WPFIN 2013c). This spending has direct and indirect

beneficial economic effects on the communities and ports in the Pacific Island Region through expenditures in support of NOAA vessels, chartered vessels, and research facilities as well as providing employment and contracted services that contribute to local economies. Similarly, in addition to benefits of social and economic research to the fisheries management enterprise, PIFSC supplies contracts and grants to individual social science researchers and to academic and other institutions throughout the Pacific Islands that conduct social science research on how humans impact and are impacted by ecosystems, climate change, interactions with protected species, and other issues.

The magnitude of the economic impacts of PIFSC fisheries research activities must be placed in the context of regional and local economies according to the impact criteria in Table 4.1-1. While the contribution of research-related employment and purchased services is undoubtedly important and beneficial for many individuals and families, the total sums spent for research are very small compared to the value of commercial and recreational fisheries in the area as well as the overall economy of those communities. The contribution of PIFSC research is relatively larger for some communities where the research is centered (i.e., Honolulu, Hawaiʻi) or where the fishing industry is a large component of the local economy, and may be considerate moderate in magnitude for those communities, but the overall direct impact would be minor in magnitude for most communities. The economies of the MARA, ASARA, and WCPRA are typically smaller in scale, with a larger component of the overall economy coming from research activities for each of the research areas. These direct impacts would occur under the Status Quo Alternative, would affect numerous communities throughout the region, and would be long-term and beneficial. Overall, the beneficial economic impacts of PIFSC fisheries research activities would be considered minor to moderate according to the impact criteria in Table 4.1-1.

There are certainly indirect impacts of fisheries research to the economic status of fishing communities but these impacts are filtered through a long and complicated fisheries management environment. It is not possible to assign a monetary value to these indirect impacts although, as stated before, these impacts are generally considered beneficial to fishing communities through their contribution to sustainable fisheries management. In any case, fisheries management decisions by the Fishery Management Councils and NMFS are subject to their own NEPA compliance processes where these types of economic impacts are analyzed in depth so they will not be assessed in this DPEA.

4.2.8.4 Collaborations between the Fishing Industry and Fisheries Research

Under the Status Quo Alternative, the relationships that are being built between scientists and the fishing industry through collaborative research efforts would continue to serve as a vehicle for sharing knowledge and building mutual understanding and respect. As more members of the fishing industry become engaged in the research programs that ultimately feed into the development of fisheries management measures, there will be an increased level of public education and awareness about the basis for fishery regulatory changes. The participation of highly experienced and resourceful members of the fishing industry also leads to valuable advances in conservation engineering, which in turn results in more efficient fishing and fewer adverse effects on the marine environment. The PIFSC fisheries research program contributes to these objectives by providing rigorous scientific data for the development of fisheries stock assessments and federal fishery management actions in the Pacific Island region. The survey data from PIFSC research surveys thereby provides the scientific basis for fisheries management in the region. As a result, many communities are directly affected by the fisheries research program and fisheries management.

4.2.8.5 Fulfillment of Legal Obligations Specified by Laws and Treaties

Chapter 6 provides a list of laws and treaties applicable to the PIFSC fisheries research program. These obligations include the 1996 amendment to the MSA, which requires assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on

fishing communities (NMFS 2007b). The PIFSC fisheries research programs in the HARA, MARA, ASARA, and WCPRA help fulfill these obligations under the MSA for the Pacific Island Region.

4.2.8.6 Conclusion

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

The direct and indirect effects of the Status Quo Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Pacific Island region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Status Quo Alternative on the social and economic environment would be minor to moderate and beneficial.

4.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2 - PREFERRED ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 2 – Preferred Alternative on the physical, biological, and social environment. Under this Alternative, PIFSC would conduct a new suite of research activities, expand on several of the Status Quo research activities, eliminate other Status Quo research alternatives, and implement new mitigation measures in addition to the Status Quo program to comply with the MMPA and ESA compliance process. The new suite of research activities is a combination of past research and additional, new research. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all Resource Components evaluated under the Preferred Alternative is presented below in Table 4.3-1.

Table 4.3-1 Preferred Alternative Summary of Effects

Resource	Physical Environment	Special Resource Areas and EFH	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.3.1**	**4.3.2**	**4.3.3**	**4.3.4**	**4.3.5**	**4.3.6**	**4.3.7**	**4.3.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.3.1 Effects on the Physical Environment

The effects of the Preferred Alternative on the physical environment would be similar to those of the Status Quo Alternative (Section 4.2.1). For example, new bottom-contact instruments with updated technologies (e.g., MOUSS) have very similar effects (usually with a smaller footprint) as the previous generation instruments (e.g., BotCam). The additional mitigation measures for protected species proposed under the Preferred Alternative would not change the effects of the research activities on physical properties of the environment. The changes to the suite of research activities conducted under the Preferred Alternative would result in minimal changes to the physical effects to the benthic environment relative to the Status Quo Alternative. Therefore, the overall effects of The Preferred Alternative on the physical environment would be minor in magnitude. Small areas (much less than one percent of each research area) would be impacted, and the areas of impact would be dispersed over a large geographic area. Low intensity impacts resulting from the disturbance of organisms that produce structure could persist for several months, however impacts resulting in measureable changes to the physical environment would be temporary and the intensity of impact would decrease with the passage of time. In general, any measureable alterations to benthic habitat would recover within several months through the action of water currents and natural sedimentation. Overall impacts would be considered minor adverse according to the impact criteria in Table 4.1-1, with a minor long-term beneficial impact from continued removal of derelict fishing gear during the Marine Debris Research and Removal Surveys.

4.3.2 Effects on Special Resource Areas and EFH

The effects of the Preferred Alternative on special resource areas would be similar to those of the Status Quo Alternative (Section 4.2.2). The additional mitigation measures for protected species proposed under the Preferred Alternative would not change the effects of the research activities on the physical components of the environment or most biological components; they would only tend to decrease effects on protected species. The changes to the suite of research activities conducted under the Preferred

Alternative would result in minimal changes to the physical and biological effects to special resource areas relative to the Status Quo Alternative. Therefore, the overall effects of The Preferred Alternative on special resource areas would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1. As was the case for the Status Quo Alternative, the scientific data generated from PIFSC research activities under the Preferred Alternative would also have beneficial effects on special resource areas, including MNM, NMS, and other MPAs through their contribution to science-based conservation management practices. As described in Section 3.1.2.1, EFH includes hard bottom structures underlying the waters and associated biological communities. These biological communities include corals, seagrass, algae, and mangroves. Effects to these biological communities under the Preferred Alternative are evaluated in Section 4.3.7.

4.3.3 Effects on Fish

PIFSC fisheries research conducted under the Preferred Alternative would have the same types of effects on fish species as described for the Status Quo Alternative (Section 4.2.3) through mortality, disturbance, and changes in habitat. There are small changes in the research projects conducted under the Preferred Alternative (Table 2.3-1) that could affect the catch rate or species of fish caught relative to the Status Quo Alternative, including:

- Elimination of Northwestern Hawaiian Islands Lobster Survey
- Elimination of Northwestern Hawaiian Islands Bottomfish Survey
- Elimination of Pelagic Longline Hook Trials
- Elimination of Longline Gear Research Surveys
- Elimination of Marlin Longline Surveys
- Increase in geographic scope and in number of annual operations of Insular Fish Abundance Estimation Comparison Survey
- Addition of Pelagic Troll and Handline Sampling Survey
- Addition of hook-and-line gear to Kona Integrated Ecosystem Assessment Cruises
- Addition of Sampling of Juvenile-stage Bottomfish via Settlement Traps Survey
- Addition of Pelagic Longline, Troll, and Handline Gear Trials Survey

Several other projects also either add or subtract video camera equipment, UAS gear, plankton sampling, scuba divers, or other minor gears that would not affect catch of fish. None of the differences between the Preferred Alternative and the Status Quo Alternative would substantially change the potential impacts of research on benthic habitat or the risk of accidental contamination. These potential effects were considered minor adverse under the Status Quo Alternative because of their relatively low magnitude, dispersal over time and space, and, in the case of contamination, the small risk of occurrence (Section 4.2.3). These types of effects would also be considered minor adverse under the Preferred Alternative for the same reasons. The following discussion will therefore focus on potential effects through mortality of fish.

4.3.3.1 ESA-listed Species

No ESA-listed scalloped hammerhead sharks have been caught under the Status Quo Alternative. The overall net effort of troll and longline operations would be reduced under the Preferred Alternative from 130 operations to 70 operations per year, further reducing the likelihood of catch. Given the lack of historical takes coupled with decreased fishing effort, the potential for future takes under the Preferred

Alternative is considered small and unlikely to affect the population of any ESA-listed DPS of scalloped hammerhead shark. The effects of the Preferred Alternative are therefore considered minor adverse based on the criteria in Table 4.1-1.

4.3.3.2 Target and Other Fish Species

Mortality from Fisheries Research Activities in the HARA

Under the Preferred Alternative, the Northwestern Hawaiian Islands Bottomfish Surveys (hook-and-line gear with 256 operations per year) is not carried forward. New surveys or modified surveys in the HARA that may catch fish include the Sampling of Juvenile-stage Bottomfish via Settlement traps Survey (up to 60 lines of traps per year), the addition of a midwater trawl to the Cetacean Ecology Assessment Survey (90 trawls per year), and addition of hook-and-line gear to the Kona Integrated Ecosystem Assessment Cruise (50 hours of total soak time per year).

The new Pelagic Troll and Handline Sampling Survey may increase catch. Since this survey has not been deployed previously, it is difficult to know how much and what types of fish may be caught. However, based on the type of gear being used and the planned amount of effort, PIFSC has estimated potential catch of pelagic species (Boggs pers. comm. 2015). Catch estimates of these species have been added to Status Quo average annual catches of these species to estimate potential future catches under the Preferred Alternative, with totals shown in Table 4.3-2.

For the Insular Fish Abundance Estimation Comparison Survey, there is a substantial increase in the number of operations in the HARA. The Status Quo Alternative includes 540 drops per year whereas 7,680 drops per year are planned under the Preferred Alternative, an increase of more than 14 times the original number of deployments. It is likely that this increase in effort will translate to a corresponding increase in catch and may result in additional species being caught besides the Deep-7 species this survey has traditionally caught. Survey design parameters indicating spacing between drop locations, depth, water temperature, and other variables would influence species and number of fish caught. For the purpose of this DPEA it is assumed that a 14-fold increase in gear deployments will translate to a 14-fold increase in catches of historic fish species. This increase is captured in Table 4.3-2.

Table 4.3-2 provides an analysis of the impact of research catch under the Preferred Alternative. The combined estimated catch from surveys in the HARA is compared to recent ACLs and commercial catch, as was done for the Status Quo Alternative analysis (Table 4.2-1). These data indicate that for all species the average amount of fish mortality under the Preferred Alternative would be less than one percent of ACLs or of commercial catches. For these species, the magnitude of research mortality is small relative to the fisheries and even smaller relative to the estimated populations of these fish. For all target species in the HARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Preferred Alternative.

For all research areas, research data is necessary for monitoring the status of stocks of conservation concern and to determine if management objectives for rebuilding those stocks are being met. Fisheries managers typically consider the estimated amount of research catch from all projects along with other sources of mortality (e.g., bycatch in other fisheries and predation) before setting commercial fishing limits to prevent overfishing of stocks or to help overfished stocks rebuild. The amount of fish that are likely to be caught in various research projects is often estimated and incorporated into the fishery management process during annual reviews of research proposals, which would continue to occur in the future under the Preferred Alternative. These annual reviews would also determine whether the proposed projects were consistent with the NEPA analysis presented in the DPEA or whether additional NEPA analysis was required (see Section 2.3.5).

Table 4.3-2 indicates that, while mortality to fish species under the Preferred Alternative is a direct effect of PIFSC HARA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial fisheries, which are just fractions of the total populations for these species. In all cases, research catch in the HARA represents much less than one percent of the ACL or commercial catch. For all target species in the HARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Preferred Alternative.

Table 4.3-2 Estimated Fish Caught under the Preferred Alternative Compared to ACLs or Commercial Catch in the HARA

Species are listed in descending order of estimated research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)[B]	2013 Commercial catch (pounds)[C]	Estimated PIFSC catch compared to ACL or commercial catch (percentage)
Blue shark (*Prionace glauca*)	Not overfished	Pelagic MUS	597	N/A	138,423	0.43%
Amberjack (*Seriola* spp.)	Not overfished	Hawaiʻi Bottomfish MUS	327	193,423[D]	N/A	0.17%
Brown speckled eel (*Gymnothorax steindachneri*)	Unknown	Hawaiʻi CHCRT	238	142,282[D]	N/A	0.17%
Red snapper (*Etelis carbunculus*)	Not overfished	Hawaiʻi Deep 7 Bottomfish MUS	596	346,000[D]	N/A	0.17%
Longtail snapper (*Etelis coruscans*)	Not overfished	Hawaiʻi Deep 7 Bottomfish MUS	291	346,000[D]	N/A	0.08%
Sea bass (*Epinephelus quernus*)	Unknown	Hawaiʻi Deep 7 Bottomfish MUS	332	346,000[D]	N/A	0.10%
Pink snapper (*Pristipomoides filamentosus*)	Not overfished	Hawaiʻi Deep 7 Bottomfish MUS	117	346,000[D]	N/A	0.03%
Undulated moray (*Gymnothorax undulates*)	Unknown	Hawaiʻi CHCRT	189	142,282[D]	N/A	0.13%

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)[B]	2013 Commercial catch (pounds)[C]	Estimated PIFSC catch compared to ACL or commercial catch (percentage)
Broadbill swordfish (*Xiphias gladius*)	Not overfished	Pelagic MUS	120	N/A	2,332,850	0.01%
Silky shark (*Carcharhinus falciformis*)	Unknown	Pelagic MUS	102	N/A	138,423	0.07%
Albacore tuna (*Thunnus alalunga*)	Not overfished	Pelagic MUS	483	N/A	828,487	0.06%
Bigeye tuna (*Thunnus obesus*)	Subject to overfishing, not overfished	Pelagic MUS	298	N/A	15,864,768	<0.01%
Skipjack tuna (*Katsuwonus pelamis*)	Not overfished	Pelagic MUS	100	N/A	1,114,756	<0.01%
Yellowfin tuna (*Thunnus albacares*)	Not overfished	Pelagic MUS	1470	N/A	3,686,695	0.04%
Dolphinfish (*Coryphaena hippurus*)	Unknown	Pelagic MUS	486	N/A	1,585,129	0.03%
Moonfish (*Lampris* spp.)	Unknown	Pelagic MUS	270	N/A	2,102,745	0.01%
Wahoo (*Acanthocybium solandri*)	Unknown	Pelagic MUS	270	N/A	878,640	0.03%
Striped marlin (*Tetrapturus audax*)	Subject to overfishing, overfished	Pelagic MUS	126	N/A	982,750	0.01%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. 2014 ACL information from WPRFMC. Available online: http://www.wpcouncil.org/managed-fishery-ecosystems/annual-catch-limits/2014-acl-specification/

C. Commercial catch information compiled by Hawai‘i DAR and the Western Pacific Fishery Information Network. Available online: http://www.pifsc.noaa.gov/wpacfin/hi/dar/Pages/hi_data_3.php

D. This species is included in a MUS; catch is managed as a complex, in total, not by individual species. The ACL stated is for all species in the specified MUS.

Mortality from Fisheries Research Activities in the MARA

New surveys or modified surveys in the MARA that may catch fish include the Pelagic Troll and Handline Sampling Survey, the addition of a midwater trawl to the Cetacean Ecology Assessment Survey,

and expanded geographic scope of Insular Fish Abundance Estimation Comparison Surveys to include the MARA. The total effort under the Preferred Alternative would be up to 330 trawls, 880 hook-and-line operations, and 28 new pelagic troll and handline operations per year. This is almost 1.5 times the average level of effort for midwater trawling and four times the effort for hook-and-line gear under the Status Quo Alternative (240 trawls and 240 hook-and-line operations per year). Given the uncertainties about the scope and nature of research projects, there is no way to translate this programmatic increase in research fishing effort into quantitative estimates of catch without making some assumptions. For the purposes of this DPEA analysis, the resulting mortality from fish catch will assumed to be 400 percent of the Status Quo Alternative for most species. This level of catch is likely to be substantially higher than what might actually occur and therefore provides a conservative estimate of the impacts of research.

The new Pelagic Troll and Handline Sampling Survey may increase research catch of some pelagic species caught in either very small amounts or not at all in past surveys. For these species (e.g., tunas, wahoo, mahimahi, sharks, and striped marlin), it is difficult to know how much and what types of fish may be caught. However, based on the area and type of gear being used and the planned amount of effort, PIFSC has estimated catch of these pelagic species (Boggs pers. comm. 2015) and added them to Status Quo average annual catches of these species to estimate potential future catches under the Preferred Alternative, with totals shown in Table 4.3-3.

Table 4.3-3 provides the same analysis of research catch relative to ACLs as the Status Quo Alternative (Table 4.2-3), but multiplies the catch from hook-and-line research by four. The combined estimated catch from surveys in the MARA is then compared to the recent ACLs as was done for the Status Quo Alternative analysis. For pelagic species which may not have ACLs, research estimates are compared to commercial catches. These data indicate that for most species the average amount of fish mortality is less than one percent of ACLs or commercial landings. For these species, the magnitude of research mortality is small relative to the fisheries and even smaller relative to the estimated populations of these fish. Four species have catch totals over one percent of ACLs or commercial landings: whitetip reef shark (1.03 percent), orangespine unicornfish (1.31 percent), yellowfin tuna (3.73 percent), and bicolor parrotfish (4.33 percent). While these catches represent a higher percentage of ACLs or commercial landings compared to other species, they still represent a small fraction of the total population. For all target species in the MARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Preferred Alternative.

Table 4.3-3 Estimated Fish Caught under the Preferred Alternative Compared to ACLs or Commercial Catch in the MARA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)[B,C]	2013 Commercial catch (pounds)[D]	Estimated PIFSC catch compared to ACL or commercial catch (percentage)
Longtail snapper (*Etelis coruscans*)	Not overfished	MARA Bottomfish MUS	2,324	294,800[E]	N/A	0.79%
Bicolor parrotfish (*Scarus rubroviolaceus*)	Unknown	MARA CHCRT	1,404	32,433[E]	N/A	4.33%

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)[B,C]	2013 Commercial catch (pounds)[D]	Estimated PIFSC catch compared to ACL or commercial catch (percentage)
Orangespine unicornfish (*Naso lituratus*)	Unknown	MARA CHCRT	1020	77,586[E]	N/A	1.31%
Black jack (*Caranx lugubris*)	Not overfished	MARA Bottomfish MUS	720	294,800[E]	N/A	0.24%
Red snapper (*Etelis carbunculus*)	Not overfished	MARA Bottomfish MUS	552	294,800[E]	N/A	0.05%
Yellowtail snapper (*Pristipomoides auricilla*)	Not overfished	MARA Bottomfish MUS	460	294,800[E]	N/A	0.19%
Silver jaw jobfish (*Aphareus rutilans*)	Not overfished	MARA Bottomfish MUS	432	294,800[E]	N/A	0.15%
Bluefin trevally (*Caranx megalampys*)	Unknown	MARA CHCRT	412	66,889[E]	N/A	0.62%
Bluespine unicornfish (*Naso unicornus*)	Unknown	MARA CHCRT	323	77,586	N/A	0.42%
Yelloweye snapper (*Pristipomoides flavipinnis*)	Not overfished	MARA Bottomfish MUS	178	294,800[E]	N/A	0.06%
Humpnose big-eye bream (*Monotaxis grandoculis*)	Unknown	MARA PHCRT	148	93,034	N/A	0.16%
Whitetip reef shark (*Trianodon obesus*)	Unknown	MARA CHCRT	129	12,542	N/A	1.03%
Snapper (*Pristipomoides zonatus*)	Not overfished	MARA Bottomfish MUS	656	294,800[E]	N/A	0.22%
Pink snapper (*Pristipomoides filamentosus*)	Not overfished	MARA Bottomfish MUS	1022	294,800[E]	N/A	0.35%
Longnose Emperor (*Lethrinus olivaceus*)	Unknown	MARA PHCRT	123	93,034	N/A	0.13%
Blue shark (*Prionace glauca*)	Not overfished	Pelagic MUS	180	N/A	N/A	N/A

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)[B,C]	2013 Commercial catch (pounds)[D]	Estimated PIFSC catch compared to ACL or commercial catch (percentage)
Silky shark (*Carcharhinus falciformis*)	Unknown	Pelagic MUS	450	N/A	N/A	N/A
Albacore tuna (*T. alalunga*)	Not overfished	Pelagic MUS	483	N/A	N/A	N/A
Bigeye tuna (*Thunnus obesus*)	Unknown	Pelagic MUS	298	N/A	N/A	N/A
Skipjack tuna (*Katsuwonus pelamis*)	Not overfished	Pelagic MUS	100	N/A	193,382	0.05%
Yellowfin tuna (*Thunnus albacares*)	Subject to overfishing, not overfished	Pelagic MUS	1470	N/A	39,372	3.73%
Dolphinfish (*Coryphaena hippurus*)	Not overfished	Pelagic MUS	243	N/A	134,234	0.18%
Wahoo (*Acanthocybium solandri*)	Not overfished	Pelagic MUS	135	N/A	33,060	0.41%
Striped marlin (*Tetrapturus audax*)	Unknown	Pelagic MUS	63	N/A	20,597	0.31%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. 2014 ACL information from WPRFMC. Available online: http://www.wpcouncil.org/managed-fishery-ecosystems/annual-catch-limits/2014-acl-specification/

C. ACLs are listed separately for the CNMI and Guam. The ACL stated is combined for both regions to represent all of the MARA.

D. Commercial catch information is combination of data compiled by Guam DAWR, CNMI, and the Western Pacific Fishery Information Network. Available online: http://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_data_menu.php , and http://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_data_menu.php.

E. This species is included in a MUS; catch is managed as a complex, in total, not by individual species. The ACL stated is for all species in the specified MUS.

Mortality from Fisheries Research Activities in the ASARA

Similar to the activities in the MARA, New surveys or modified surveys in the ASARA that may catch fish include the Pelagic Troll and Handline Sampling Survey, the addition of a midwater trawl to the Cetacean Ecology Assessment Survey, and expanded geographic scope of Insular Fish Abundance Estimation Comparison Surveys to include the MARA, ASARA, and WCPRA. The total effort under the Preferred Alternative would be up to 130 trawls, 900 hook-and-line operations, and 28 new pelagic troll and handline operations per year. This is about three times the average level of effort for midwater trawling and almost four times the effort for hook-and-line gear under the Status Quo Alternative (240 trawls and 240 hook-and-line operations per year). Given the uncertainties about the scope and nature of research projects, there is no way to translate this programmatic increase in research fishing effort into quantitative estimates of catch without making some assumptions. For the purposes of this DPEA

analysis, the resulting mortality from fish catch will assumed to be 400 percent of the Status Quo Alternative for most species. This level of catch is likely to be substantially higher than what might actually occur and therefore provides a conservative estimate of the impacts of research.

The new Pelagic Troll and Handline Sampling Survey may increase research catch of some pelagic species caught in either very small amounts or not at all in past surveys. For these species (e.g., albacore and skipjack, and striped marlin), it is difficult to know how much fish may be caught. However, based on the area and type of gear being used and the planned amount of effort, PIFSC has estimated catch of these pelagic species (Boggs pers. comm. 2015) and added them to Status Quo average annual catches of these species to estimate potential future catches under the Preferred Alternative, with totals shown in Table 4.3-4.

Table 4.3-4 provides the same analysis of research catch relative to ACLs as the Status Quo Alternative (Table 4.2-4), but multiplies the catch from hook-and-line research by four. The combined estimated catch from surveys in the ASARA is then compared to the recent ACLs or commercial catch landings as was done for the Status Quo Alternative analysis. These data indicate that for most species the average amount of fish mortality is less than one percent of ACLs or commercial catch landings. For these species, the magnitude of research mortality is small relative to the fisheries and even smaller relative to the estimated populations of these fish. Two species have catch totals over one percent of ACLs or commercial catches: great barracuda (1.78 percent) and blue shark (4.74 percent). While these catches represent a higher percentage of the ACLs or commercial landings compared to other species, they still represent a small fraction of the total population. For all target species in the ASARA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Preferred Alternative.

Table 4.3-4 Estimated Fish Caught under the Preferred Alternative Compared to ACLs or Commercial Catch in the ASARA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)	2013 Commercial catch (pounds)[B]	Estimated PIFSC catch compared to ACL or Commercial Catch (percentage)
Yellowfin tuna (*Thunnus albacares*)	Not Overfished	Pelagic MUS	1,920	N/A	901,323	0.21%
Wahoo (*Acanthocybium solandri*)	Unknown	Pelagic MUS	730	N/A	198,325	0.37%
Blue marlin (*Makaira mazara*)	Not Overfished	Pelagic MUS	480	N/A	67,557	0.71%
Silver jaw jobfish (*Aphareus rutilans*)	Not Overfished	ASARA Bottomfish MUS	380	101,000	N/A	0.38%
Longtail snapper (*Etelis coruscans*)	Not Overfished	ASARA Bottomfish MUS	350	101,000	N/A	0.35%

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2014 ACL (pounds)	2013 Commercial catch (pounds)[B]	Estimated PIFSC catch compared to ACL or Commercial Catch (percentage)
Great barracuda (*Sphyraena barracuda*)	Not Overfished	ASARA CHCRT	336	18,910	N/A	1.78%
Dolphinfish (*Coryphaena hippurus*)	Unknown	Pelagic MUS	192	N/A	41,948	0.46%
Bigeye tuna (*Thunnus obesus*)	Not Overfished	Pelagic MUS	180	N/A	187,954	0.10%
Blue shark (*Prionace glauca*)	Not Overfished	Pelagic MUS	164	N/A	3,477	4.74%
Albacore tuna (*T. alalunga*)	Not overfished	Pelagic MUS	483	N/A	4,678,485	0.01%
Skipjack tuna (*Katsuwonus pelamis*)	Not overfished	Pelagic MUS	100	N/A	162,307	0.06%
Striped marlin (*Tetrapturus audax*)	Subject to overfishing, overfished	Pelagic MUS	63	N/A	8,049	0.78%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. Commercial catch information compiled by American Samoa DMWR and the Western Pacific Fishery Information Network. Available online: http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_menu.php

Mortality from Fisheries Research Activities in the WCPRA

The reduced longline effort from 130 operations to 70 operations per year described in Section 4.3.3.1 would likely result in reduced mortality of target and other fish species throughout the WCPRA. Modifications to existing surveys include the addition of a midwater trawl to the Cetacean Ecology Assessment Survey and expanded geographic scope of Insular Fish Abundance Estimation Comparison Surveys to include the WCPRA. When considered with the reduced longline effort, the above mentioned survey modifications would have a negligible effect on the overall fishing effort in the WCPRA.

The new Pelagic Troll and Handline Sampling survey may increase catch. Since this survey has not been deployed previously, it is difficult to know how much and what types of fish may be caught. However, based on the area and type of gear being used and the planned amount of effort, PIFSC has estimated potential catch of pelagic species (Boggs pers. comm. 2015). Catch estimates of these species have been added to Status Quo average annual catches to estimate potential future catches under the Preferred Alternative, with totals shown in Table 4.3-5.

Table 4.3-5 provides an analysis of the impact of research catch under the Preferred Alternative. The combined estimated catch from surveys in the WCPRA is compared to recent commercial catch, as was done for the Status Quo Alternative analysis (Table 4.2-4). In most cases, research catch in the WCPRA represents much less than one percent of the commercial catch. For thresher sharks, the average annual research catch is greater than 1 percent, and greater than 7 percent in the case of silky sharks. While this

catch represents a higher percentage of commercial landings compared to other species, they still represent a very small portion of total populations.

Table 4.3-5 indicates that, while mortality to fish species under the Status Quo Alternative is a direct effect of the PIFSC WCPRA surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of commercial landings, which are just fractions of the total populations for these species. For all target species in the WCPRA, mortality from PIFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Preferred Alternative.

Table 4.3-5 Estimated Fish Caught under the Preferred Alternative Compared to Commercial Catch in the WCPRA

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 100 pounds or those that are overfished are listed.

Species	Stock Status[A]	Stock Complex	Estimated PIFSC catch per year under Preferred Alternative (pounds)	2012 Commercial catch (pounds)[B]	Estimated PIFSC catch compared to Commercial Catch (percentage)
Yellowfin tuna (*Thunnus albacares*)	Not Overfished	Pelagic MUS	3120	2,610,273	0.12%
Silky shark (*Carcharhinus falciformis*)	Unknown	Pelagic MUS	327	4,409	7.42%
Thresher sharks (*Alopias* spp.)	Unknown	Pelagic MUS	525	28,660	1.83%
Bigeye tuna (*Thunnus obesus*)	Not Overfished	Pelagic MUS	838	11,375,853	0.01%
Broadbill swordfish (*Xiphias gladius*)	Unknown	Pelagic MUS	348	2,008,411	0.02%
Albacore tuna (*T. alalunga*)	Not overfished	Pelagic MUS	483	8,265,130	0.01%
Skipjack tuna (*Katsuwonus pelamis*)	Not overfished	Pelagic MUS	100	1,064,833	0.01%
Blue shark (*Prionace glauca*)	Not overfished	Pelagic MUS	180	39,683	0.45%
Dolphinfish (*Coryphaena hippurus*)	Unknown	Pelagic MUS	243	773,823	0.03%
Moonfish (*Lampris* spp.)	Unknown	Pelagic MUS	135	981,057	0.01%
Wahoo (*Acanthocybium solandri*)	Unknown	Pelagic MUS	135	526,905	0.03%
Striped marlin (*Tetrapturus audax*)	Subject to overfishing, overfished	Pelagic MUS	63	593,043	0.01%

A. Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Fourth Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. Commercial catch information from the Pelagic Fisheries of the Western Pacific Region 2012 Annual Report. Available online: http://www.wpcouncil.org/wp-content/uploads/2013/03/2012-Pelagics-Annual-Report_9-21-2014.pdf

4.3.4 Effects on Marine Mammals

The direct and indirect effects of the Preferred Alternative on marine mammals are very similar to those described for the Status Quo (Section 4.2.4). The Preferred Alternative is comprised of a combination of research activities continued from the past and additional, new research surveys and projects. The Preferred Alternative would not include several of the projects described in Table 2.2-1 under the Status Quo. Those surveys have been noted in Table 2.2-1 and include the following:

- The Northwestern Hawaiian Islands Lobster Survey
- The Northwestern Hawaiian Islands Bottomfish Survey
- Pelagic Longline Hook Trials
- Longline Gear Research Surveys
- Marlin Longline Surveys

The above longline projects will not continue to be supported by PIFSC under the Preferred Alternative, however, similar research continues to be conducted and funded by the Pacific Islands Regional Office through contracts with commercial fisheries. Any incidental takes resulting from such research would be authorized under sections of the MMPA dealing with commercial fisheries and incidental takes of protected species resulting from such research would be considered to be the result of the commercial fishery. The impacts of non-PIFSC research are included in the analysis of cumulative effects (Chapter 5.5) but are not considered further in this analysis of the Preferred Alternative.

Several new research surveys and projects have been added to the Preferred Alternative that were not included in the Status Quo Alternative and other existing research projects have been modified; these new projects and changes in existing projects are summarized in Table 2.3-1. Under the Preferred Alternative, the Cetacean Ecological Assessment surveys described under the Status Quo would include increased levels of effort, and would be expanded to include all four of the research areas within the Pacific Islands Region.

Under this alternative, PIFSC would also apply for authorizations under the MMPA and the ESA for incidental take of protected species during these research activities. The Preferred Alternative includes several mitigation measures for protected species designed to reduce adverse impacts to marine mammals (visual monitoring, move-on rule, and gear modifications).

The following analysis draws heavily on the analysis provided under the Status Quo Alternative (Section 4.2.4) but focuses on the differences that may result from the new research elements and mitigation measures added under the Preferred Alternative.

The Preferred Alternative is the PIFSC research program and suite of mitigation measures that are being proposed in the MMPA LOA application (Appendix C). The analysis of effects in the LOA application was based primarily on the history of past environmental effects under the status quo conditions. However, especially with regard to mitigation measures for marine mammal interactions, the status quo reflects a dynamic situation in that PIFSC is continually monitoring their effects and exploring ways to effectively reduce and document those adverse interactions while fulfilling their mission to collect scientific information for fisheries and natural resource management. The Status Quo Alternative therefore reflects the mitigation equipment and procedures as they were implemented at the end of 2014 while the Preferred Alternative includes ongoing efforts to improve mitigation measures.

The potential effects of the Preferred Alternative on marine mammals involve adverse interactions with research vessels, survey gear, sonar and other active acoustic devices, and other associated equipment, including:

- Disturbance and behavioral responses due to acoustic equipment

- Injury or mortality due to vessel strikes
- Injury or mortality due to interactions with research gear
- Changes in food availability due to research survey removal of prey and discards
- Contamination from discharges

These mechanisms of potential effects are discussed in the Status Quo Alternative (Section 4.2.4), most of which will not be repeated here. The mechanism for acoustic disturbance would be the same for the Preferred Alternative as it is for the Status Quo Alternative because there are no new acoustic sound sources that would be introduced, and no new mitigation measures are being proposed that would address potential effects due to acoustic disturbance. Although every species of marine mammal in the four research areas may be exposed to sounds from active acoustic equipment used in PIFSC research, many of the acoustic sources are likely not audible to many species and the others would likely cause temporary and minor changes in behavior for nearby animals as the ships pass through any given area. The overall effects from acoustic disturbance are considered minor adverse for all species, in all four research areas.

The potential effects from changes in food availability and contamination are also considered to be minor adverse for all species of marine mammals in all four research areas in which PIFSC operates and will not be discussed further. The potential for PIFSC research vessels to accidentally strike marine mammals is also considered to be remote and would not differ from the risks presented under the Status Quo Alternative. The following discussion will therefore focus on the potential effects from entanglement or incidental capture in fishing gear used in PIFSC research under the Preferred Alternative.

4.3.4.1 ESA-listed Species

The ESA listed marine mammals that occur in PIFSC research areas include blue, fin, sei, humpback, sperm, false killer whale - MHI insular stock, North Pacific right whales, and Hawaiian monk seals. All of these species are under the jurisdiction of NMFS in regard to compliance with the MMPA and ESA. There have been no entanglements of ESA-listed marine mammals in PIFSC fisheries research from NOAA vessels or NOAA chartered vessels. However, the LOA application (Appendix C) includes a request for authorization of potential Level A harassment/mortality and serious injury (M&SI) takes for two ESA-listed cetaceans based on documented takes of these species in analogous commercial and non-commercial fisheries. The take request includes one take each over the five-year authorization period for sperm and humpback whales in longline gear and one take of a humpback whale over the five-year authorization period due to entanglement in mooring lines during instrument deployment (Table 4.2-7). These takes, if they actually occurred, would represent less than ten percent of PBR for each species and would be considered minor in magnitude according to the impact criteria described in Table 4.1-1.

PIFSC considered the risk of interaction with marine mammals for all the research gears and instruments it uses but did not request incidental takes in research gears other than midwater trawls, longline, and instrument deployments. There is evidence that Hawaiian monk seals (and bottlenose dolphins) occasionally pursue fish caught on various hook-and-line gears (depredation of fishing lines) deployed in commercial and non-commercial fisheries across Hawaiʻi (Nitta and Henderson 1993, Kobayashi and Kawamoto 1994). This depredation behavior, which is documented as catch loss from the hook-and-line gear, may be beneficial to the marine mammal in providing prey but it also opens the possibility for the marine mammal to be hooked or entangled in the gear. PIFSC gave careful consideration to the potential for including incidental take requests for marine mammals in bottom handline (bottomfishing) gear although it has not had any marine mammal interactions in the past while conducting research with bottomfishing gear in the MHI.

Fisheries in state waters are not observed by independent, trained monitors and therefore few data exist on interactions with marine mammals. A recently published preliminary summary of self-reported catch loss

data from the State of Hawaiʿi Commercial Marine License reporting system indicates that the number of catch loss incidents by monk seals and dolphins in the MHI may be increasing, but is still relatively rare (Boggs et al. 2015). The authors of the summary emphasize that the data received only cursory treatment and should not be viewed as comprehensive.

The population of monk seals in the MHI is relatively small (minimum abundance estimate in 2011 of 138 seals), but it is growing at approximately 6.5% per year (Caretta et al. 2015). No mortality or serious injuries of monk seals have been attributed to the MHI bottomfish handline fishery (Caretta et al. 2015). However, the latest marine mammal stock assessment report (Caretta et al. 2015) notes: "In 2012, 16 Hawaiian monk seals were observed hooked, four of which died as a result of ingesting hooks. The remaining 12 were non-serious hookings, although 5 of these would have been deemed serious had they not been mitigated by capture and hook removal. Several incidents involved hooks used to catch ulua (jacks, Caranx spp.)." The hook-and-line rigging used to target ulua are typical of shoreline fisheries that are distinct from the bottomfishing gear and methods used by PIFSC during its fisheries and ecosystem research. Although there are some similarities between the shoreline fishery and the bottomfishing gear used by PIFSC (e.g., circle hooks), the general size and the way the hooks are rigged (e.g., baits, leaders, weights, tackle) are typically different and probably present different risks of incidental hooking to monk seals. Ulua hooks are generally much larger circle hooks than PIFSC uses because the targeted ulua are usually greater than 50 pounds in weight. Shoreline fisheries (deployed from shore with rod and reel) also typically use "slide bait" or "slide rigs" that allow the use of live bait (small fish or octopus) hooked in the middle of the bait. If a monk seal pursued this live bait and targeted the center of the bait or swallowed it whole, it could get hooked in the mouth. PIFSC research with bottomfishing gear uses pieces of fish for bait that attract bottomfish but not monk seals. Monk seals could be attracted to a caught bottomfish but, given the length of the target bottomfish (averaging approximately 14 inches long; Boggs, personal communication), it is unlikely that a monk seal would be physically capable of swallowing the whole fish and therefore bites and tears at the caught fish (i.e., shreds the body of the fish while feeding). The risk of monk seals getting hooked on bottomfishing gear used in PIFSC research is therefore less than the risk of getting hooked on shoreline hook-and-line gears which are identified in the marine mammal stock assessment report (Caretta et al. 2015).

Given the mitigation measures the PIFSC intends to implement for bottomfishing research under the Preferred Alternative (see Section 2.3.1.3), PIFSC has concluded that the risk of marine mammal interactions with its research bottomfishing gear is not high enough to warrant an incidental take request for marine mammals in that gear. PIFSC intends to document potential depredation of its bottomfish research gear (catch loss) in the future, and increase monitoring efforts when catch loss becomes apparent, in an effort to better understand the potential risks of hooking to monk seals and other marine mammals.

In addition to Level B harassment takes of Hawaiian monk seals from acoustic disturbance, PIFSC seeks authorization of Level B harassment takes of this species due to the physical presence of researchers near haulouts used by Hawaiian monk seals. In some cases PIFSC research involves nearshore diving and shallow water fisheries sampling using rod and reel or other such gear. In addition, nearshore and shore-based research to assess and remove marine debris (primarily derelict fishing gear) is conducted at many locations where Hawaiian monk seals may be present. Often, when removing marine debris from shallow-water coral reefs, fish hiding in the debris may be flushed out and thus attract monk seals in the vicinity. PIFSC scientists are very aware of this situation and take precautions to avoid and minimize the chance of inadvertently disturbing monk seals, including reconnaissance of all beaches before approaching in skiffs or on foot (see mitigation procedures detailed in Section 2.2.1). However, there are numerous locations where Hawaiian monk seals may be resting adjacent to vegetation, or just emerging from the water onto the beach, and would not be immediately visible and where the options for alternate passage may be limited. Combined with the fact that this population is expanding in some PIFSC regions and that

pinnipeds may haul out in new locations on a regular basis, it is essentially impossible for researchers to completely avoid disturbing monk seals as they travel around to conduct research.

Based on the locations of known haulouts (Baker and Johanos 2004, PIFSC 2014a and 2014b), PIFSC estimates the minimum population estimate for the Hawaiian monk seal population at about 1,182 animals. Given that only about one-third of the population is onshore at any particular time (Parrish et al. 2000) and that researchers generally do not approach any particular beach more than once per year, PIFSC conservatively estimates that no more than one-third of the Hawaiian monk seal population might be approached per year (394 animals). Thus the total request for Level B harassment takes is 1,970 Hawaiian monk seals (394 x 5) for the duration of the five-year authorization period.

Given the mitigation measures in place and the lack of historical takes, PIFSC does not expect that all of the requested takes of ESA-listed species would actually occur during future PIFSC fisheries and ecosystem research under the Preferred Alternative. While the LOA application (Appendix C) takes a conservative approach when estimating take; in the unlikely event that the requested takes actually occur, the effects would likely have minor adverse impacts on each each ESA-listed stock according to the impact criteria described in Table 4.1-1.

4.3.4.2 Other Cetaceans

As noted above, there has been no history of marine mammal takes in PIFSC fisheries and ecosystem research gears. Measures to mitigate the risk of entanglements are described in Section 2.2.1. The PIFSC LOA application (Appendix C) includes estimates of the potential number of marine mammals that may interact with research gear based on documented takes of species taken in analogous commercial fisheries, e.g., those operating in similar areas and using similar gear types (Table 4.2-7). Note that the LOA application does not request authorization to take all species of marine mammals that occur in the PIFSC research areas; only those species listed in Table 4.2-7 are considered to have a reasonable risk of adverse interactions with gear used for PIFSC fisheries and ecosystem research. PIFSC considers these estimates to be greater than what is likely to occur in the future, especially given the fact that none of these species have been taken in research gears in the past, the relatively small level of fishing effort during PIFSC fisheries and ecosystem research, and the mitigation measures in place to reduce potential interactions.

The take request includes 12 species of cetaceans in longline gear (one each of the stocks listed in Table 4.2-7 over the five-year authorization period), requested takes of bottlenose dolphin, pantropical spotted dolphin, spinner dolphin, and rough-toothed dolphin in midwater trawl gear (one each of the stocks listed in Table 4.2-7 over the five-year authorization period), and requested takes of bottlenose dolphin, pantropical spotted dolphin, rough-toothed dolphin, and spinner dolphin (one take for each species over the five-year authorization period) by entanglement during instrument deployments (Table 4.2-7).

For almost all of these stocks, the combined requested level of take in all gears, if it occurred, would be less than ten percent of PBR and would be considered minor in magnitude for each stock. The exception is for spinner dolphins. The combined take of two spinner dolphins (one in midwater trawl and one in instrument deployments) would be 12.1% of the Oahu/4-Islands stock's PBR if both takes occurred on this one stock and this level of take would be considered to be moderate in magnitude. However, since the request is for all stocks due to the spatial extent of the research, the uncertainty of stock boundaries, and possibility of encountering individuals from undescribed stocks, the impact would be more likely to be spread across more than one stock of spinner dolphin and the resulting impact would likely be of smaller magnitude.

In addition, under the Preferred Alternative, PIFSC would make gear modifications to their instrument deployments that are designed to reduce the risk of entanglement in mooring lines (see Section 2.3.1), thereby mitigating some of the risk of entangling humpback whales and dolphins.

There are several species for which the stock structure throughout the PIFSC research area has not been determined (e.g., bottlenose dolphin) or for which abundance and PBR values have not been determined. The impact of potential takes from these stocks relative to PBR is therefore not available.

PIFSC considered the risk of interaction with marine mammals for all the research gears it uses but did not request incidental takes in research gears other than trawls, longline, and instrument deployments. There is evidence that bottlenose dolphins occasionally pursue fish caught on various hook-and-line gears (depredation of fishing lines) deployed in commercial and non-commercial fisheries across Hawaiʿi (Boggs et al. 2015). However, PIFSC has concluded that the risk of marine mammal interactions with its research bottomfishing gear is not high enough to warrant an incidental take request for marine mammals in that gear in the LOA application (see section 4.3.4.1 above). PIFSC intends to document potential depredation of its bottomfish research gear (catch loss) in the future, and increase monitoring efforts when catch loss becomes apparent, in an effort to better understand the potential risks of hooking to bottlenose dolphins and other marine mammals.

4.3.4.3 Conclusion

Under the Preferred Alternative, the potential direct and indirect effects on marine mammals through ship strikes, acoustic disturbance, potential changes in prey availability, and contamination or degradation of habitat would be similar to those described for the Status Quo Alternative (Section 4.2.4) and would be considered minor adverse for all species.

PIFSC has never caught or had marine mammals entangled in fisheries research gear. However, incidental takes of marine mammals have occurred in commercial and non-commercial fisheries in the same areas as PIFSC research occurs and using gears similar to those used in research. PIFSC has used information on these analogous fisheries to make precautionary estimates of marine mammals that may be incidentally taken during future fisheries and ecosystem research. These combined Level A harassment and M&SI takes include three ESA-listed species and 13 non-listed cetacean species, primarily by research using longline gear but also including midwater trawls and instrument deployments (potential entanglement in mooring lines). For almost all stocks for which PBR has been determined, the requested takes, if they occurred, would represent less than ten percent of PBR and would be considered minor in magnitude. The exception is for spinner dolphins. If all of the requested takes for spinner dolphin occurred on the Oahu/4-Islands stock, the takes would be 12.1% of PBR for this stock and would be considered moderate in magnitude.

Given the mitigation measures that would be implemented under the Preferred Alternative, including modification of instrument deployment gears to reduce the risk of entanglement in mooring lines relative to the status quo conditions, the relatively small amount of fishing effort involved in PIFSC research, and the lack of takes in the past, PIFSC does not anticipate that the level of requested takes will actually occur in the future. The overall impact of the potential takes of these species, if they occurred, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

In addition to Level B harassment takes for many species through acoustic disturbance, PIFSC is requesting Level B harassment takes for Hawaiian monk seals due to the physical presence of researchers in nearshore waters and beaches. Given the protocols for monitoring and avoiding interactions with monk seals, these potential takes would likely result in only temporary disturbance of small numbers of monk seals and adverse impacts would be minor.

The overall effects of the Preferred Alternative on marine mammals would be minor to moderate in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.3.5 Effects on Birds

The effects of the Preferred Alternative on birds would be very similar to those described for the Status Quo Alternative (Section 4.2.5). Additional mitigation for protected species proposed under the Preferred Alternative may theoretically decrease the potential for seabirds to become entangled in floating line used to deploy stationary research equipment to the seafloor, but in general but the additional mitigation associated with the Preferred Alternative is unlikely to change the actual effects of PIFSC research activities on seabirds, which are minor. The changes to the suite of research activities conducted under the Preferred Alternative would also result in minimal changes to the effects on seabirds relative to the Status Quo Alternative. The overall effects of the Preferred Alternative on seabirds would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.3.6 Effects on Sea Turtles

The effects of the Preferred Alternative on sea turtles would be similar in nature and magnitude to those of the Status Quo Alternative (see Section 4.2.6). Direct and indirect effects of PIFSC research activities on sea turtles may include: disturbances or changes in sea turtle behavior due to physical movements and sounds, injury or mortality due to ship strikes, gear interaction, changes in food availability, and contamination or degradation of sea turtle habitat. These mechanisms are described in Section 4.2.6.

Mitigation measures for protected species required under the Preferred Alternative, such as the use of sinking line to allow any excess scope in the line to sink to a depth where it would be below where most whales and dolphins commonly occur, could potentially decrease the likelihood of adverse impacts to sea turtles. Although no adverse interactions have occurred in the past between sea turtles and PIFSC fisheries and ecosystem research activities, the additional mitigation measure proposed under the Preferred Alternative may decrease the likelihood of sea turtle entanglement in line used to deploy stationary instruments to the seafloor. In addition, the implementation of procedures for handling of incidentally captured protected species could decrease the potential for adverse impacts to sea turtles. However, considering that there have been no reported instances of PIFSC survey activities resulting in sea turtle entanglement or mortality, the mitigation measures described under the Preferred Alternative would not result in substantial changes to the overall level of impact on sea turtles.

Under the Preferred Alternative, the addition of several new surveys in the HARA, MARA, ASARA, and WCPRA would involve deployment of pelagic longline gear, plankton nets, CTD sensors, sediment traps, and water sampling equipment, as well as collection of additional acoustic data and deployment of unmanned surface and underwater vehicles. These survey activities would pose a small additional risk of adverse effects to turtles. However, there have been no reported adverse interactions between sea turtles and PIFSC fisheries and ecosystem research activities, due in part to adherence to the requirements based on regulations of the Western Pacific Regional Fisheries Management Council (WPRFMC 2014). Based on the lack of adverse interactions with sea turtles during previous PIFSC research activities, it is not anticipated that any sea turtles would be adversely afected during the research proposed under the Preferred Alternative.

The additional survey activities described under the Preferred Alternative would result in the potential for minor impacts to sea turtles in addition to those described under the Status Quo Alternative. However, the discontinuation of several surveys involving longline gear under the Preferred Alternative would decrease the potential for adverse interactions between PIFSC survey activities and longline research gear. Therefore, the overall effects of the Preferred Alternative on sea turtles would be substantially the same as those resulting from the Status Quo Alternative; minor adverse effects are expected to occur using the gear types and mitigation measures described under the Preferred Alternative; these effects would be isolated and rare, and would not impact sea turtles at the population level in any of the PIFSC research areas.

4.3.7 Effects on Invertebrates

PIFSC fisheries research conducted under the Preferred Alternative would have the same types of effects on invertebrate species as described for the Status Quo Alternative (Section 4.2.7) through physical damage, directed take of coral, mortality, changes in species composition, and contamination. There are small changes in the research projects conducted under the Preferred Alternative (Table 2.3-1) that could affect the physical damage and mortality of invertebrates relative to the Status Quo Alternative, including:

- Elimination of Northwestern Hawaiian Islands Lobster Survey
- Addition of a midwater trawl to the Cetacean Ecology Assessment Survey
- Increased geographic scope of Insular Fish Abundance Estimation Comparison Surveys

None of the differences between the Preferred Alternative and the Status Quo Alternative would substantially change the potential impacts of research with respect to directed take of corals, changes in species composition, or risk of accidental contamination. Stereo-video surveys would transition from the previous generation of BRUVs and BotCams in the Status Quo Alternative to the new generation of MOUSS in the Preferred Alternative. The MOUSS is a smaller and lighter instrument than the BotCam, with better instrumentation than the BRUVs, and uses similar but smaller weights than the BotCam when deployed. These potential effects were considered minor adverse under the Status Quo Alternative because of their relatively low magnitude, dispersal over time and space, and, in the case of contamination, the small risk of occurrence (Section 4.2.3). These types of effects would also be considered minor adverse under the Preferred Alternative for the same reasons. The following discussion will therefore focus on potential effects through physical damage and mortality of invertebrates.

Under the Preferred Alternative, the Northwestern Hawaiian Islands Lobster Survey is not carried forward. The elimination of this survey would substantially reduce the total mortality of lobsters from PIFSC research activities. Modified surveys include a midwater trawl added to the Cetacean Ecology Assessment Survey and increased geographic scope of the Insular Fish Abundance Estimation Comparison Surveys (deploys a BotCam, BRUVS, and MOUSS) to include the MARA, ASARA, and WCPRA. As discussed above in Section 4.2.7, these stationary bottom-contact gears have very small footprints and therefore the potential to crush, bury, remove, or expose invertebrates is also very small.

The overall effects of the Preferred Alternative on invertebrates would likely be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

In addition to these minor adverse effects, the Preferred Alternative would contribute to long-term beneficial effects on invertebrate species throughout the Pacific Islands Region through the contribution of PIFSC fisheries and ecosystem research, especially through the removal of derelict fishing gear. Specifically, the RAMP surveys support numerous management objectives, including monitoring ecosystem health, understanding the effects of climate change and ocean acidification, assessing ecological effects of fishing, prioritizing and planning conservation strategies, and detecting ecosystem shifts.

4.3.8 Effects on the Social and Economic Environment

Under the Preferred Alternative, PIFSC would change current operations to include additional observation and monitoring research activities (Section 2.2-1). Similar to the Status Quo Alternative, research activities under the Preferred Alternative would be conducted away from known historic cultural resource sites, such as shipwrecks, burial sites, and fish ponds, and avoid locations were contemporary cultural resources are known to occur. Relative to the Status Quo Alternative, the addition of observation and monitoring research activities would minimally increase direct impacts to marine resources important to Pacific Island peoples.

The PIFSC-affiliated research program under the Preferred Alternative includes the addition or expansion of several long-term surveys noted in Table 2.3-1 and the modification of several long-term surveys conducted under the Status Quo Alternative noted in Table 2.2-1. In addition, short-term cooperative research projects would use the same types of fishing gears but have greater levels of effort than the Status Quo Alternative and the particular goals and objectives of those projects could be different under the Preferred Alternative (see Section 2.3.4). These differences in the PIFSC fisheries research program under the Preferred Alternative are not expected to measurably increase or decrease socioeconomic effects compared to the Status Quo Alternative (see Section 4.2.8).

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

The direct and indirect effects of the Preferred Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Pacific Island region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Preferred Alternative on the social and economic environment would be minor to moderate and beneficial.

4.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3 – MODIFIED RESEARCH ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of the Modified Research Alternative on the physical, biological, and social environment. Under this Alternative, PIFSC would conduct a new suite of research activities and implement new mitigation measures in addition to the Status Quo program. The new suite of research activities is a combination of past research and additional, new research, as described for the Preferred Alternative. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all Resource Components evaluated under the Modified Research Alternative is presented below in Table 4.4-1.

Table 4.4-1 Modified Research Alternative Summary of Effects

Resource	Physical Environment	Special Resource Areas and EFH	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.4.1**	**4.4.2**	**4.4.3**	**4.4.4**	**4.4.5**	**4.4.6**	**4.4.7**	**4.4.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.4.1 Effects on the Physical Environment

The effects of the Modified Research Alternative on the physical environment would be similar to those of the Status Quo Alternative (see Section 4.2.1). Additional mitigation measures for protected species required under the Modified Research Alternative would not change the effects of the research activities on physical properties of the environment with the potential exception of the spatial/temporal restrictions on PIFSC research activities intended to reduce adverse impacts to protected species (i.e., spatial/temporal restrictions). This type of mitigation measure could potentially reduce the overall level of research effort or alter where and when the research occurs. However, the overall effects on the physical environment are assumed to be essentially the same as those described under the Status Quo Alternative. Therefore, the overall effects of the Modified Research Alternative on the physical environment would be minor in magnitude. Small areas (much less than one percent of each research area) would be impacted, and the areas of impact would be dispersed over a large geographic area. Low intensity impacts resulting from the disturbance of organisms that produce structure could persist for months, however impacts resulting in measureable changes to the physical environment would be temporary. In general, any measureable alterations to benthic habitat would recover within several months through the action of water currents and natural sedimentation. Overall impacts would be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.2 Effects on Special Resource Areas and EFH

The effects of the Modified Research Alternative on special resource areas and EFH would be similar to those of the Status Quo Alternative (see Section 4.2.2). As described in Section 3.1.2.1, EFH includes hard bottom structures underlying the waters and associated biological communities. These biological communities include corals, seagrass, algae, and mangroves. Effects to these biological communities under the Modified Research Alternative are evaluated in their respective sections below.

Most of the additional mitigation measures for protected species proposed under the Modified Research Alternative would not change the effects of the research activities on the physical components of the

environment or most biological components; they would only tend to decrease effects on protected species. The exception is the potential for spatial/temporal restrictions on PIFSC research activities intended to reduce adverse impacts on protected species. These restrictions could be placed on particular gear types of concern or in particular areas of concern such as federal and state MPAs. Some MPAs have permit systems for activities that would otherwise be prohibited, such as scientific research with bottom trawl gear, and PIFSC routinely applies for such permits if a particular research activity may adversely affect the MPA. These permits may restrict the level of effort, gear types used, locations, and other conditions of the activity as well as having monitoring and reporting requirements. The Status Quo therefore already includes the potential prohibition or restriction of PIFSC research activities in MPAs. Any spatial/temporal restrictions on PIFSC fisheries research in MPAs (or other designated areas) under the Modified Research Alternative would decrease or minimize the potential for direct adverse impacts to special resource areas relative to the Status Quo Alternative, which were considered minor.

MPAs are, by definition, managed more carefully than other special resource areas and depend more heavily on scientific data about their status to sustain the habitats and resources they are designed to protect. Furthermore, many of the MPAs in the Pacific Islands Region were designated with the specific purpose of being used as places of research. As was the case for the Status Quo Alternative, the scientific data generated from PIFSC research activities under the Modified Research Alternative could have beneficial effects on special resource areas through their contribution to science-based conservation management practices. This is why many MPAs include exemptions or permit processes for scientific research. Indirect effects resulting from spatial/temporal restrictions on research in MPAs could include adverse impacts resulting from a lack of the data needed to support science-based management of MPAs. The magnitude and duration of the indirect adverse effects would depend on how extensive the restrictions on research became and how long such restrictions lasted.

Specific spatial/temporal restrictions on PIFSC research have not been proposed under the Modified Research Alternative; the overall level of research effort and therefore effects on the marine environment are assumed to be essentially the same as those described under the Status Quo Alternative. Therefore, the overall effects of the Modified Research Alternative on special resource areas would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.3 Effects on Fish

Under the Modified Research Alternative, PIFSC would implement additional mitigation measures for protected species while conducting the same scope of research as described under the Preferred Alternative. Most of the additional mitigation measures would be unlikely to affect the amount of fish caught for research purposes. The exceptions are the suspension of trawl operations at night or periods of low visibility and the potential for spatial/temporal restrictions on PIFSC research in areas considered important to protected species.

One potential measure would require PIFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize interactions with protected species that would be difficult to detect by visual monitoring. This would have negative budgetary and logistical implications for completing the research. Currently research vessels have a limited midwater trawl depth capability and need to conduct trawls at night when the targeted micronekton migrate to shallower depths. Such a rule would prevent PIFSC from meeting its scientific objectives for fisheries management under the MSA.

Spatial/temporal restrictions could reduce research fishing and hence impacts on fish in some locations. However, researchers may respond to spatial/temporal restrictions by redirecting research efforts to other locations if such movements are consistent with research goals and do not compromise time-series data sets. If so, overall research efforts could remain the same. The Modified Research Alternative does not

specify particular spatial/temporal restrictions but it is assumed for the DPEA analysis that overall research effort and therefore impacts to fish would be very similar under the Modified Research Alternative as they are for the Preferred Alternative, although they may occur in somewhat different locations and times.

It is assumed for this DPEA analysis that overall impacts to fish under the Modified Research Alternative would be substantially the same as those described under the Preferred Alternative. These effects would be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1. As was the case with the Status Quo and Preferred Alternatives, the Modified Research Alternative would also contribute to long-term beneficial effects on managed fish species throughout the Northeast region through the contribution of PIFSC fisheries research to sustainable fisheries management.

4.4.4 Effects on Marine Mammals

The Modified Research Alternative includes the same scope of research in all four of the PIFSC research areas (HARA, MARA, ASARA, and WCPRA) as the Preferred Alternative, including the same mitigation measures currently implemented or to be implemented, and intended to reduce potentially adverse interactions with marine mammals and other protected species. The Modified Research Alternative differs from the Preferred Alternative in that it also includes a suite of mitigation measures that PIFSC is not proposing to implement as part of the proposed action in the PIFSC LOA application (Appendix C). PIFSC considers the suite of mitigation measures to be implemented under the Preferred Alternative to represent the optimal mix of efficacy and practicability to reduce the risk of adverse interactions with protected species during the research activities. However, the NMFS' Office of Protected Resources (OPR) must consider a broad range of mitigation measures under the MMPA authorization and ESA consultation processes, and these additional measures will be considered in this alternative. These additional mitigation measures focus on reducing the likelihood of injury, serious injury, and mortality from interaction with fisheries research gear and are described in Section 2.4 of this DPEA. They involve:

- The use of additional personnel and equipment or new technologies to improve detection of marine mammals, especially at night or other low-visibility conditions.
- Operational restrictions on survey activities at night or other low-visibility conditions.
- The use of additional acoustic or visual deterrents to keep marine mammals away from research gear.
- The incorporation of high-resolution, high-speed video cameras into trawl nets with open cod ends.
- Temporal or geographic restrictions to avoid known concentrations of marine mammals or federal and state MPAs.
- Use of decoy vessels to distract marine mammals away from research sets.

None of the additional mitigation measures directly concern the reduction of noise from acoustic devices (Level B harassment take), reducing the numbers of fish and invertebrates caught in research samples, or reducing the risk of accidental contamination from spills. The analyses of effects through these mechanisms (disturbance or changes in habitat quality) are the same as described for the Status Quo and Preferred Alternatives and will not be discussed further. The following analysis will therefore focus on the potential for the additional mitigation measures to reduce the risk of injury, serious injury, and mortality through entanglement in fishing gear or ship strikes.

Scientists at PIFSC continually review their procedures to see if they can do their work more efficiently and with fewer adverse effects on the marine environment, including effects on marine mammals. Many of the additional mitigation measures included in this alternative have been discussed and considered in the past by PIFSC scientists; however, any changes to operational procedures or the equipment used during surveys must also be considered from the standpoint of how they affect the integrity of the scientific data collected, the cost of implementing equipment or operational changes, and the safety of the vessel and crew. It is not possible to quantify how much any one of these measures (or some combination of them) may reduce the risk of future takes relative to the Status Quo or Preferred Alternatives. Any revisions to the estimated takes of each species, to directly compare with the Status Quo or Preferred Alternatives, would be based on speculation. This analysis will therefore provide a qualitative discussion of the potential for each additional mitigation measure to reduce takes and other effects on marine mammals as well as how each measure may affect practicability, data integrity, and other aspects of the survey work.

4.4.4.1 Trawl Surveys

Several PIFSC surveys use midwater and surface trawl gear. The following mitigation measures would apply to all trawl gear, even though no marine mammals have been taken in PIFSC trawl gears.

Monitoring Methods

Visual observations (using bridge binoculars as needed) by the officer on watch, Chief Scientist (CS) or other designated scientist, and crew standing watch are currently the primary means of detecting protected species in order to avoid potentially adverse interactions. However, there are other detection methods that have been tested or used in commercial fisheries, naval exercises, and geotechnical exploration that could be considered. These additional types of detection methods would be intended to be used in specific circumstances, such as operating at night or in low visibility conditions.

Visual surveillance by dedicated Protected Species Observers (PSO)

This measure would require PIFSC to use trained protected species observers whose dedicated job is to detect the presence of marine mammals and other protected species within the survey area and communicate their presence to ship operations personnel. Considerations include the use of dedicated observers for all surveys or during trawl surveys of particular concern.

Under the Status Quo Alternative, the officer on watch (or other designated member of the scientific party), and crew standing watch on the bridge visually scan for marine mammals (and other protected species) during all daytime operations. Bridge binoculars are used as necessary to survey the area upon arrival at the station, during reconnaissance of the trawl line to look for potential hazards (e.g., presence of commercial fishing gear, etc.), and while the gear is deployed. If any marine mammals are sighted by the bridge or deck crew prior to or after setting the gear, the bridge crew and/or Chief Scientist are alerted as soon as possible. Currently, not all crew members have received formal training in marine mammal identification or marine mammal mitigation procedures, although they are briefed on what they are looking for and may have considerable experience with the task. The difficulty in having crew members assigned only to PSO duties is that most vessels have limited carrying capacity for personnel and any berths given to PSOs would mean a reduction in personnel available to help with other research or vessel duties. This could compromise crew safety or the amount of research that could be conducted. For research projects using contracted commercial fishing vessels, there is often no additional space on the vessels for personnel other than essential crew.

Use of underwater video systems to monitor trawl gear

Underwater video technology may allow PIFSC to determine the frequency of marine mammal interactions with the trawl gear and evaluate the effectiveness of Marine Mammal Excluder Devices (MMEDs) or other efforts to mitigate entanglement interactions. Underwater video systems have been used for these purposes in several fisheries, both in the U.S. and abroad (Northridge 2003, Lyle and Willcox 2008, Dotson et al. 2010). Northridge (2003) describes a twin camera system used to monitor the grid and escape hole of an MMED and quantify the frequency and outcome of marine mammal interactions with trawl gear. Video images were carried by cable from the cameras to the wheelhouse for continuous display and recording (Northridge 2003). Similarly, Lyle and Willcox (2008) used a low-light black and white digital camera with a 90 degree wide-angle lens coupled to a commercially available hard drive unit to monitor interactions involving marine mammals and other megafauna.

Underwater video equipment may provide useful information about the efficacy of additional mitigation measures but the video equipment itself is unlikely to influence bycatch rates of protected species. In order to directly reduce takes of marine mammals, a video system to detect marine mammals underwater would have to be linked to a means of avoiding entanglement in gear. However, ships with deployed trawl nets cannot “swerve” to avoid a marine mammal for two reasons: 1) all marine mammals can swim faster than the tow speed so trying to move gear away from an animal that is likely attracted to fish in the net will be ineffective, and 2) changing the vessel direction suddenly risks tangling the gear, making it difficult and dangerous to retrieve, delaying retrieval and making the risk of marine mammal entanglement worse. Furthermore, PIFSC currently targets plankton, micronekton, and other small organisms in their midwater trawls, therefore few if any prey fish are found in the codend and a camera system would not be capable of providing the desired scientific data.

Use of passive acoustic monitoring

Passive acoustic monitoring involves the detection of animals by listening for the sounds that they produce (Barlow and Gisiner 2006). Use of passive acoustic monitoring may aid in the detection of marine mammals present in survey areas, and could potentially be used to inform decisions about when to implement appropriate modifications of fishing operations to prevent interactions with marine mammals. Marine mammal calls can be reliably detected using hydrophones mounted on ships, autonomous underwater gliders, buoys, moorings, or bottom-founded installations. However, not all marine mammals vocalize and the vocalization rates of marine mammals may vary in a complex fashion depending upon environmental factors, including long periods of silence (Barlow and Gisiner 2006). While detection of a marine mammal call indicates the presence of a marine mammal, the absence of marine mammal calls does not necessarily indicate the absence of marine mammals. In addition, if the intent is to locate marine mammals so that they can be avoided, hydrophones in multiple locations combined with real-time processing are required to allow triangulation of the acoustic signal. This may be more practicable for planning large-scale activities at a set time and place rather than directing specific locations for research sampling, which involves continuous movement of a vessel from widely spaced sampling stations. Taking the time to set up a triangulated hydrophone system in an area prior to each trawl would greatly lengthen the time and cost of collecting a certain amount of sample data. In summary, passive acoustic monitoring may be useful for detecting underwater marine mammals that could potentially interact with research activities but it would have substantial costs in terms of the research data collected and it would not guarantee the avoidance of all adverse interactions; passive acoustic monitoring inevitably overlooks those marine mammals that are not vocalizing and marine mammals may move into an area after trawl gear is deployed and still be at risk.

Use of aircraft or unmanned aerial or underwater gliders to expand detection of marine mammals

Currently, surveys using manned aircraft are routinely conducted to obtain unbiased estimates of marine mammal populations and their distributions. Aerial surveys provide reliable information about marine

mammal populations because they are able to cover large areas over relatively short periods of time. In addition, airborne survey platforms generally do not influence the distribution or behavior of the marine mammals being counted, whereas many species of marine mammals are either attracted to or avoid seagoing vessels (Barlow and Gisiner 2006). The usefulness of manned aerial surveys for detection of marine mammals that could interact with fisheries research activities is limited by the range that the aircraft may travel from shore, flight time constraints, weather conditions, poor visibility in rough seas, logistical difficulties in matching a fast-moving airplane with a slow-moving research vessel, and considerable expense that would likely decrease the amount of ship-based research that could be conducted. Aerial surveys may be more practicable for planning large-scale activities at a set time and place rather than directing specific locations for research sampling, which involves continuous movement of a vessel from widely spaced sampling stations. Even with this capacity, the risk of marine mammal interactions would remain because any marine mammals that are not near the surface would not be detectable by airborne observers and, as with other extended detection methods, marine mammals may move into an area after trawl gear is deployed but before it is retrieved.

Unmanned aerial vehicles have the potential to overcome many of the limitations associated with manned aerial surveys for detection of marine mammals. Unmanned aerial systems range from inexpensive lightweight radio-controlled aircraft to complex autonomous aircraft developed for military applications. Unmanned aerial systems could be launched and retrieved from the research vessel, stream video data to observers onboard or at a shore station, and provide near-real-time data of marine mammals in proximity to fisheries research activities. Several systems are commercially available that have the ability to remain airborne for up to 24 hours and can be operated many miles from the control station. Several tests have successfully used unmanned aerial vehicles for marine mammal detection (NOAA 2006). However, these systems can only be operated in mild to moderate wind conditions, with increasing wind speeds strongly reducing their range and making recovery difficult.

Advantages associated with the use of unmanned aerial systems include the ability to operate in areas far from shore, long flight times, increased safety of observers who can monitor the data from the ship or a shore based location, and decreased expense relative to surveillance conducted from manned aircraft. Unmanned aerial technologies are rapidly evolving; over the next five to 10 years, increased video resolution and advanced sensors are likely to increase the utility of these systems for monitoring marine mammals. However, approval from additional regulatory agencies, including the Federal Aviation Administration, would be required for operation of unmanned aerial vehicles for marine mammal monitoring or research purposes. Federal Aviation Administration approval has been very difficult to obtain, even in areas with very little air traffic, which currently limits the potential for using these systems over large areas.

Autonomous underwater gliders are highly successful platforms for the collection of oceanographic data and environmental characterization. Gliders offer an attractive platform for marine mammal detection due to their relatively low cost, low power consumption, and the ability to cover large areas of ocean during long-term deployments (Olmstead et al. 2010). Gliders have been used to locate and identify marine mammals using passive acoustic technology, and the U.S. Navy is conducting additional research and development using autonomous underwater gliders to support efforts to mitigate impacts from marine mammal interactions (Hildebrand et al. 2009). The use of underwater gliders to provide mitigation options for research activities is limited by the same issues as described above for other passive acoustic detection systems.

Use of infrared technologies

Infrared (IR) sensors may be useful for detection of marine mammals under certain circumstances. IR sensors used for marine mammal detection generally measure the spatial distribution of mid-wavelength IR radiation (three to five micrometers). IR emissivity of an object in this waveband is closely correlated

to the object's surface temperature, such that IR sensor arrays can detect slight variations in temperature across relatively large areas. This technology, also known as 'thermal imaging', could be useful to augment visual detection of marine mammals, particularly in conditions with low ambient light when visual detection of marine mammals would be difficult. IR image data also lends itself to automated image processing. With additional research and development, it is possible that an automated marine mammal detector could be designed to recognize the IR 'signatures' of certain marine mammals. However, several major drawbacks currently preclude such use of IR detection for automated marine mammal detection.

First, because emitted IR radiation is absorbed in the first few millimeters of water surrounding an object, IR technology is only able to detect animals at the surface, and only those parts that are above the surface of the water. Since water is virtually opaque to IR radiation, IR detection of marine mammals is also complicated by the thin film of water that covers the dorsal surfaces of marine mammals at the sea surface. The temperature measured by an IR sensor is the temperature of the water on the surface of the animal, which may only be a couple degrees above the surface water temperature (Cuyler et al. 1992, Kasting et al. 1989). Under ideal conditions (flat calm seas and close proximity to the IR detector), this slight temperature difference can be detected. However, waves cause the measured temperature of the sea surface to be much more variable and the thermal signature of the animal can easily be masked (Graber et al. 2011).

Second, the likelihood of detecting a temperature signature from a marine mammal falls off quickly with distance from the detector. In tests under ideal conditions, the ability of an IR system to detect killer whales, which present a large portion of their body and a tall dorsal fin above the surface of the water, was very poor beyond 330 feet (Graber et al. 2011). The ability of an IR system to detect much smaller targets like dolphins and porpoises would presumably be much less than it is for killer whales. Finally, considerable effort and time is required to process the video data so that the thermal signatures of animals can be distinguished from the surrounding water. This greatly reduces the effectiveness of the technique for real-time monitoring tied to potential mitigation. In summary, the logistical difficulties of using IR detectors in a real-life context on a research vessel would be overwhelming and currently preclude this potential tool as a practical element of mitigation.

Use of night vision devices

Like IR imaging devices, night vision devices may be used for detecting marine mammals at or above the water surface in low-light conditions. Unlike IR sensors, night vision devices operate by amplifying the signal produced when visible light interacts with a detector. Although night vision devices could potentially improve an observer's ability to detect a marine mammal under low light conditions, previous studies have shown that the effective range of detection for marine mammals using night vision devices is only about 330 feet (Calambokidis and Chandler 2000, Barlow and Gisner 2006). These devices work best when there is a little light on the water (from the moon or nearby land sources) but they must be directed away from deck lights because they are too bright. This means they could not be used to monitor trawl gear as it is being deployed or retrieved because of the deck lights used for crew safety. They also have a very narrow field of view, making broad area searches inefficient and unreliable, and if sea conditions are rough the many reflections off waves make it very difficult to distinguish objects in the water. Some observers found the devices disorienting and uncomfortable and all observers said it was very difficult to estimate distances while using the night vision devices (Calambokidis and Chandler 2000). Failure to detect marine mammals using such devices would not decrease the uncertainty about whether marine mammals are actually in the immediate area or not and would thus offer no help in deciding whether to deploy trawl gear or not.

Operational Restrictions

One potential mitigation measure considered here would require PIFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize interactions with marine mammals that would be difficult to detect by visual monitoring. Since many PIFSC research trawls occur during dusk, hours of darkness, or in early morning conditions, this measure has the potential to substantially reduce sampling effort with trawl gear. Restrictions on trawling at night could seriously hinder the ability of PIFSC to complete their sampling protocol. If survey vessels had to stand down when they encountered fog or rough seas, survey periods would have to be extended or fewer stations would have to be sampled to accommodate such delays. This would mean substantially higher costs and/or decreased quality of data. Although visual monitoring is a reasonable and practicable precaution to undertake for trawl surveys, it does not ensure that marine mammals will be detected or that entanglement can be prevented even if they are detected.

Acoustic and Visual Deterrents

This measure would require PIFSC to use acoustic deterrents on all trawl gear, including pingers and recordings of predator (e.g., killer whale) vocalizations to deter interactions with trawl gear. This measure would also require PIFSC to use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope) to reduce marine mammal interactions with the gear.

Acoustic pingers have been shown to be effective in deterring some marine mammals, particularly harbor porpoises, from interacting with gillnet gear (Nowacek et al. 2007, Carretta and Barlow 2011). There are, however, few studies testing their efficacy when used with trawl gear. Studies of acoustic deterrents in a trawl fishery in Australia concluded that pingers are not likely to be effective in deterring bottlenose dolphins, as they are already aware of the gear due to the noisy nature of the fishery (Stephenson and Wells 2008, Allen et al. 2014). Acoustic deterrents were also ineffective in reducing bycatch of common dolphins in the U.K. bass pair trawl fishery (Mackay and Northridge 2006). Although acoustic deterrents may be effective in preventing bycatch in gillnets, their efficacy in preventing bycatch in trawl nets is currently uncertain. A primary reason for this is that the noise associated with trawl gear (chains, ropes, trawl doors) is sufficiently loud that any acoustic device used would have to be louder than that generated by the ship and fishing gear which could, in turn, cause auditory damage or exclusion of cetaceans from important habitat (Zollett 2005). Underwater broadcasting of pre-recorded predator sounds (e.g. killer whale calls) to scare animals away from the fishing operation has been suggested as a potential mitigation measure but Jefferson and Curry (1996) concluded that this technique was largely ineffective for reducing marine mammal interactions with commercial fisheries based on their review of multiple studies. It is also unclear whether killer whale calls would be effective at deterring marine mammals from an area in places where killer whales are rarely encountered, i.e., where PIFSC research occurs.

Several methods have been suggested to help protected species visually detect fishing gear and avoid entanglement. Increasing acoustic reflectivity of nets through the addition of materials such as barium sulphate or acoustic reflectors has been tested, with varying degrees of success, in several set-net fisheries (Mooney et al. 2004, Rowe 2007). The applicability and efficacy in trawl fisheries is currently unknown. Similarly, nets could be illuminated with phosphorescent or luminescent materials and, ultimately, reduce the potential for entanglement. Wang et al. (2013) tested the efficacy of illuminating nets used in a Mexican bottom set-net fishery with ultraviolet (UV) light-emitting diodes to reduce sea turtle bycatch. UV net illumination significantly reduced green sea turtle bycatch without impacting target fish catch rates. Applicability in trawl fisheries and efficacy in deterring marine mammals with similar technology are, however, currently unknown. It is possible that different colored anchor or tether lines on instruments and gear could improve the ability of whales to detect those lines and avoid entanglement, although such suggestions have not been tested.

Gear Modifications

PIFSC would need to install marine mammal excluder devices on trawl nets under the Modified Research Alternative. Marine mammal excluder devices have been developed for several types of trawl nets. These devices are similar to turtle excluder devices and are designed to allow fish to pass through the bars of the excluder while marine mammals are guided to an escape hatch built into the net. The challenge with developing an excluder device is to minimize the impact on the fishing performance of the net while effectively reducing captures of marine mammals in the net. The shape, size, design, and positioning of an excluder device in the net can substantially impact the fishing performance of the net (Dotson et al. 2010). Unlike research efforts oriented toward stock assessments of commercially harvested target species, PIFSC uses midwater trawls to sample planktonic organisms rather than commercially harvested fish, so changes in "catchability" of target organisms would likely not be an issue for PIFSC research trawls.

An important factor to consider when developing excluder devices or any other gear modifications is to determine how the device or gear modification impacts the scientific objectives of the research. Given the value of long time-series data sets for tracking ecosystem changes and the potentially huge economic implications for fisheries management of highly valuable commercial fisheries, any potential changes to research gear or protocols that may introduce uncertainty and bias into survey results must be thoroughly examined and planned years in advance of their implementation.

PIFSC has not attempted to develop marine mammal excluder devices for any of the midwater trawls it uses for research. There have been no historical captures of marine mammals in PIFSC trawls; given the scientific uncertainties it could introduce into time-series data, and the economic cost of conducting calibration experiments to validate such gear modifications, PIFSC is not proposing to conduct such gear modification research on trawl nets in the near future.

Temporal or Geographic Restrictions

Spatial/temporal restrictions can be a direct way of reducing adverse impacts to protected species if there are known overlaps in time and space of the survey's footprint with concentrations of protected species. This measure would require PIFSC to identify areas and times that are most likely to result in adverse interactions with marine mammals (e.g., areas of peak humpback whale abundance during winter) and to avoid, postpone, or limit their research activity to minimize the risk of such interactions with marine mammals. This may include limits on specific locations, physical or oceanographic features, biologically important times, and/or gear types.

While the rationale for such restrictions is clear, the methods for identifying appropriate places and times for effective restrictions are not. PIFSC has been conducting marine mammal surveys in the Pacific for many years to monitor the changing patterns of marine mammal abundance and distribution. These patterns of abundance are dynamic and often correlated to particular oceanographic conditions, which vary among seasons and years, so marine mammal survey information from the previous year or even the previous month may not reflect actual conditions when it is time to deploy trawl gear. It might be possible to conduct aerial surveys or passive acoustic surveys in an area prior to conducting trawls, but such surveys require time to process data before actual density information is available.

Assuming recent marine mammal survey data are available for delimiting time or area restrictions, questions remain about what standards of density should be used for limiting research. This is important to the potential effectiveness of such restrictions because it is not clear if marine mammal density is a key factor in the risk of catching animals in a research trawl. Marine mammals can all swim much faster than an active trawl tow (two to four knots) so they can easily avoid such gear if they perceive it and choose to move. This is true no matter how many animals are in a given area. The risk of entanglement is likely influenced much more by the attraction of marine mammals to fish caught in the trawl or disturbed by it as the trawl passes by, which in turn may be influenced by the overall availability of prey and the nutritional status of the marine mammals. Even if there are only a few marine mammals in an area, the

risk of entanglement could be high if they are very hungry and strongly attracted to fish in a trawl. Conversely, the risk of entanglement could be quite small even if there are many marine mammals in an area if they have been foraging successfully and are inclined to avoid the disturbance of a trawl operation.

In any case, under the Status Quo and Preferred Alternatives, the "move-on" rule would be applied if any marine mammals are sighted from the vessel within 30 minutes before deploying trawl gear and appear to be at risk of interactions with the gear. If an area has a high density of marine mammals, they would likely be sighted during this 30-minute monitoring period prior to setting the gear and the station would be moved away or abandoned to avoid the marine mammals.

A special case of spatial/temporal restrictions would be for PIFSC to avoid trawl survey work within federal and state MPAs (see Section 3.1.2). While PIFSC has conducted survey work within some MPAs under the authority of special use permits, these permits primarily provide authority to scientifically sample fish in areas that are otherwise closed to fishing and do not concern the incidental take of marine mammals. PIFSC will continue to apply for special use permits to sample in MPAs as necessary to meet the scientific needs of their surveys and, if the managing agencies of any MPAs prohibit such sampling, PIFSC will avoid those areas. However, as described above, the same concerns about the effectiveness of spatial/temporal restrictions as a mitigation measure would apply to MPAs. They may or may not have high concentrations of marine mammals relative to the surrounding areas but, given the uncertainty about what factors contribute to high risk of entanglement in trawl gear and the imposition of the "move-on" rule, the potential for actually reducing incidental take by avoiding certain areas is not clear. Such avoidance also comes at the cost of not sampling in areas that are important to different fish species or that were established to promote recovery of depleted stocks. Scientific sampling is often the only reliable way to track the status of these stocks and the effectiveness of the MPA in fulfilling its established goals.

4.4.4.2 Longline Gear

Monitoring Methods

The potential to use additional monitoring methods during hook-and-line surveys mostly involves the same considerations discussed with trawl surveys above. However, the potential to use dedicated PSOs is restricted primarily by vessel and crew size considerations. Longline surveys are conducted on smaller vessels than trawl surveys and the size of the crew is typically smaller. Under the Status Quo, at least one member of the crew is charged with watching for protected species before the gear is set. Dedicated PSOs would not be distracted by other vessel or research gear duties and would thus offer an advantage in monitoring for protected species. However, given the current size of vessels and crews used for these surveys, the inclusion of a crew member dedicated to only one task would compromise the ability of the remaining crew to conduct the survey safely.

Operational Procedures

This measure would require use of a decoy research vessel playing pre-recorded longline fishing sounds to distract marine mammals away from research longline sets. There have been no attempts to test the effectiveness of this method but it is likely that cetaceans would quickly learn to tell the difference between decoys and actual fishing operations (Gillman et al. 2006). Although the potential effectiveness is not clear, the additional cost of chartering another vessel to serve as a decoy would certainly compromise the research budget and restrict the amount of data that could be collected. In addition, a second vessel and broadcast fishing sounds would add to the amount of noise introduced to the marine environment, potentially increasing the number of animals taken by disturbance (Level B takes) everywhere the survey was conducted.

Acoustic Deterrents

This measure would require PIFSC to use deterrents such as acoustic pingers or recordings of predator (e.g., killer whales) vocalizations to deter interactions with longline gear. Although no marine mammals have been taken in longline gear during PIFSC fisheries research, takes of marine mammals on longline surveys in other regions involved animals hooked while depredating fish caught on the gear. Tests of the use of acoustic deterrents to mitigate depredation showed varying results. Signals emitted by pingers may decrease interactions of toothed whales with longlines by interrupting echolocation signals. Depredation by dolphins in the Mediterranean Sea appeared to decrease in response to some pingers, although distance from fishing vessels was not affected (Buscaino et al. 2011). Tests of similar devices in the tuna longline fishery off Hawaiʻi indicate that the pingers probably reduced depredation rates (Nishida and McPherson 2011). Fixed frequency (10 kHz) acoustic pingers affixed to longlines in the South Pacific and Indian Oceans had a deterrent effect compared to random frequency (5-160 kHz) small pingers (Huang 2011). Adding pingers to the longline could also serve to attract animals rather than deter them (the "dinner bell" effect) (Jefferson and Curry 1996). As with trawl gear, attempts to scare animals off by playing killer whale recordings are likely to prove ineffective. In a draft review paper, Hamer et al. (2010) note that, although the use of predator playback has not been well studied, it may only work over short distances and individuals would likely habituate to the sounds. There is also the potential that introduction of these acoustic devices could deter or attract the target species, thereby compromising the continuation of the time-series data set.

Visual Deterrents

This measure would require PIFSC to use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope, or marked lines) to make the longline gear more detectable thereby reducing the likelihood of hooking or entangling a marine mammal. This measure would theoretically reduce rates of interaction or entanglement for animals that have trouble detecting the fishing gear in order to avoid it (Gillman et al. 2006). Similarly, phosphorescent or luminescent material can be incorporated into fishing gear to emit light underwater at wavelengths that are visible to protected species. However, it is not clear that such measures to enhance the acoustic or visual appearance of trawl nets would have the same effect on all species. For some species that are attracted to the fish caught on the longline, efforts to increase the "visibility" of a longline set may increase the potential for interactions rather than decrease those risks. In addition, devices added to longline gear to increase their visibility may deter or attract the target species, potentially compromising the continuation of the time-series data set.

4.4.4.3 Conclusion

Under the Modified Research Alternative, PIFSC would implement additional mitigation measures for protected species while conducting the same scope of research as described under the Preferred Alternative. Of the potential techniques and procedures considered under this alternative to improve monitoring of trawl gear, three techniques appear to offer some promise in helping to detect marine mammals in conjunction with the current visual monitoring protocol. These include the use of underwater video technology, passive acoustic monitoring, and unmanned aerial or underwater surveillance vehicles. However, all three techniques have substantial limitations in terms of conditions under which they may be useful (e.g. weather and sea state), the logistics of incorporating them into sampling procedures (e.g. timing of deployment, crew responsibilities, and data processing), and how they might be incorporated into actual marine mammal take-avoidance decisions like the "move-on" rule. These three techniques may warrant further examination to explore these limitations and to see how they may be applied under actual survey conditions if the technology advances and is improved. The other technological approaches considered, infra-red imaging and use of night vision devices, have severe limitations to their usefulness in a real-world situation and therefore offer no advantages for actual mitigation.

Operational restrictions such as not allowing trawls to be set at night or in poor visibility conditions would certainly reduce the risk of taking marine mammals. However, part of their effectiveness may be due to reduced overall sampling effort rather than because marine mammals are more likely to be caught under those conditions. Such restrictions could have a serious impact on the ability of PIFSC to collect certain kinds of research data and would have impacts to the cost and scope of research that could be conducted. The spatial/temporal restrictions that were considered to avoid high densities of marine mammals are similar in that they would reduce risk of take by reducing overall sampling effort but also strongly impact the ability of PIFSC to pursue certain scientific goals (e.g., studies on the seasonal life histories of certain species).

The use of additional acoustic and visual deterrents may warrant further investigation if new devices enter the market and are demonstrated to be effective. However, the effectiveness of the devices considered in this alternative appears to be species specific; mitigation advantages for some species may lead to higher risk for other species. The effectiveness of these techniques may also decrease with time as animals habituate to various devices and techniques.

The analysis of additional measures considered to decrease the risk of marine mammal takes in hook-and-line gear is similar to trawl gear. Hook-and-line surveys are conducted on much smaller vessels with limited crew. Dedicated PSOs could offer an advantage for monitoring, but the lack of crew space is limiting; all crew members have multiple tasks that are necessary for safe navigation and to conduct the survey. Decoy vessels, acoustic deterrents, and visual deterrents are all unlikely to provide consistent mitigation value and may increase the risk for certain species. New variations on these techniques may be developed in the future that address some of these concerns. Thus far, there have been no takes of marine mammals by hook-and-line gear during PIFSC fisheries research.

In conclusion, some elements of the Modified Research Alternative (e.g., dedicated PSOs) could offer mitigation advantages compared to the Status Quo Alternative and the Preferred Alternative, although with no history of past takes in research gear, the advantage for using PSOs during PIFSC research appears to be minimal. The impacts of the Modified Research Alternative on marine mammals would therefore be similar to the impacts of the Preferred Alternative, which were considered minor adverse under the criteria described in Table 4.1-1. Some concepts and technologies considered in the Modified Research Alternative are promising and NMFS will evaluate the potential for implementation if they become more practicable.

4.4.5 Effects on Birds

The effects of the Modified Research Alternative on birds would be very similar to those described for the Status Quo Alternative (Section 4.2.5) and the Preferred Alternative (Section 4.3.5). The exceptions involve two potential additional mitigation measures intended to reduce impacts on protected species. The Modified Research Alternative includes potential spatial/temporal restrictions on where and when PIFSC-affiliated research could occur. Such restrictions may reduce impacts on sea birds in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Status Quo Alternative. Overall effects on seabirds would therefore be similar even if research was conducted in somewhat different places and times.

Another additional mitigation measure under the Modified Research Alternative would be for PIFSC to deploy streamer lines on longline gear to reduce the risk of catching seabirds. Deploying streamer lines on each side of the baited longline to discourage seabirds from diving on baited hooks has proven effective in reducing seabird bycatch in some Pacific fisheries (Melvin et al. 2001). This measure would reduce the already-low risk to seabirds from PIFSC's longline surveys, but considering the lack of historical interactions with birds during historic PIFSC research activities using similar gear configurations and

protocols, the difference in impacts to birds resulting from implementation of this mitigation measure would likely be minimal. If seabird interactions with longline gear are documented in the future, PIFSC will revisit whether the use of streamer lines is warranted given the tradeoffs between the potential conservation benefit and changes to research protocols that might affect time-series data.

The overall effects of PIFSC research activities on birds under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.6 Effects on Sea Turtles

Additional mitigation measures described under the Modified Research Alternative are unlikely to decrease the potential for adverse impacts to sea turtles relative to the Status Quo Alternative. Under the Modified Research Alternative, underwater video technology may allow PIFSC to determine the frequency of sea turtle interactions with research equipment and evaluate the effectiveness of devices intended to reduce entanglement or bycatch of protected species. This technology may provide useful information about the efficacy of some mitigation measures; however, the use of video equipment is unlikely to influence the impact of PIFSC research activities on sea turtles.

Passive acoustic monitoring involves the detection of animals by listening for the sounds that they produce (Barlow and Gisiner 2006). This technology is not expected to be effective for detection or avoidance of sea turtles because sea turtles vocalize only during copulation and nesting, and are the least vocal of living reptiles (Cook and Forrest 2005). Likewise, IR detection is unlikely to improve the ability to detect and avoid sea turtles in the water because water is effectively opaque to IR radiation. Although turtles come to the surface to breathe, only a very small area of a turtle is exposed above the sea surface. In addition, because turtles are ectothermic (cold-blooded) reptiles, temperature differences between the turtle and the surrounding water would be minimal and difficult to detect using IR-sensing devices. Similarly, sea turtles in the water would be extremely difficult to detect using night-vision technology.

Operational restrictions proposed under the Modified Research Alternative would require PIFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize adverse interactions with protected species including sea turtles, which would be difficult to detect by visual monitoring under low-visibility conditions. As discussed in Section 4.3.4, visual monitoring is a reasonable precaution to undertake in relation to research equipment using trawl gear or other towed equipment, but would not ensure detection of sea turtles, nor would it necessarily decrease the potential for adverse interactions between sea turtles and PIFSC research activities. Thus, the suspension of trawl activities during low-visibility conditions is not expected to influence overall effects of PIFSC research activities on sea turtles in the HARA, MARA, ASARA, and WCPRA. Under the Modified Research Alternative, PIFSC would implement video sampling with an open codend as an additional mitigation measure. However, this mitigation measure is not expected to influence the likelihood or outcome of interactions with sea turtles.

The effectiveness of visual deterrents for mitigation of sea turtle interactions with fishing gear is uncertain. Some data suggest that the use of luminescent lightsticks and LEDs may decrease rates of green sea turtle bycatch in longline gear (Wang et al. 2009). However, results from other studies demonstrate that sea turtles are attracted to underwater illumination (Wang et al. 2007).

The uses of aircraft or unmanned aerial or underwater gliders to detect sea turtles in the vicinity of PIFSC research operations are untested. While this mitigation could potentially be effective for detecting and subsequently avoiding sea turtles, the overall influence of the mitigation measure on the impacts to sea turtles is expected to be trivial.

Spatial-temporal restrictions are one of the most direct means of reducing adverse impacts to protected species. Where and when the gear is deployed and retrieved are critical variables for reducing the

potential for adverse interactions with sea turtles. The implementation of time-area closures to restrict fishing activities at times and places turtles are most likely to be present in the highest numbers have been shown to be effective for reducing impacts to sea turtles in the Pacific Islands Region (Kobayashi and Polovina 2005). Time-area restrictions proposed as mitigation measures under the Modified Research Alternative could potentially alter the spatiotemporal distribution and overall level of impacts to sea turtles resulting from PIFSC research activities; if the species of interest has a predictable distribution in time and space, this would facilitate the design of an effective time-area closure. However, the identification of specific sea turtle migratory pathways or high-residence areas and times would be essential for the establishment of effective spatial-temporal restrictions to reduce adverse interactions with sea turtles. Because PIFSC fisheries and ecosystem research has not resulted in any historical adverse interactions with sea turtles, additional restrictions on the spatiotemporal distribution of research activities proposed under the Modified Research Alternative would be unlikely to influence the overall level of impacts on sea turtles in the HARA, MARA, ASARA, and WCPRA.

Thus, additional mitigation measures described under the Modified Research Alternative are unlikely to substantially decrease the potential for adverse impacts to sea turtles relative to the Status Quo Alternative. Mitigation measures for protected species proposed under the Modified Research Alternative could result in decreased potential for adverse interactions with sea turtles relative to the Status Quo Alternative provided that the restrictions accurately address the spatiotemporal distribution of sea turtles in PIFSC research areas. However, considering that PIFSC research activities historically have not resulted in any adverse interactions with sea turtles, the implementation of such mitigation measures would not be expected to result in any substantial reduction in impacts to sea turtles. Thus, the overall level of effects on sea turtles resulting from the actions proposed under the Modified Research Alternative would be substantially similar to those of the Status Quo Alternative. Minor adverse effects could occur using gear types and mitigation measures described under the Modified Research Alternative; these effects would be isolated and infrequent, and would not result in any measurable changes to sea turtles at the population level in any of the PIFSC research areas.

4.4.7 Effects on Invertebrates

The effects of the Modified Research Alternative on invertebrates would be very similar to those described for the Status Quo Alternative (Section 4.2.7). The Modified Research Alternative includes potential spatial/temporal restrictions on where and when PIFSC research could occur. Spatial/temporal restrictions may reduce impacts on invertebrates in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. Such restrictions could also reduce overall research fishing effort in important habitats and limit the ability of PIFSC to sample invertebrate species as prescribed in their research plans. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Preferred Alternative. Overall effects on invertebrates would therefore be similar even if research was conducted in somewhat different places and times.

Overall impacts to invertebrates under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.8 Effects on the Social and Economic Environment

Under the Modified Research Alternative, PIFSC would continue fisheries research as described in Section 2.3. Research activities under the Modified Research Alternative would include one or more additional mitigation measures as described in Section 4.2.4.

The effects of the Modified Research Alternative on the social and economic environment depend on the extent that additional mitigation measures would be implemented. Some of the mitigation measures require additional equipment than is currently used and the addition of trained protected species observers to the crew, which could increase spending on wages, rentals, and equipment (see Section 2.4.1). However, on surveys conducted on relatively small vessels with limited crew space, the inclusion of crew dedicated to protected species monitoring would decrease the number of crew available to conduct research, thereby decreasing the amount of research that could be conducted in a given time period and potentially creating safety concerns. Other measures such as no night fishing and spatial/temporal restrictions could curtail research operations in areas important for stock assessment and fishery management purposes. Spatial/temporal restrictions may reduce some operational costs if surveys are reduced in scope, with a resulting loss of scientific information, but may also increase survey expenses if surveys need to be extended in time to compensate for restricted data collection opportunities.

The scientific value of data collected with changes in research protocols due to additional mitigation measures has not been evaluated because the number of unresolved variables would make any such analysis speculative. It is therefore uncertain if an altered PIFSC fisheries research program under the Modified Research Alternative would contribute a similar value to fisheries management as the Status Quo Alternative. However, it is probable that some of the additional mitigation measures included in the Modified Research Alternative, if implemented, would decrease the ability of PIFSC to provide comparable levels or quality of scientific information to the fisheries management process. While these conditions may reduce the scientific value of PIFSC research relative to the Status Quo Alternative, the overall contribution of PIFSC research to the socioeconomic environment would likely be similar to those described for the Status Quo Alternative (Section 4.2.8).

The direct and indirect effects of the Modified Research Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Pacific Island Region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Modified Research Alternative on the social and economic environment would be minor to moderate and beneficial.

4.5 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4 – NO RESEARCH ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 4 – the No Research Alternative – on the physical, biological, and social environment. Under the No Research Alternative, PIFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered in the scope of this DPEA. This discontinuation of fieldwork would not extend to research that is not within the scope of this DPEA, such as directed research on marine mammals and ESA-listed species covered under separate research permits and NEPA documents. Under Alternative 4, NMFS would rely on other data sources, such as fishery-dependent data (i.e., harvest data), and state or privately supported data collection programs to fulfill its responsibility to manage, conserve, and protect living marine resources in the U.S.

The potential direct and indirect effects of implementing Alternative 4 were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all Resource Components evaluated under this Alternative are presented below in Table 4.5-1.

Table 4.5-1 No Research Alternative Summary of Effects

Resource	Physical Environment	Special Resource Areas and EFH	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.5.1**	**4.5.2**	**4.5.3**	**4.5.4**	**4.5.5**	**4.5.6**	**4.5.7**	**4.5.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Moderate *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*	Minor to Moderate *adverse*

4.5.1 Effects on the Physical Environment

Under the No Research Alternative, PIFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters. This would eliminate the potential for direct adverse impacts to the physical environment from PIFSC-affiliated fisheries research, although such impacts may continue through research activities conducted and funded by other entities. Under this alternative, PIFSC would also discontinue efforts to remove derelict fishing gear from sensitive reefs and nearshore habitats, which has beneficial effects on benthic substrates and living marine resources. Those beneficial impacts would be lost under the No Research Alternative.

The research conducted by PIFSC includes assessments of fisheries and marine ecosystems that are used to inform a wide range of plans, policies, and resource management decisions. Many of the plans, polices and decisions that are partially based upon PIFSC data are concerned with conservation of ecological properties of the environment, and maintenance of the habitat that sustains living marine resources. FMPs developed for the Pacific Islands and Western Pacific Regions are partially based on scientific advice derived from PIFSC data. These FMPs strategically limit impacts to physical habitat such as disturbance of benthic habitat and removal of organisms that produce seafloor structure. Without a relatively continuous input of PIFSC data, including long-term time-series data, management authorities would lose some of the information necessary to establish management measures in a meaningful fashion. Discontinuance of research under the No Research Alternative would also substantially reduce the capacity of NMFS to monitor and investigate changes to the physical environment due to coastal developments, marine industrial activities, and climate change among other factors.

The loss of information on physical resources under the No Research Alternative would affect a number of different federal and state resource management agencies to various degrees. The PIFSC research program is not the only source of information available to these resource managers but the No Research Alternative could lead to changes in some management scenarios based on greater uncertainty. Given the potential for resource management agencies to compensate for this loss of information to some extent, and the preference to avoid rapid, major changes in management strategies, the potential magnitude of effects on the physical environment would likely be minor and be limited in geographic extent in the near future. Under the No Research Alternative, the overall impact of these indirect effects on physical resources would be considered adverse and minor according to the criteria in Table 4.1-1.

4.5.2 Effects on Special Resource Areas and EFH

The No Research Alternative would result in the elimination of the minor adverse direct impacts to special resource areas described in Section 4.2.2 for the Status Quo Alternative. However, the beneficial effects of PIFSC research on the conservation management of special resource areas would also be lost under the No Research Alternative.

The loss of scientific information about these areas would make it difficult for fisheries managers to assess the habitats, resources, and ecosystem functions that closed areas such as MNM, NMS, and other MPAs, are designed to protect through the implementation of sound science-based management practices. Furthermore, a loss of input from PIFSC research would handicap the maintenance and effective management of existing EFH, component HAPC, and closed areas, and would encumber the designation of additional special resource areas in the future. The loss of information about special resource areas under the No Research Alternative would have various implications for different federal and state resource management agencies. The PIFSC research program is not the only source of information available to these resource managers but it could lead to changes in some management scenarios based on greater uncertainty (e.g., greater restrictions on commercial fisheries in MPAs). If PIFSC discontinued collecting information on special resource areas and EFH, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect ecological properties of the environment could become less effective. The indirect effects of these potential management implications would likely vary among the many special resource areas considered. Given the potential for resource management agencies to compensate for this loss of information to some extent and the tendency to avoid rapid, major changes in management strategies, the potential magnitude of effects on special resource areas would likely be minor and be limited to a few local areas within the Pacific in the near future. Under the No Research Alternative, the overall impact of these indirect effects on special resource areas would be considered adverse and minor according to the impact criteria described in Table 4.1-1.

As described in Section 3.1.2.1, EFH includes hard bottom structures underlying the waters and associated biological communities. These biological communities include corals, seagrass, algae, and mangroves. Effects to these biological communities under the No Research Alternative are evaluated in Section 4.5.7.

4.5.3 Effects on Fish

Under the No Research Alternative, there would be no direct effects of PIFSC research on fish because PIFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research. The lack of at-sea research activities would eliminate the risk of mortality from fisheries research activities, disturbance and changes in behavior due to the presence of vessels and research gear, and potential contamination from vessel discharges. However, the loss of scientific information about fish populations and their habitats, especially commercially valuable species (e.g. tuna and billfishes), would make it increasingly difficult for fisheries managers to effectively monitor stock status, set commercial harvest limits, or develop fishery regulations to recover depleted stocks or protect vulnerable stocks, especially as

information used in stock assessments gets older and less reliable. For non-commercial species, the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular fish species is unknown.

The conservation and management of fishery resources is a core mission for NMFS and is listed among the ten National Standards set forth in the MSA. In carrying out Congress's mandate under the MSA, NMFS is responsible for ensuring that management decisions involving fishery resources are based on the highest quality, best available scientific information on the biological, social, and economic status of the fisheries. In the Pacific Islands Region, this is achieved through the work of PIFSC, which provides supporting scientific information that NMFS uses as the basis for their fisheries management actions. In addition to assessing the status of stocks and examining potential effects of commercial fishing activities, NMFS uses PIFSC research data in the development and implementation of FMPs. The ability to acquire scientific information is essential to the agency's responsibility to manage our nation's fishery resources.

Without PIFSC fisheries research, NMFS would need to rely on other data sources, such as fishery-dependent harvest data and state or privately supported fishery-independent data collection surveys or programs. It is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by PIFSC.

Although other data sources are available to support resource management decisions, the No Research Alternative would be expected to result in increased uncertainty and changes in some management scenarios. If PIFSC discontinued collecting information on fish stocks, management authorities would lose important information needed to establish sustainable harvest limits and other management measures in a meaningful fashion, and current conservation measures in place to rebuild overfished stocks and protect ecological properties of the environment would become less effective. The indirect effects of these potential management implications would likely vary among fisheries management areas and the different fish stocks assessed by PIFSC. There are too many unknown variables to estimate what the indirect effects of this loss of information would mean to any particular fish stock. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on fish stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact on commercially important fish stocks would be considered moderate adverse for the areas surveyed by PIFSC according to the criteria in Table 4.1-1

4.5.4 Effects on Marine Mammals

Under the No Research Alternative, PIFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters of the HARA, MARA, ASARA, or WCPRA. Directed research on marine mammals (i.e., Cetacean Ecology Assessment surveys) may continue under MMPA section 101 directed research permits but the associated use of active acoustic equipment and fishing gear (small towed nets) to sample prey fields and other oceanographic conditions would not be conducted under the No Research Alternative. This would eliminate the potential for direct effects on marine mammals through disturbance, entanglement in gear, changes to prey availability, and contamination of the marine environment in all four research areas and for all species of marine mammals.

Under this alternative PIFSC would also discontinue efforts to remove derelict fishing gear from sensitive reefs and nearshore habitats, which has beneficial effects on marine mammals that may be entangled in such gear. Those beneficial impacts would be lost under the No Research Alternative.

Many of the PIFSC projects that would be eliminated under this alternative include observations made from the deck of the vessels (transects while vessels are underway) which provide scientific data on the abundance and distribution of marine mammals in these four areas. Oceanographic and fisheries data collected by PIFSC is also important for monitoring the ecological status of the environment important to marine mammals. While there would be no direct effects on marine mammals due to adverse interactions with ships and scientific gear, the loss of some opportunistic observational information and a great deal of ecological information important to marine mammals would indirectly affect resource management decisions concerning the conservation of marine mammals.

Given the fact that PIFSC is not the only source of information available to federal and state resource managers, and the potential for resource managers to compensate for this loss of information, the No Research Alternative is expected to have an adverse and minor indirect effect on marine mammals for all of the PIFSC research areas. There are too many unknown variables to estimate what the indirect effects this lack of information would mean to any particular stock of marine mammal. However, the overall impact on marine mammals would likely be adverse and minor for all four PIFSC research areas.

4.5.5 Effects on Birds

The No Research Alternative would result in the elimination of the minor adverse direct impacts to seabirds through disturbance, entanglement in gear, changes to prey fields, and contamination of the marine environment for all species of birds (Section 4.2.5). However, as discussed in the marine mammal section above, some of the PIFSC projects that would be eliminated under this alternative have beneficial impacts on seabirds, including removal of derelict fishing gear and seabird observations made from PIFSC research vessels which provide scientific data on the abundance and distribution of seabirds in the Pacific. This information contributes to ecosystem modeling and resource management issues important to seabirds. Oceanographic and fisheries data collected by PIFSC is also important for monitoring the ecological status of the environment important to seabirds. While there would be no direct effects on seabirds, the loss of observational and ecological information important to seabirds would adversely affect resource management decisions concerning the conservation of seabirds. Although NMFS does not have regulatory jurisdiction over birds, the scientific contribution from PIFSC observational research on seabirds is used, at least partially, to support fishery management decisions, USFWS conservation efforts, and international treaties. If PIFSC discontinued collecting ecological and observational information on seabirds, long-term data sets contributing to the quality of information about seabird trends would be disrupted and adverse effects could result from the decreased ability of state and federal agencies to make informed decisions regarding the conservation of seabirds and the ecosystems that sustain them. Considering PIFSC fisheries and ecosystem research activities are not the only source of seabird-related information available to federal and state resource managers, and the potential for resource managers to compensate for loss of information to some extent on other vessels of opportunity, the No Research Alternative is expected to have an adverse and minor indirect effect on seabirds in the PIFSC research areas.

4.5.6 Effects on Sea Turtles

Under the No Research Alternative, PIFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters of the the four research areas. This would eliminate the potential for direct impacts to sea turtles through disturbance, entanglement in gear, changes in food availability, or contamination associated with PIFSC research activities. PIFSC would also discontinue efforts to remove derelict fishing gear from sensitive reefs and nearshore habitats, which has beneficial effects on sea turtles that may be entangled in such gear. Those beneficial impacts would be lost under the No Research Alternative.

Several of the PIFSC projects that would be eliminated under this alternative include observations made from the deck of the vessels which provide scientific data on the distribution of sea turtles in the HARA,

MARA, ASARA and WCPRA. Oceanographic and fisheries data collected by PIFSC is also important for monitoring the ecological status of environments important to sea turtles. These data support the management and conservation of sea turtle populations and the habitats and ecosystems that sustain them. Many of the plans, polices and decisions that are based upon PIFSC data are used to support the conservation and ongoing management of sea turtle populations, both inside and outside the U.S. EEZ. FMPs that are developed based, at least partially, on scientific advice derived from PIFSC data include management measures such as time area closures and gear type restrictions for commercial fisheries specifically intended to reduce adverse interactions with sea turtles. These management measures strategically limit impacts to sea turtles, and are partially dependent on periodic input of PIFSC data. Without these data, management authorities would lack some of the information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect sea turtles would become obsolete. The loss of scientific information important to understanding sea turtle ecology under Alternative 4 would affect federal and state resource management agencies to various degrees. Without the input of PIFSC data relevant to sea turtle ecology, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect ecological properties of the environment would become less effective. Since PIFSC is not the sole provider of scientific information on sea turtles or their habitats, resource management agencies would be forced to compensate for this loss of information through changes in management scenarios. There are too many unknown variables to estimate what the indirect effects of this loss of information and associated management implications would mean to any particular sea turtle species. Under the No Research Alternative, the loss of information currently provided by PIFSC research activities is expected to have adverse and minor indirect effects on sea turtles in the HARA, MARA, ASARA and WCPRA.

4.5.7 Effects on Invertebrates

Under the No Research Alternative, there would be no direct effects of PIFSC research on invertebrates through physical damage, directed take of coral, mortality, changes in species composition, and contamination. The beneficial effects of derelict fishing gear removal from coral reefs would be lost under this alternative.

The loss of scientific information about invertebrates would impede the ability of fisheries managers to effectively assess and monitor stocks, set harvest limits, or develop necessary regulations to protect vulnerable stocks. For non-commercial species (e.g. various corals), the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular invertebrate species is unknown.

As described in Section 4.5.3 for fish, the conservation and management of marine invertebrate resources is a core mission for NMFS under the MSA and needs to be based on the best available scientific information. In addition to assessing the status of commercially important invertebrate stocks and examining potential effects of commercial fishing activities, NMFS uses PIFSC research data to develop and implement FMPs. The ability to acquire scientific information is essential to the agency's responsibility to manage our nation's fishery resources.

Without PIFSC fisheries research, NMFS would need to rely on other data sources such as fishery-dependent harvest data and state or privately supported fishery-independent data collection surveys or programs. It is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by PIFSC.

Although other data are available to support resource management decisions, the interruption or cessation of long-term data series on commercially valuable invertebrate stocks could lead to increased uncertainty and changes in some management scenarios. Management authorities would lose important information needed to establish sustainable harvest limits and help conserve and restore benthic habitats. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on invertebrate stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact on commercially important invertebrate stocks would be considered moderate adverse according to the impact criteria in Table 4.1-1.

4.5.8 Effects on the Social and Economic Environment

Section 3.3 describes the interaction of PIFSC with the social and economic environment of the Pacific Island region. This section describes the effects of the No Research Alternative on socioeconomic resources of the Pacific Island Region. Major factors that would be affected by the cessation of fieldwork associated with the PIFSC fisheries research program include:

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

4.5.8.1 Effects on Cultural Resources

Under Alternative 4, the No Research Alternative, PIFSC fisheries at-sea fieldwork would be suspended in all four research areas. With no field operations and no personnel actively engaged in research activities, Alternative 4 would not have a direct impact on archaeological and contemporary cultural resources because there would be no actions that could affect these resources.

Alternative 4 would have an indirect adverse impact on marine resources of cultural importance through the loss of fisheries management data used to set harvest limits and ensure the long-term use of marine resources important to fishing communities and their contemporary cultural uses. Without fisheries research being conducted, fishing community fisheries management needs would be less informed, and contemporary cultural resources potentially impacted through unsustainable fishing practices. The extended time-series of data helps identify trends that inform fisheries management planning and can help determine which communities are designated as fishing communities.

Under the No Research Alternative, indirect impacts would be medium in intensity with measurable impacts to the fisheries resources utilized by fishing communities. Possible impacts from the loss of fisheries management data to contemporary cultural resources would be long-term in duration, with impact extend beyond authorization period, regional in extent due to the large geographic range of the research areas, and important in context due to value of these resource to fishing communities. Overall the direct and indirect effects of PIFSC operations under the No Research Alternative would be moderate because of reduced contributions to local fishing communities, collaboration with other researchers, and contributions to fisheries management.

4.5.8.2 Collection of Scientific Data used in Sustainable Fisheries Management

Under the No Action Alternative, PIFSC would not conduct or fund fisheries research involving the deployment of vessels or fishing gear in marine waters of the Pacific Island region. Without the scientific data for updated stock and habitat assessments provided by PIFSC-affiliated research, scientists and fisheries managers would have to rely on other data sources, such as commercial and recreational fisheries harvest data and fisheries-independent research conducted and funded by state agencies, academic institutions, or other independent research organizations. Organizations that have participated in cooperative research programs may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding (see Section 2.5). This would have a direct adverse effect on the statistical confidence of stock assessments and other scientific information important to fisheries management. Without federal fisheries-independent research, areas closed to fishing for various conservation reasons, such as stock or habitat recovery, would be without the primary scientific data used to monitor the effectiveness of those conservation measures and the recovery of depleted species.

The use of fishery-dependent data alone may severely limit the ability of managers to evaluate and make predictions about the status of some stocks because harvest data do not sample early age classes and therefore provide little data on potential recruitment to harvestable stocks. Uncertainty about stock assessments would increase over time as knowledge of population structures diminish. This, in turn, could require use of ever more precautionary approaches, which could reduce commercial and recreational fishing opportunities, and therefore associated income, through such means as reduced fishing quotas or target catch levels and/or extended closures of fishing areas. The redistribution of research effort to non-NMFS entities would also require new lines of communication with the Fishery Management Councils, new data review processes, and new procedures for integrating separate research results into the regional perspective. Cessation of fisheries research conducted and funded by PIFSC would gradually undermine the statistical basis for use of more sophisticated management models, leading to reliance on less sophisticated and more conservative fishery management.

Another potential result of greater uncertainty in the scientific basis for fisheries management is that fisheries managers may overestimate overfishing levels and set harvest limits too high for some species, resulting in overfishing and depletion of fish stocks. The initial effect of this would be to increase the revenues from commercial fishing and its related industries. However, over time, the depletion of fish stocks would result in lower catches and therefore reduced incomes. Further, quotas that are lower than objectively necessary mean not only losses to the fishing industry, fisheries dependent shoreside industries and fishing families and communities. Even with a precautionary approach, in the absence of objective data, quotas may still be set too high, meaning the long-term yield from the fishery will be driven down due to unsustainable harvest levels. This would result in both a conservation loss and a long-term economic loss to the Pacific Island Region.

The absence of federal fishery-independent research surveys and the long-term data sets they provide would eliminate the primary set of trend information used to monitor broad changes in the marine ecosystem. Climate change and ocean acidification have the potential to impact the population and distribution of many marine species. Long-term, scientifically robust research that provides information on changes to and trends in the marine ecosystem, and on human impacts from and adaptations to those changes and trends, would be greatly diminished if PIFSC ceased conducting and funding fisheries and ecosystem fieldwork.

The end result could be an undermining of confidence in the fisheries management program. This could lead to less cooperation and exchange of important information and data. Without this cooperation the Fishery Management Councils would find it more difficult to sustain the support of the individual states, potentially undermining the fisheries management process. The No Research Alternative clearly does not enable collection and development of adequate, timely, high quality scientific information comparable to that provided by PIFSC under any of the three research alternatives. In NMFS view, the inability to

acquire scientific information essential to developing fisheries management actions that must prevent overfishing and rebuild overfished stocks would ultimately imperil the agency's ability to meet its mandate to promote healthy fish stocks and fully restore the nation's fishery resources.

4.5.8.3 Economic Support of Fishing Communities

As stated previously, PIFSC currently spends approximately $29.2 million annually in support of fisheries research that support local economies in the form of employment, services, chartered vessels, fees, taxes, equipment, and fuel. Cooperative research grants and research set-aside programs account for substantial additional charter services. Under the No Research Alternative, this financial contribution to local economies and the resulting support of the social environment would cease. A number of people currently employed to conduct fisheries research either as federal employees or contractors would likely lose their jobs and the number of support services required for PIFSC would decrease substantially. It is unlikely that state agencies or other funding sources would be able to completely compensate for this loss of federal funding to support fisheries research by state agencies, academic institutions, and industry groups.

While the loss of research-related employment and purchased services would be important and adverse for many individuals and families, the total sums spent for research are very small compared to the value of commercial and recreational fisheries in the area as well as the overall economy of those communities. The lost economic contribution of PIFSC research would be relatively larger for some communities where the research is centered (i.e., Honolulu, Hawai‘i) and may be considered moderate in magnitude for those communities but the overall direct impact of that loss would be minor in magnitude for most communities. The economies of the MARA, ASARA, and WCPRA are typically smaller in scale, with a larger component of the overall economy coming from research activities for each of the research areas. These direct adverse economic impacts would be certain to occur under the No Research Alternative, would affect numerous communities throughout the region, and could be felt for several years. Overall, the direct economic impacts of the No Research Alternative would be considered minor to moderate and adverse according to the impact criteria in Table 4.1-1.

4.5.8.4 Collaborations between the Fishing Industry and Fisheries Management

Over time, the No Research Alternative would cause an adverse indirect effect on the social and economic environment by degrading the relationships that has been established between scientists and fishing groups through working together on cooperative research programs. This deterioration in trust and cooperation would likely get worse if commercial fisheries were managed more conservatively because of higher uncertainty resulting from less reliable information to feed into fisheries management. It is not clear what impacts this would have on particular economic or regulatory issues but an atmosphere of distrust often complicates and slows down public decision-making processes such as those used to develop fisheries regulations and harvest allocations. This type of effect could last for many years and would therefore be considered a long-term, adverse effect.

4.5.8.5 Fulfillment of Legal Obligations Specified by Laws and Treaties

The cessation of field work associated with the PIFSC research programs considered in this DPEA would compromise the ability of NMFS to fulfill its obligations under various U.S. laws and international treaties (Chapter 6). NMFS manages finfish and shellfish harvest under the provisions of several major statutes, including the MSA, MMPA, and ESA. Fulfilling the obligations of these statutes requires NMFS to provide specific research data and scientific expertise to support legal reviews and management decision-making processes. The cessation of field research would substantially erode the value of scientific advice provided to these various processes and increase uncertainty about the effects of conservation and management measures on fishing communities as well as NMFS ability to provide socioeconomic analyses required for fisheries regulatory actions. It would also compromise the U.S.

partnership and collaboration with other agencies, entities, and countries that collect, analyze, and share complementary data for management of highly migratory species and other international resources.

4.5.8.6 Conclusion

The direct and indirect effects of The No Research Alternative on the social and economic environment would be subject to a great deal of uncertainty depending on the response of many entities to the cessation of PIFSC fisheries research and the ensuing uncertainty in the fisheries management process. The impacts on the economies of local communities would be adverse, minor to moderate in magnitude depending on the community, long-term in duration, and would be felt throughout the Pacific Island region. The loss of research related to highly migratory species would compromise the ability of the U.S. to comply with its international treaty obligations. The loss of cooperative research programs would also cause deterioration in the relationships between NMFS scientists and fisheries managers with the fishing industry and public, with decreasing public trust in fisheries management regulations. The overall direct and indirect effects of the No Research Alternative on the social and economic environment would be minor to moderate in magnitude, felt across a broad geographic area, and long-term and would therefore be considered moderate adverse according to the impact criteria established in Table 4.1-1.

4.6 COMPARISON OF THE ALTERNATIVES

The following discussion compares and contrasts the direct and indirect impacts of the four alternatives on each resource area. The first three alternatives are much more similar to each other than to Alternative 4 because the first three alternatives involve robust and extensive PIFSC fisheries and ecosystem research programs. Alternative 4 is quite different from the other alternatives in that it does not include fieldwork conducted or funded by PIFSC.

Alternative 1, the Status Quo Alternative, includes the research program as it has been performed over the past five years, although some of the surveys/projects conducted in that period have not been conducted recently or were short-term projects that were not intended to be continued in the future. The mitigation measures for protected species under Alternative 1 are those that have been consistently used over the past five years.

Alternative 2, the Preferred Alternative, includes the suite of research surveys/projects that are currently being conducted and are anticipated to be conducted in the foreseeable future. It also includes the current suite of mitigation measures for protected species as well as proposed improvements to protected species impact mitigation procedures. These new efforts are intended to improve the overall effectiveness of mitigation measures to reduce adverse interactions with protected species.

Alternative 3, the Modified Research Alternative, includes the same set of research activities as Alternative 2, and also includes a range of additional mitigation measures for protected species that are not included in Alternative 2. These additional mitigation measures include operational restrictions as well as the potential incorporation of gear modifications into research protocols. Many of these additional mitigation measures would impact the collection of fisheries and ecosystem research data or require extensive and costly testing before they could be implemented, and are therefore not part of the Preferred Alternative.

Under Alternative 4, the No Research Alternative, PIFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered within the scope of this DPEA. Under the No Research Alternative, it is unlikely that any state or other institutional research programs would be able to achieve the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by PIFSC. NMFS would need to rely on other data sources, such as fishery-dependent data (e.g., harvest data) and state or privately supported fishery-independent data collection surveys or programs to fulfill its responsibility to manage, conserve and protect living marine resources in the U.S.

The effects of the alternatives on each resource type were assessed using an impact assessment criteria table to distinguish between major, moderate, and minor effects. The analysis shows that all three of the research alternatives could directly and indirectly impact the physical and biological environments in similar ways, and that the effects would be minor and adverse. In addition, the three research alternatives would have indirect beneficial effects on many biological resources and special resource areas through their contribution of scientific information to various resource management and conservation processes. The three research alternatives would also have minor to moderate beneficial effects on the social and economic environment of fishing communities by providing the scientific information needed for sustainable fisheries management and by providing funding, employment, and services. The No Research Alternative, in contrast, would eliminate the direct minor adverse effects of the research alternatives on the marine environment, but would have moderate indirect adverse effects on the social and economic environment through long-term and widespread adverse impacts on sustainable fisheries management. Table 4.6-1 provides a summary of impact determinations for each resource component by alternative.

Table 4.6-1 Summary of Environmental Effect Conclusions for Each Alternative

Resource Component	Alternative 1 (Status Quo)	Alternative 2 (Preferred)	Alternative 3 (Modified Research)	Alternative 4 (No Research)
Physical Environment	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Special Resource Areas and EFH	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Fish	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Marine Mammals	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Birds	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Sea Turtles	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Invertebrates	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Social and Economic Environment	Minor to Moderate *beneficial*	Minor to Moderate *beneficial*	Minor to Moderate *beneficial*	Minor to Moderate *adverse*

4.6.1 Summary of Effects on the Physical Environment

Under the three research alternatives, direct impacts to benthic habitats would occur through the use of several types of bottom-contact equipment. Bottom-contact fishing gear used in PIFSC fishery research activities under the three research alternatives would include lobster traps and BRUVs that rest directly on the seafloor, as well as ARMS, ADCPs, BMUs, CAUs, STRs, HARPs, PUCs, RAS, SEAFETs and SAMIs and EARs that are either fixed or anchored to the benthic substrate (Table 2.2-1; also see Appendix A for description of gear types). Due to the small areas affected by stationary bottom-contact fishing gear, the geographic extent of impacts would be limited to much less than 1 percent of the project area and would therefore be considered minor in magnitude and localized. PIFSC does not use bottom trawl or dredge equipment for any of its research programs.

Most disturbances to benthic habitats would be expected to recover with several months due to the action of ocean currents and natural depositions. Water quality could be affected through disturbance of bottom sediments, causing temporary and localized increases in turbidity. The potential for accidental fuel spills or other contamination from research vessels is considered small and any incidents would be rare due to the training and spill response equipment required for work on all research vessels, and adherence to Coast Guard regulations regarding safety and pollution prevention, and the experience of NOAA Corps and charter captains and crew. The overall effects on benthic habitat and water quality are considered minor in magnitude, s dispersed over a large geographic area, and temporary in duration. Low intensity impacts resulting from the disturbance of organisms that produce structure could persist for months, however impacts resulting in measureable changes to the physical environment would be temporary. In general, any measureable alterations to benthic habitat would recover within several months through the action of water currents and natural sedimentation. Overall impacts would therefore be considered minor adverse under all three of the research alternatives, as they would all have similar impacts on the physical environment.

Under the No Research Alternative, there would be no direct impacts on the physical environment from PIFSC-affiliated fisheries and ecological research. However, the loss of scientific information generated by PIFSC research would contribute to greater uncertainty about the effects of climate change, ocean acidification, commercial fisheries impacts, and other external factors on benthic ecosystems. Indirect effects could occur through less scientifically informed decisions by resource management agencies. The loss of information from PIFSC would likely affect a large geographic area but would be minor in magnitude given other potential sources of scientific research data. Impacts to the physical environment would therefore be considered minor adverse under the No Research Alternative.

4.6.2 Summary of Effects on Special Resource Areas and EFH

Under the three research alternatives, PIFSC would conduct some fisheries and ecosystem research activities in EFH, monument areas, sanctuaries, and refuges; however, the research activities would be limited, minimally invasive, and extractive sampling would not occur to any considerable extent. The potential effects on special resource areas and EFH resulting from PIFSC research under the Status Quo Alternative are similar or the same as those discussed for physical, biological, and socioeconomic resources elsewhere in this DPEA. These effects primarily involve potential adverse interactions with EFH coral habitat, protected species, and the risk of accidental spills or contamination from vessel operation. Near-surface and midwater trawl gear, as well as various plankton nets, water sampling devices, and acoustic survey equipment could result in temporary impacts to pelagic habitat within special resource areas and EFH. Presence of pelagic sampling equipment may result in short-term disturbance or displacement of pelagic species, but the duration of impacts to pelagic habitats within special resource areas and EFH would generally not extend beyond the duration of the research activity. While survey activities may occur within special resource areas and EFH, these activities would have *de minimus* impacts on benthic habitats within sanctuaries, EFH, or other special resource areas because PIFSC does not use bottom-contact trawl equipment or other mobile bottom-contact research equipment for any of fisheries and ecosystem research programs proposed under the three research alternatives. Stationary bottom-contact equipment that could potentially influence benthic habitat within special resource areas and EFH are described in section 4.2.1.

Possible PIFSC surveys conducted within the special resource areas and EFH would include the randomized Reef Assessment and Monitoring Program (RAMP) surveys in nearshore areas using non-invasive survey techniques. RAMP survey locations are selected randomly, and can potentially occur within MPAs and other special resource areas. Under all of the three research alternatives such activities would be minimally extractive, and would occur infrequently. Any research activities occurring within special resource areas and EFH would meet established conservation measures and restrictions for the location.

Impacts to special resource areas and EFH under Alternative 2 would be very similar to the impacts under Alternative 1. Alternative 3 includes the potential for spatial/temporal restrictions on PIFSC fisheries research as a means to reduce impacts on protected species. This provision may reduce impacts on certain areas if such closures were determined to be effective mitigation measures. However, specific determinations about potential research restrictions have not been made and it is assumed that impacts to special resource areas and EFH under Alternative 3 would be very similar to those under Alternatives 1 and 2.

Under the No Research Alternative, there would be no direct impacts on special resource areas and EFH from PIFSC-affiliated fisheries and ecolosystem research. However, the indirect effects on resource management agencies and conservation plans for protected areas due to the loss of scientific information would be similar to that described for the physical environment and would be considered minor adverse.

4.6.3 Summary of Effects on Fish

Under all of the three research alternatives, potential effects of research vessels, survey gear, and other associated equipment on fish species found in the research areas would include mortality from fisheries and ecosystem research activities, contamination from discharges, and potential disturbance and changes in behavior due to sound sources. The only fish species in the project area listed as threatened or endangered under the ESA is the scalloped hammerhead shark. Historically, only four scalloped hammerhead sharks have been captured as a result of PIFSC fisheries and ecosystem research, all of which belonged to the non ESA-listed Central Pacific DPS. Furthermore, all four of these captures were released alive with no resulting mortality. Given the lack of historical takes of ESA-listed fish species, the potential for future takes is considered small and unlikely to affect any ESA-listed population of scalloped hammerhead shark. For most species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to research surveys and projects is much less than one percent of ACLs or commercial harvest and is considered to be minor in magnitude for all species. For species which exceed one percent of ACLs or commercial harvest, catch is still small relative to the population of each species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities. Disturbance of fish from research activities would be temporary and minor in magnitude for all species. As described in Section 4.2.3.6, the potential for accidental contamination of fish habitat is considered minor in magnitude and temporary or short-term in duration. The overall effects of any of the three research alternatives on target fish would be minor in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

In contrast to these adverse effects, PIFSC research also provides long-term beneficial effects on managed fish species throughout the Pacific Islands Region through its contribution to sustainable fisheries management. Data from PIFSC fisheries and ecosystem research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks. The beneficial effects of the time-series data provided by PIFSC research programs effects are especially valuable for long-term trend analysis for commercially harvested fish and, combined with other oceanographic data collected during fisheries research, provide the basis for monitoring changes to the marine environment important to fish populations.

Under the No Research Alternative, there would be no direct effects of PIFSC research on fish because PIFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research. The lack of at-sea research activities would eliminate the risk of mortality from fisheries research activities, disturbance and changes in behavior due to the presence of vessels and research gear, and potential contamination from vessel discharges. However, the loss of scientific information about fish populations and their habitats, especially commercially valuable species (e.g. tuna and billfishes), would make it increasingly difficult for fisheries managers to effectively monitor stock status, set commercial harvest limits, or develop fishery regulations to recover depleted stocks or protect vulnerable stocks, especially as information used in stock assessments gets older and less reliable. For non-commercial species, the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular fish species is unknown. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on fish stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact of the No Research Alternative on commercially important fish stocks would be considered moderate adverse for the areas surveyed by PIFSC according to the criteria in Table 4.1-1

4.6.4 Summary of Effects on Marine Mammals

The potential direct and indirect effects of PIFSC research activities on marine mammals have been considered for each of the four PIFSC research areas (HARA, MARA, ASARA, and WCPRA) and for all gear types used in research under each of the three research alternatives. While many of the marine mammal species in the PIFSC research areas may be exposed to sounds from active acoustic equipment used in PIFSC research, not all are. Additionally, many of the acoustic sources are not likely to be audible to many marine mammal species. For the marine mammals affected, those effects would likely be temporary and minor changes in behavior for nearby animals as the ships pass through any given area. The potential for TTS in hearing is low for high frequency cetaceans (beaked whales and dwarf and pygmy sperm whales) and very low to zero for other species. The potential for hearing loss or injury to any marine mammal is essentially zero. Because of the minor magnitude of effects and the short-term duration of acoustic disturbance, the overall effects of acoustic disturbance are considered minor adverse for all species under all of the three research alternatives.

PIFSC has never caught, hooked, or had marine mammals entangled in fisheries research gear. However, incidental takes of marine mammals have occurred in commercial and non-commercial fisheries in the same areas as PIFSC research occurs and using gears similar to those used in research. PIFSC has used information on these analogous fisheries to make precautionary estimates of marine mammals that may be incidentally taken during future fisheries and ecosystem research, which are assumed to be the same for all three of the research alternatives. These requested Level A harassment and mortality and serious injury takes include three ESA-listed species and 13 non-listed cetacean species, primarily by research using longline gear but also including research with midwater trawl gear and instrument deployments (potential entanglement in mooring lines or other lines). For almost all species and stocks with determined PBR values, the requested takes, if they occurred, would represent less than ten percent of PBR and would be considered minor in magnitude. The exception is for spinner dolphins. If all of the requested takes for spinner dolphin occurred on the Oahu/4-Islands stock, the takes would be 12.1% of PBR for this stock (Table 4.2-7) and would be considered moderate in magnitude. Given the mitigation measures implemented under the Status Quo and Preferred Alternatives, the relatively small amount of fishing effort involved in PIFSC research, and the lack of takes in the past, PIFSC does not anticipate that the level of requested takes will actually occur in the future. Mitigation measures would be expanded considerably under the Modified Research Alternative but the potential benefit to marine mammals would be minimal considering the absence of takes under status quo conditions. The overall impact of the potential takes of these species, if they occurred, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

PIFSC considered the risk of interaction with marine mammals for all the research gears it uses but did not request incidental takes in research gears other than midwater trawls, longline, and instrument deployments. PIFSC also uses bottomfishing hook-and-line gear, troll gear, bongo nets, baited traps, SCUBA gear, and other gears and scientific instruments in the course of conducting fisheries and ecosystem research (Table 2.2-1) that are not considered to present reasonable risks of incidental takes of marine mammals and for which no take requests have been made.

In addition to Level B harassment takes for many species through acoustic disturbance, PIFSC is requesting Level B harassment takes for Hawaiian monk seals due to the physical presence of researchers in nearshore waters and beaches. Given the existing protocols for monitoring and avoiding interactions with monk seals, these potential takes would likely result in only temporary disturbance of small numbers of monk seals and adverse impacts would be minor.

Given the very small amounts of fish and invertebrates removed from the ecosystem during scientific sampling, the dispersal of those sampling efforts over large geographic areas, and the short duration of sampling efforts, the overall risk of causing changes in food availability for marine mammals is considered minor adverse for all research areas under each of the three research alternatives. Also, given

the crew training, required emergency equipment, and adherence to environmental safety protocols on NOAA research vessels and NOAA chartered vessels, the risk of altering marine mammal habitat through contamination from accidental discharges into the marine environment is considered minor adverse for all three research alternatives.

The overall impacts to marine mammals would be similar among the three research alternatives, and would be minor to moderate in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

Under the No Research Alternative, PIFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters of the HARA, MARA, ASARA, or WCPRA, with the exception of directed marine mammal research conducted under MMPA section 101 research permits. These surveys could continue but would not be authorized to deploy active acoustic gear or nets that may interact with marine mammals. This would eliminate the potential for direct effects on marine mammals through disturbance, entanglement in gear, changes to prey availability, and contamination of the marine environment in all four research areas and for all species of marine mammals. However, many of the PIFSC non-marine mammal research projects that would be eliminated under this alternative sometimes include opportunistic observations of marine mammals made from the deck of the vessels (transects while vessels are underway) which provide information on the abundance and distribution of marine mammals in these four research areas. Oceanographic and fisheries data collected by PIFSC is also important for monitoring the ecological status of the environment important to marine mammals. While there would be no direct effects on marine mammals due to adverse interactions with ships and scientific gear, the loss of observational and ecological information important to marine mammals would indirectly affect resource management decisions concerning the conservation of marine mammals. There are too many unknown variables to estimate the magnitude of effects this lack of information would mean to any particular stock of marine mammal but they would likely be minor in the near future. Through these indirect effects on future management decisions, the overall impact to marine mammals would be adverse and minor for all four PIFSC research areas under the No Research Alternative.

4.6.5 Summary of Effects on Birds

There have been no known adverse interactions with seabirds during PIFSC research activities; there are no records of birds being hooked or caught in research gear or ship strikes. All three of the research alternatives include the use of fishing gear (e.g., trawls, longlines) that have had substantial incidental catch of seabirds in commercial fisheries. However, research gear is generally smaller than commercial gear and research protocols are quite different than commercial fishing practices. In particular, fisheries research uses much shorter duration sets than commercial fisheries and no bait/offal is thrown overboard while research gear is in the water, thereby greatly reducing the attraction of seabirds to research vessels. Based on this historical lack of interactions between seabirds and equipment used for PIFSC fisheries and ecosystem research, incidental take of seabirds in research gear is unlikely. This DPEA also considers the potential for fisheries research to affect the habitat quality of seabirds through removal of prey and contamination of seabird habitat and, as described above for marine mammals, concludes that these effects would be minor adverse for all species. The overall effects on seabirds are therefore considered minor adverse under all three research alternatives. One potential mitigation measure under Alternative 3 would be for PIFSC to deploy streamer lines on longline gear to reduce the risk of catching seabirds. If seabird interactions with longline gear are documented in the future, PIFSC will evaluate whether use of streamer lines is warranted given the tradeoffs between the potential conservation benefit and changes to research protocols that might affect time-series data.

Some PIFSC surveys take bird biologists on board when there is bunk space available to conduct transect surveys for bird distribution and abundance in the PIFSC research area. This information is used by

NMFS, the U.S. Fish and Wildlife Service, and other international resource management agencies to help with bird conservation issues and is considered to have indirect beneficial effects on birds.

Under the No Research Alternative, the risk of direct adverse effects on seabirds from PIFSC research would be eliminated, but there could be potential long-term minor adverse indirect impacts to seabirds because resource management authorities would lose ecological information about the marine environment important to seabird conservation.

4.6.6 Summary of Effects on Sea Turtles

The DPEA analyzes the same direct and indirect effects of PIFSC fisheries research on sea turtles as described for marine mammals. The potential for ship and small boat strikes, removal of prey, and contamination of marine habitat would be similar to the risks described for marine mammals; these effects are considered minor adverse for all species under all three research alternatives. Sea turtles hearing range is apparently well below the frequencies of acoustic instruments used in fisheries research so turtles are unlikely to detect these sounds or be affected by them. PIFSC has no history of interactions with sea turtles in research gear and the potential for injury or mortality under all of the research alternatives is very small. The overall effects of the research alternatives would therefore be considered minor adverse on all species of sea turtles.

As with marine mammals and seabirds, the No Research Alternative would eliminate the risk of direct adverse effects on sea turtles from PIFSC research. However, there could be minor adverse indirect impacts due to the loss of PIFSC-affiliated research on bycatch reduction and ecological information important to sea turtle conservation.

4.6.7 Summary of Effects on Invertebrates

PIFSC fisheries and ecosystem research conducted under all of the three research alternatives could have direct and indirect effects on many invertebrate species through physical damage to infauna and epifauna, directed take of coral specimens, mortality, changes in species composition, and contamination or degradation of habitat.

For all invertebrate species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to PIFSC fisheries and ecosystem research surveys and projects is less than two percent of commercial and recreational harvest and is considered to be minor in magnitude for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities and the risk of altering benthic community structure would be minimal. Disturbance of invertebrates and benthic habitats from research activities would be temporary and minor in magnitude for all species. The overall direct and indirect effects of the Status Quo Alternative on invertebrates would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

Under the Preferred Alternative, the Northwestern Hawaiian Islands Lobster Survey is not carried forward. The elimination of this survey would substantially reduce the total mortality of lobsters from PIFSC research activities. Modified surveys include a midwater trawl added to the Cetacean Ecology Assessment Survey and increased geographic scope of the Insular Fish Abundance Estimation Comparison Surveys (deploys a BotCam, BRUVS, and MOUSS) to include the MARA, ASARA, and WCPRA. As discussed above in Section 4.2.7, these stationary bottom-contact gears have very small footprints and therefore the potential to crush, bury, remove, or expose invertebrates is also very small. The overall effects of the Preferred Alternative on invertebrates would likely be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

The Modified Research Alternative includes potential spatial/temporal restrictions on where and when PIFSC research could occur. Spatial/temporal restrictions may reduce impacts on invertebrates in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. Such restrictions could also reduce overall research fishing effort in important habitats and limit the ability of PIFSC to sample invertebrate species as prescribed in their research plans. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Preferred Alternative. Overall effects on invertebrates would therefore be similar even if research was conducted in somewhat different places and times. Thus, overall impacts to invertebrates under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

In addition to these minor adverse effects, each of the three research alternatives would contribute to long-term beneficial effects on invertebrate species throughout the Pacific Islands Region through the contribution of PIFSC fisheries research. Specifically, the RAMP surveys support numerous management objectives, including monitoring ecosystem health, understanding the effects of climate change and ocean acidification, assessing ecological effects of fishing, prioritizing and planning conservation strategies, and detecting ecosystem shifts.

Under the No Research Alternative, there would be no direct effects of PIFSC fisheries and ecosystem research on invertebrates through physical damage, directed take of coral, mortality, changes in species composition, and contamination. However, the loss of scientific information about invertebrates would impede the ability of fisheries managers to effectively assess and monitor stocks, set harvest limits, or develop necessary regulations to protect vulnerable stocks. For non-commercial species (e.g. various corals), the absence of new fieldwork conducted and funded by PIFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers. Although other data are available to support resource management decisions, the interruption or cessation of long-term data series on commercially valuable invertebrate stocks could lead to increased uncertainty and changes in some management scenarios. Management authorities would lose important information needed to establish sustainable harvest limits and help conserve and restore benthic habitats. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on invertebrate stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact of the No Research Alternative on commercially important invertebrate stocks would be considered moderate adverse according to the impact criteria in Table 4.1-1.

4.6.8 Summary of Effects on the Social and Economic Environment

The effects of PIFSC fisheries and ecosystem research on the social and economic environment are expected to be very similar under all three research alternatives. Each of these alternatives would include important scientific contributions to sustainable fisheries management for some of the most diverse and important commercial and recreational fisheries throughout the Pacific Island region, which benefits commercial and non-commercial fisheries and the communities that support them. These industries have regionally large economic footprints, generate millions of dollars worth of sales and thousands of commercial fishing-related jobs, and provide millions of people across the country with highly valued seafood. Millions of non-commercial fishers also participate and support fishing service industries. PIFSC fisheries research activities would also have minor to moderate beneficial impacts to the economies of fishing communities through direct employment, purchase of fuel, vessel charters, and supplies.

Continued PIFSC fisheries research is important to build trust and cooperation between the fishing industry and NMFS scientists and fisheries managers. The overall effects of PIFSC-affiliated research would be long-term, distributed widely across the Pacific Island region, and would be considered minor to moderately beneficial to the social and economic environment for all three research alternatives.

The impacts of the No Research Alternative would be the inverse of the three research alternatives. It would likely have minor to moderate adverse impacts on the social and economic environment through greater uncertainty in fisheries management, which could lead to more conservative fishing quotas (i.e., underutilized stocks and lost opportunity) or an increased risk of overfishing, followed by reductions in commercial and non-commercial fisheries harvests. The lack of scientific information would also compromise efforts to rebuild overfished stocks and monitor the effectiveness of no-fishing conservation areas. These impacts would adversely affect the ability of NMFS to comply with its obligations under the MSA. It would also eliminate research-associated federal spending on charter vessels, fuel, supplies, and support services in various communities. The No Research Alternative would also have long-term adverse impacts on the scientific information PIFSC contributes to meet U.S. obligations for living marine resource management under international treaties.

5.1 INTRODUCTION AND ANALYSIS METHODOLOGY

The Council on Environmental Quality (CEQ) defines cumulative impact as:

> *The impact on the environment which results 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 other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).*

Cumulative effects are assessed by aggregating the potential direct and indirect effects of the proposed action with the impacts of past, present, and reasonably foreseeable future actions (RFFAs) in the vicinity of the project. The ultimate goal of identifying potential cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the project alternatives. As suggested by the CEQ handbook, Considering Cumulative Effects Under the National Environmental Policy Act (1997), the following basic types of cumulative effects are also considered:

- Additive – the sum total impact resulting from more than one action,
- Countervailing – adverse impacts that are offset by beneficial impacts, and
- Synergistic – when the total impact is greater than the sum of the effects taken independently.

Cumulative effects may result from the incremental accumulation of similar effects or the synergistic interaction of different effects. Repeated actions may cause effects to build up over time, or different actions may produce effects that interact to produce cumulative impacts greater than (or less than) the sum of the effects of the individual actions.

As directed by CEQ's National Environmental Policy Act (NEPA) regulations (40 CFR 1502.16), direct and indirect impacts on specific physical, biological, and social resources are discussed in combination with varying levels of effects, ranging from negligible to major. While the effects of individual actions may be only minor, substantial cumulative effects may result from multiple actions occurring in the same geographic area. The implementing regulations of NEPA require analysis of cumulative effects in order to alert decision makers of the full consequences of all actions affecting a resource component and assess the relative contribution of the proposed action and alternatives.

Chapter 3 of this Draft Programmatic Environmental Assessment (DPEA) provides baseline information on the physical, biological, and social components of the environment that may be affected by Pacific Islands Fisheries Science Center (PIFSC) research activities, including summaries of historic activities within the four PIFSC research areas. Chapter 4 provides an analysis of the direct and indirect effects on these resources of the four alternatives considered in this EA. Because the first three alternatives involve the continuation of PIFSC research activities (referred to collectively as the action alternatives) and contribute similar effects to the cumulative effects on most resources, they are generally considered together in the following Chapter 5 analysis. The contribution of the No Research Alternative to cumulative effects is quite different and is considered separately for each resource.

5.1.1 Analysis Methodology

The cumulative effects analysis methodology is similar to the effect assessment methodology for direct and indirect effects in Section 4.1. It consists of the following steps:

1. Define the geographic area and timeframe. These may vary between resource components.

2. Identify external actions [14], including:
   a. Past actions that have already occurred and resulted in lasting effects (see Chapter 3),
   b. Present actions occurring within the same timeframe as the proposed action and alternatives (see Chapter 3), and
   c. Reasonably foreseeable future actions, which are planned and likely to occur (see Table 5.1-1).
3. Evaluate the direct and indirect effects of the alternatives along with the adverse and beneficial effects of external actions and rate the cumulative effect using the effects criteria table (Table 4.1-1).
4. Assess the relative contribution of the alternatives to the cumulative effects.

5.1.2 Geographic Area and Timeframe

The cumulative effects analysis considers external actions that influence the geographic areas where PIFSC surveys occur; these areas include the HARA, MARA, ASARA, and WCPRA, as described in Section 3.1 and illustrated in Figure 1.1-2. Some actions that originate outside of the PIFSC research areas, such as discharge of pollutants, or actions that influence populations of highly migratory species, could potentially contribute to cumulative effects within the geographic areas of interest; such actions are considered in the analysis of cumulative effects. Other actions considered in the analysis of cumulative effects may be geographically widespread, such as those that could potentially result in climate change or ocean acidification. Although discussions of past actions primarily focus on the last five years, the availability of existing information and the period of time that must be considered to understand the baseline conditions vary between resource components. All analyses project five years into the future from the date this DPEA is finalized.

5.1.3 Reasonably Foreseeable Future Actions

Table 5.1-1 summarizes the RFFAs external to PIFSC fisheries research that are likely to occur in the next five years and the resources they are likely to affect. This information has been collected from a wide variety of sources, including recent NEPA documents covering the Pacific Islands marine environment, federal and state fishery agency websites and documents, United States (U.S.) Navy websites and documents, and a variety of documents concerning recreation and tourism, coastline development, and other activities. Wildlife management documents such as endangered species recovery plans and take reduction plans for sea turtles and marine mammals were also consulted to identify conservation concerns for different species and habitats.

Deciding whether to include actions that have already occurred, are ongoing, or are reasonably foreseeable in the cumulative impacts analysis depends on the resource being analyzed. Past, ongoing, and future actions must have some known or expected influence on the same resources that would be affected by the alternatives to be included in the cumulative impacts analysis. CEQ refers to this as the cause-and-effect method of connecting human activities and resources or ecosystems. The magnitude and extent of the effect of an action on a resource or ecosystem depends on whether the cumulative impacts exceed the capacity of the resource/ecosystem to sustain itself and remain productive over the long-term.

CEQ guidelines state that “it is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.” In general, actions can be excluded from the analysis of cumulative impacts if:

[14] External actions are other human activities and natural occurrences that have resulted or will result in effects to the resource components that comprise the affected environment.

- The action is outside the geographic boundaries or time frame established for the cumulative impacts analysis.
- The action will not affect resources that are the subject of the cumulative impacts analysis.
- The action is not planned or is not reasonably foreseeable (e.g., formally proposed, planned, permitted, authorized, or funded).

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Table 5.1-1 Reasonably Foreseeable Future Actions (RFFAs) related to PIFSC Research Areas

Blank cells indicate no effects on that resource.

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
Other (Non-PIFSC) Scientific Research	X	X	X	X	Sea floor disturbance	Habitat disturbance	Beneficial contribution though increased understanding of resource	Beneficial contribution though increased understanding of resource	Beneficial contribution though increased understanding of resource	Beneficial contribution though increased understanding of resource	Beneficial contribution though increased understanding of resource	Increased understanding of environment leading to better resource management
					Presence of additional vessel traffic and survey equipment	Contamination (spills, discharges)	Habitat disturbance	Behavioral disturbance or displacement	Loss from avian by-catch	Loss/injury from ship or small boat strikes	Loss or displacement due to habitat disturbance	
					Short-term turbidity increase		Behavioral disruptions	Loss/injury from ship strikes	Potential for ship collisions (lighting attraction)		Coral reef damage	
					Contamination (spills, discharges)		Removal of individuals and biomass	Noise responses			Removal of individuals and biomass	
					Generation of marine debris							
Federal and State Managed Fisheries	X	X	X	X	Seafloor disturbance	Habitat disturbance	Removal of managed targeted fisheries species	Loss/injury from ship strikes	Loss from avian by-catch	Loss/injury from ship or small boat strikes	Removal of individuals and biomass (e.g. crustaceans)	Provision of jobs and economic opportunity
					Generation of marine debris	Contamination (spills, discharges)	By-catch removal of non-target species	Loss/injury from entanglement/hooking	Potential for ship collisions (lighting attraction)	Loss/injury from turtle by-catch	Coral reef damage	Provision of food and industrial raw materials
					Presence of additional vessel traffic	Generation of marine debris	Habitat disturbance	Noise responses	Alteration or reduction of prey resources	Loss/injury from entanglement/hooking with fishing gear	Indirect loss or displacement due to habitat disturbance	Cost of operations and gear requirements
					Short-term turbidity increase		Behavioral disruption	Alteration or reduction of prey resources			Invasive species	Need for catch limits for resource management
					Contamination (spills, discharges)		Loss from capture by derelict gear	Behavioral disturbance or displacement				Need for time/area closures for resource management
					Re-suspension of disposal material		Invasive species					

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
Other Fishing Operations (Charter, Private, or Traditional)	X	X	X	X	Presence of additional vessel traffic	Habitat disturbance	Removal of managed targeted fisheries species	Loss/injury from ship strikes	Loss from avian by-catch	Loss/injury from ship strikes	Direct loss or displacement	Direct provision of jobs and economic opportunity
					Seafloor disturbance	Contamination (spills, discharges)	By-catch removal of non-target species	Loss/injury from entanglement/hooking	Potential for ship collisions (lighting attraction)	Loss/injury from turtle by-catch	Indirect loss or displacement due to habitat disturbance	Indirect support of tourist/resort economy
					Generation of marine debris	Generation of marine debris	Habitat disturbance	Noise responses	Alteration or reduction of prey resources	Loss/injury from entanglement/hooking with fishing gear	Coral reef damage	Provision of recreational opportunities
					Short-term turbidity increase		Behavioral disruption	Alteration or reduction of prey resources				Provision of food
					Contamination (spills, discharges)		Loss from capture by derelict gear	Behavioral disturbance or displacement				
Recreation and Tourism	X	X	X	X	Presence of additional vessel traffic	Habitat disturbance	Behavioral Disruption	Noise responses	Noise responses	Loss/injury from ship strikes	Loss or displacement due to habitat disturbance	Provision of jobs and economic opportunity
					Generation of Marine debris	Generation of Marine debris	Habitat disturbance	Behavioral disturbance or displacement	Potential for ship collisions (lighting attraction)	Noise responses	Loss/injury due to contamination	Provision of recreational opportunities
								Loss/injury from ship strikes	Loss/injury due to ingestion/entanglement in marine debris	Displacement	Invasive species (Cruise ship ballast water)	
								Loss/injury due to ingestion or entanglement in marine debris		Loss/injury due to ingestion/entanglement in marine debris		
Military Operations	X	X	Army reserve unit and Coast Guard	X	Contamination of water and sediment	Contamination (spills, discharges)	Noise effects (stress, altered behavior, auditory damage)	Loss/injury from ship strikes	Injury/loss due to entanglement in marine debris	Noise effects, (stress, altered behavior, auditory damage)	Injury/loss due to contamination	Temporary and localized disruption of fishing due to operations
					Generation of marine debris, including munitions	Generation of marine debris, including munitions	Mortality near detonation	Noise effects (stress, altered behavior, auditory damage)	Potential for loss from ship collisions (lighting attraction)	Loss/injury from ship strikes	Mortality near detonation	Maintaining National Defense
					Presence of additional vessel traffic		Loss/injury from contamination	Behavioral disturbance	Behavioral disturbance	Loss/injury from ingestion/entanglement in marine debris	Coral reef damage	

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
							Contamination of fish for human consumption	Displacement	Mortality near detonation	Mortality near detonation	Invasive species	
								Mortality near detonation	Displacement			
								Injury/loss due to ingestion or entanglement in marine debris				
Vessel Traffic (Shipping)	X	X	X	X	Contamination of water and sediment	Increased risk from invasive species due to long-distance shipping activity	Loss due to competition or predation from invasive species	Loss/injury from ship strikes	Loss/injury from contamination	Loss/injury from contamination	Invasive species	Direct provision of jobs and economic opportunity
					Re-suspension of sediment	Contamination (spills, discharges)	Loss/injury from contamination	Displacement	Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Loss due to competition or predation from invasive species	
							Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Loss/injury due to ingestion/entanglement in marine debris	Loss/injury due to ingestion/entanglement in marine debris	Loss/injury from contamination	
								Behavioral disturbance	Loss from ship collisions (lighting attraction)			
								Loss/injury due to ingestion/entanglement in marine debris				
								Disruption of migration patterns				
Vessel Traffic (Other)	X	X	X	X	Contamination of water and sediment	Increased risk from invasive species due to long-distance shipping activity	Loss due to competition or predation from invasive species	Loss/injury from ship strikes	Loss/injury from contamination	Loss/injury from contamination	Loss due to competition or predation from invasive species	
					Re-suspension of sediment	Contamination (spills, discharges)	Loss/injury from contamination	Displacement	Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Loss/injury from contamination	
							Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Loss/injury due to ingestion/entanglement in marine debris	Loss/injury due to ingestion/entanglement in marine debris		
								Behavioral disturbance	Loss from ship collisions (lighting attraction)			
								Loss/injury due to ingestion/entanglement in marine debris				

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
Ocean Disposal and Discharges	X	X	X		Sea floor disturbance	Contamination	Bioaccumulation of contaminants	Bioaccumulation of contaminants	Bioaccumulation of contaminants	Bioaccumulation of contaminants	Bioaccumulation of contaminants	Potential indirect impact on subsistence resources
					Increased sedimentation	Disturbance of benthic habitats Sea floor disturbance	Loss/injury from contamination	Loss/injury from contamination	Loss/injury from contamination	Loss/injury from contamination	Loss/injury from contamination	
					Increased turbidity	Increased sedimentation	Habitat disturbance	Loss/injury from ship strikes	Alteration or reduction of prey resources	Alteration or reduction of prey resources	Habitat disturbance	
					Toxic contamination Eutrophication			Alteration or reduction of prey resources	Habitat disturbance	Habitat disturbance		
								Habitat disturbance				
Dredging	X	X	X		Sea floor disturbance	Sea floor disturbance	Loss of habitat due to sea floor disturbance	Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)	Loss/displacement due to turbidity	
					Increased turbidity	Increased turbidity	Displacement due to turbidity	Loss/injury from ship strikes	Habitat disturbance/alteration	Mortality by entrainment in dredge	Indirect loss or displacement due to habitat disturbance	
					Contamination of water and sediment			Habitat disturbance/alteration	Alteration or reduction of prey resources	Habitat disturbance/alteration	Coral reef damage	
								Alteration or reduction of prey resources		Alteration or reduction of prey resources		
Coastline Development	X	X	X		Sea floor disturbance	Sea floor disturbance	Loss/alteration of habitat due to shoreline disturbance	Loss/alteration of habitat due to shoreline disturbance	Loss/alteration of habitat due to shoreline disturbance	Loss/alteration of habitat due to shoreline disturbance	Coral reef damage	Direct provision of jobs and economic opportunity
					Increased turbidity	Increased turbidity		Noise effects (stress, altered behavior)	Noise effects (stress, altered behavior)		Loss/displacement due to turbidity	
											Indirect loss or displacement due to habitat disturbance	
Geophysical/ Geotechnical Activities	X	X			Sea floor disturbance	Sea floor disturbance	Habitat disturbance	Acoustic effects from noise	Loss from ship collisions (lighting attraction)	Loss/injury from ship strikes	Habitat disturbance	
					Localized increased turbidity		Acoustic effects from noise	Loss/injury from ship strikes	Behavioral disturbance	Behavioral disturbance	Localized benthos disturbance	
								Behavioral disturbance				

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
Sea Turtle Conservation Measures	X	X	X							Decreased serious injury and mortality		Cost to fisheries, gear modifications
										Habitat protection		
Marine Mammal Conservation Measures	X	X	X					Decreased serious injury and mortality				Cost to fisheries
								Habitat protection				Displacement of personnel from fishing and other marine activities
												Need for time/area closures
Climate Change	X	X	X	X	Sea level rise, saltwater infusion in estuaries and coastal habitats	Sea level rise, saltwater infusion in estuaries and coastal habitats	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Rising water levels in coastal areas
					Increased erosion and siltation	Increased erosion and siltation					Coral bleaching	Potential changes in fisheries due to ecosystem changes
					Increased water temperatures	Increased water temperatures						New regulations on greenhouse gas emissions
					More extreme storm events	More extreme storm events						Incentives for higher vessel fuel efficiency
Ocean Acidification	X	X	X	X	Increased pCO_2	Decreased calcification among food web organisms	Potential adverse effects on prey, availability of nutritional minerals	Potential adverse effects on prey, availability of nutritional minerals	Potential adverse effects on prey, availability of nutritional minerals	Potential adverse effects on prey, availability of nutritional minerals	Decreased calcification, shell hardening impaired	Potential effects on fisheries, especially for invertebrate species
					Decreased pH	Change in primary production	Potential direct adverse effects on growth, reproduction, development				Potential adverse effects on prey, availability of nutritional minerals	
											Coral bleaching	

Action	PIFSC Research Area				Effect on Physical Environment	Effect on Special Resource Areas and EFH	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	HARA	MARA	ASARA	WCPRA								
Natural Events (Tsunami, Volcano,	X	X	X	X	Saltwater infusion in estuaries and coastal habitats		Habitat disturbance	Habitat disturbance	Habitat disturbance	Habitat disturbance	Variable effects on different species	Cost to fisheries
Earthquake, Hurricane)					Increased erosion and siltation		Variable effects on different species	Variable effects on different species	Variable effects on different species	Variable effects on different species	Coral reef damage	Job loss
					Turbidity							
					Contamination							

List of supporting documents for PIFSC RFFA table:

Hawaiian Monk Seal Recovery Actions PEIS 2011

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region FEIS 2005

http://www.fpir.noaa.gov/

Fishery Ecosystem Plan for the Mariana Archipelago 2009

Guam and CNMI Military Relocation EIS 2010

Fishery Ecosystem Plan for the American Samoa Archipelago 2009

http://www.wpcouncil.org/index-2.html

http://www.epa.gov/region9/water/dredging/disposalsites.html

Fishery Ecosystem Plan for the Pacific Remote Island Areas 2009

Maritime Shipping Routes and Strategic Passages - https://people.hofstra.edu/geotrans/eng/ch1en/appl1en/maritimeroutes.html

Final PEIS for Hawaiian Monk Seal Recovery Actions 2014

5.2 CUMULATIVE EFFECTS ON THE PHYSICAL ENVIRONMENT

Activities external to PIFSC fisheries research that could potentially affect the physical environment in the HARA, MARA, ASARA, and WCPRA may include other scientific research, federal and state managed fisheries, other fishing operations, military operations, vessel traffic, ocean-based recreation, ocean disposal and discharges, dredging, coastal development, geophysical activities, climate change, ocean acidification, and natural disasters. The potential effects of these activities are summarized in Table 5.1-1 and include:

- Seafloor disturbance
- Presence of additional vessel traffic and survey equipment
- Generation of marine debris
- Contamination of water and sediments
- Increased turbidity and sedimentation and re-suspension of sediments
- Effects of climate changes such as water temperatures and sea level rise
- Increased pCO_2 and decreased pH
- Effects of natural disasters such as increased erosion and siltation

5.2.1 External Factors in the PIFSC Research Areas

Activities that may adversely affect the physical environment of the HARA have occurred and are expected to continue to occur in the future. Due to higher development activities in this research area, the HARA has had the most adverse cumulative effects. Sources of impacts from these activities to the physical environment of the HARA are identified in Table 5.1-1.

Past activities that affected the seafloor in the HARA included other scientific research, commercial and non-commercial fisheries, military operations, ocean disposal and discharges, dredging operations, coastline development, and geophysical and geotechnical operations. These activities will also continue to influence the seafloor habitat in the HARA. Non-PIFSC scientific research activities include, but are not limited to, impacts from trawl sampling gear, diver surveys, and pot fishing studies. However, these activities provide beneficial contributions to biological resources and fisheries management considerations.

Current activities that potentially disturb the seafloor include not only fishing and aquaculture activities, but also heavy industrial activities such as channel dredging and construction of various nearshore and offshore developments, as well as military operations using heavy ordnance. These activities cause re-suspension of sediments into the water column, changes in bathymetric contours, and potential loss of benthic habitat. These activities also directly or indirectly introduce marine debris into the water (e.g., monofilament fishing line, nets, plastic) that often ends up on the seafloor or wrapped onto a shallow reef.

Contamination from spills and discharges can accumulate in the seafloor and marine life and have a toxic effect on the plants, animals and humans through the food chain ([NOAA] 2010d). There are huge numbers of potential sources of both direct and indirect marine contamination, including tankers and other marine vessels, derelict fishing gear, military operations, ocean dumping, airborne deposition, and runoff from industrial and agricultural sources on land. Some chemical compounds, such as polychlorinated biphenyl (PCB) and pesticides, can persist for many years while others, such as petroleum products, breakdown relatively quickly. Similarly, marine debris can affect the physical environment (NOAA 2010c) but most of these effects are manifested through impacts to biological systems, which are discussed in other sections of this document. Pollution is a long-term and widespread

issue in the marine environment, although it varies substantially in intensity on a local basis. In recent years there has been a concerted national and international effort to reduce pollution of ocean environments through restrictions on discharges and design features of ocean-going vessels that reduce the probability and severity of spills. As a result, although the historic problems remain, recent incidents involving unauthorized spills or discharges have either been localized and limited or, if large and widespread, have generated cleanup and mitigation responses. For the waters in the Pacific Islands Region around individual islands and atolls, ocean mixing is generally high and as a result discharges are diluted relatively quickly. Broadly speaking therefore, the cumulative effects of pollution and contamination on water quality of the PIFSC research area is expected to be minor to moderate and adverse from sources external to fisheries research.

Climate change may affect the marine 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. These changes and others are expected to continue over the reasonably foreseeable future and could aggregate with the effects of industrial activity to impact the physical environment. These changes contribute in turn to changes in the population and distribution of marine fish, mammals, seabirds, and turtles; changes in the population and distribution of fishery resources harvested in commercial fisheries, with related socioeconomic effects; and changes in FMPs or FEPs to address potential climate change 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 carbon dioxide (CO_2). Changes in the acidity of the world's oceans are expected to continue and accelerate over the reasonably foreseeable future (United States Geological Survey [USGS] 2011). Ocean acidification can harm organisms that build shells of calcium carbonate, 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 (NEA 2010). Although the dynamics of climate change and the potential magnitude and timing of its effects are poorly understood, there is general acknowledgement that the potential impacts resulting from climate change could be substantial.

5.2.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on the physical environment in the PIFSC research areas are discussed in sections 4.2.1, 4.3.1, and 4.4.1. Direct and indirect effects to benthic habitat (seafloor disturbance) and removal of organisms that produce structure would be minor and adverse. Because no ocean disposal or discharges would be authorized for PIFSC research activities under the research alternatives, there would be no contribution to cumulative effects from this action. There is the potential for accidental spills to occur or for research fishing gear or instruments to be lost. However, given the high degree of emphasis placed on safety and emergency preparedness on NOAA Corps vessels and Coast Guard requirements for training and safety equipment on commercial vessels, the magnitude of these potential spills is likely to be very small and the contribution of fisheries research to the cumulative effects of contamination is considered minor. Additionally, the accidental loss of research fishing gear or instruments during PIFSC surveys is rare. Given the relatively low effort of research activities over a very large geographic area, compared to all of the commercial and non-commercial activities in the Pacific Islands Region, the PIFSC contribution to adverse impacts to the physical environment would be relatively minor. Furthermore, the Marine Debris Research and Removal Survey activities remove tons of derelict fishing gear each year from the Pacific Islands Region, resulting in a beneficial impact on the physical environment.

Although CO_2 emissions from PIFSC research vessels would contribute to atmospheric CO_2 levels, the contribution would be minor compared to other natural and anthropogenic CO_2 sources. When aggregated with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the PIFSC

research areas, PIFSC research activities would make a minor additive contribution to cumulative adverse effects on the physical environment under each of the research alternatives.

Fisheries research programs contribute to the understanding of changes in the physical environment, including those associated with climate change and ocean acidification. Continued fisheries research programs with long-term data sets are essential to understanding changes in the physical and biological environment, and allowing NMFS to take appropriate management actions. Understanding changes in the physical environment that may affect ESA-listed species is particularly useful. PIFSC fisheries research therefore makes a beneficial contribution to cumulative effects on the physical environment.

5.2.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate the risk of direct adverse impacts to physical resources within the PIFSC research areas resulting from PIFSC research activities. However, many of PIFSC projects that would be eliminated under this alternative generate a great deal of information that, when combined with research conducted by other branches of NOAA and other agencies and institutions not included in this DPEA, is used to monitor the effects of climate change, ocean acidification, and other changes in the physical environment. It may also be used by resource managers to limit fishing-related impacts to physical habitat such as disturbance of benthic habitat from dredging and other bottom-contact gear. Without the input of PIFSC data, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect physical properties of the environment would become less effective. Although resource management agencies have other available data sources to support resource management decisions, the No Research Alternative is expected to result in increased uncertainty relating to future management scenarios. Through these indirect effects on future management decisions, the contribution of this alternative to adverse cumulative impacts on physical resources would be minor to moderate depending on how well other agencies would be able to compensate for the loss of PIFSC research.

5.3 CUMULATIVE EFFECTS ON SPECIAL RESOURCE AREAS AND EFH

Activities external to PIFSC fisheries research that could potentially affect special resource areas in the HARA, MARA, ASARA, and WCPRA may include commercial and non-commercial fisheries, coastal development, coastal recreation, other scientific research, military operations, climate change, and ocean acidification. The potential effects of these activities are summarized in Table 5.1-1 and may include:

- Contamination resulting from spills or discharges
- Presence of additional vessel traffic
- Habitat disturbances
- Increased risk of invasive species introductions resulting from long-distance shipping activity
- Effects of climate change such as increased water temperatures and sea level rise
- Effects of ocean acidification such as decreased calcification among food web organisms

5.3.1 External Factors in the PIFSC Research Areas

As described in Section 3.2, Special Resource Areas include Essential Fish Habitat (EFH), Habitat Areas of Particular Concern (HAPC), and Marine Protected Areas (MPAs), including Marine National Monuments (MNM), and National Marine Sanctuaries (NMS). The cumulative effects of activities that disturb the seafloor in special resource areas are similar to those discussed for the physical environment in Section 5.2.1. Cumulative impacts to biological resources within special resource areas are discussed in Sections 5.4 through 5.8. Cumulative effects from, dredging, military operations, and geophysical exploration would be considered as part of the federal permitting processes required for these activities. Contributions to cumulative effects from such activities would be limited by permit conditions and mitigation measures required by permitting agencies.

Adverse impacts from fishing, especially those using bottom-contact fishing gear, could be substantial in heavily fished areas and could affect EFH and component HAPC areas to various degrees. Detailed descriptions of specific prohibited gear types by area are provided in Section 3.1.2.1. The cumulative effect from all external sources of disturbance to special resource areas is expected to be minor to moderate.

5.3.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on special resource areas in the Pacific are discussed in Sections 4.2.2, 4.3.2, and 4.4.2. When aggregated with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the project, PIFSC research activities would make a minor additive contribution to cumulative adverse impacts to special resource areas in the HARA, MARA, ASARA, and WCPRA under each of the research alternatives. While there are no intentional discharges of pollutants from fisheries research vessels there is potential for accidental spills to occur. However, the magnitude of these potential spills is likely to be very small and the contribution of fisheries research to the cumulative effects of contamination is considered minor.

PIFSC fisheries research programs contribute to understanding the status of special resource areas, including changes to EFH associated with climate change and ocean acidification. Continued fisheries research programs with long-term data sets are essential to understanding changes in the physical and biological environment within special resource areas, which by definition have special management needs. Furthermore, many special resource areas have been identified as valuable reference sites to compare existing marine resources with relatively low- or no-impact ecosystems that are also habitat for

rare species. PIFSC fisheries research therefore has a beneficial contribution to cumulative effects on special resource areas in addition to the minor adverse effects.

5.3.3 Contribution of the No Research Alternative

The No Research Alternative would result in elimination of any direct impacts from PIFSC fisheries research to special resource areas that could potentially occur under each of the research alternatives. However, PIFSC research activities proposed under the research alternatives would generate information important to resource managers to monitor species and habitat recovery, environmental changes, and the effectiveness of conservation measures for special resource areas. This type of information is especially important for management of special resource areas designated to protect and conserve natural resources that are susceptible to natural fluctuations and anthropogenic impacts. Although resource management agencies have other available data sources to support resource management decisions, the No Research Alternative is expected to result in increased uncertainty and changes in some management scenarios that may affect a few local areas. Through these indirect effects on future management decisions, the contribution of this alternative to cumulative impacts on special resource areas, including Marine National Monuments and National Marine Sanctuaries, would be minor adverse.

5.4 CUMULATIVE EFFECTS ON FISH

Activities external to PIFSC fisheries research that could potentially affect fish species in the HARA, MARA, ASARA, and WCPRA may include commercial and recreational fisheries, other scientific research, military operations, vessel traffic, ocean disposal and discharges, dredging, coastal development, geophysical/geotechnical activities, climate change, and ocean acidification. These activities and potential effects are summarized in Table 5.1-1 and include:

- Habitat disturbances
- Behavioral disruptions
- Removal of managed targeted fisheries species
- Bycatch removal of non-target species
- Invasive species
- Noise effects
- Loss/injury from contamination
- Loss due to competition or predation from invasive species
- Loss of habitat and displacement from seafloor disturbance, shoreline alteration, or turbidity
- Ecosystem level changes

5.4.1 External Factors in the PIFSC Research Areas

5.4.1.1 ESA-listed Species

As discussed in Section 4.2.3.1, the only fish species in the project area listed as threatened or endangered under the ESA is the Indo-West Pacific DPS scalloped hammerhead shark. Only four scalloped hammerhead sharks have been caught by PIFSC, all of which belonged to the non ESA-listed Central Pacific DPS. Furthermore, all four of these captures were released alive with no resulting mortality.

The past, present, and reasonably foreseeable future activities that have or are likely to have the greatest effect on Indo-West Pacific DPS scalloped hammerhead sharks in the PIFSC research areas external to PIFSC fisheries research are intentional and incidental takes in commercial and non-commercial fisheries. Scalloped hammerhead sharks are taken as bycatch in the Hawai‘i-based pelagic longline fishery which targets tunas and billfish. Fishery observer data from 1995 to 2006 indicate a low catch number of scalloped hammerhead sharks (56 individuals from 26,507 total sets). More recent data from 2009 to 2011 indicates even fewer caught individuals (Miller et al. 2013, Walsh et al. 2009).

The activities external to PIFSC fisheries research affecting scalloped hammerhead sharks will likely continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

5.4.1.2 Target and Other Species

Target species are those fish which are managed for commercial and recreational fisheries and are the subject of PIFSC research surveys for stock assessment purposes or are often caught as incidental bycatch. These fisheries are the primary past, present, and reasonably foreseeable future activities that have or are likely to have the greatest effect on these species in PIFSC research areas external to PIFSC

fisheries research. Natural population fluctuations and periodic short-term and longer term climate changes also affect population viability and stock sizes.

The numerous target species in PIFSC research areas are managed through the WPRFMC and several fisheries management plans (FMPs). The analysis of effects in Chapter 4 focuses on those species most frequently caught (in quantities of 100 pounds or more) in PIFSC research activities and species that are considered overfished (Tables 4.2-1 through 4.2-4). The cumulative effects analysis takes a similar approach.

The striped marlin is the only overfished target species encountered during PIFSC surveys (Table 4.2-5). Annual commercial catch of this species for 2013 was 983,440 pounds. A stock that is overfished is one whose biomass level is sufficiently depleted to jeopardize the stock's ability to produce at Maximum Sustainable Yield (NMFS 2012a). Other overfished stocks occur in PIFSC research areas but have not been caught during surveys, including the Hancock Seamount Groundfish Complex and bluefin tuna.

The activities external to PIFSC fisheries research affecting target and other species will likely continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures and management schemes. The potential effects of climate variability are unpredictable, but are also likely to continue into and beyond the foreseeable future.

5.4.2 Contribution of the Research Alternatives

5.4.2.1 ESA-listed Species

As discussed above, listed scalloped hammerhead sharks have not been taken during PIFSC research activities. When considered in conjunction with commercial and recreational fisheries and other external activities affecting ESA-listed scalloped hammerhead sharks in PIFSC research areas, the contribution of PIFSC fisheries and ecosystem research to cumulative effects would be considered minor adverse.

5.4.2.2 Target and Other Species

The average catch of target species under the Status Quo Alternative during PIFSC research surveys in all research areas (Tables 4.2-1 to Table 4.2-5) is orders of magnitude smaller than commercial harvest levels. For example, the PIFSC average annual catch of broadbill swordfish under the Status Quo Alternative in the HARA (212 pounds) is the equivalent of <0.01 percent of the 2013 commercial landings. For all of the species listed in Tables 4.2-1 through 4.2-4 for which ACLs is established or commercial catch levels are known, research catch is less than three percent of commercial takes or ACLs. The average catch of target species under the Preferred Alternative during PIFSC research surveys in all research areas (Tables 4.3-1 and 4.3-2) is orders of magnitude smaller than most commercial harvest levels. For some species, such as bluefin trevally, bicolor parrotfish, and blue shark, the estimated research catch exceeds three percent of ACLs or commercial catch. However, the magnitude of research mortality for these species is still small relative to the estimated populations of these fish. For target species in all research areas under the research alternatives, mortality from PIFSC research surveys would be considered minor on the population level.

While mortality to target and other fish species is a direct effect of PIFSC surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of fish taken in commercial and recreational fisheries, which are just fractions of the total populations for these species.

When considered in conjunction with commercial and recreational fisheries and other external activities affecting target and other species in the HARA, MARA, ASARA, and WCPRA, the contribution of PIFSC fisheries and ecosystem research to cumulative effects would be minor adverse under all the

research alternatives. PIFSC fisheries research also has beneficial contributions to fish species through its contribution to sustainable fisheries management decisions and would help to address a range of adverse cumulative effects.

5.4.3 Contribution of the No Research Alternative

5.4.3.1 ESA-listed Species

Under the No Research Alternative, PIFSC would no longer conduct or fund research in the project area, so would not indirectly contribute to cumulative effects on ESA-listed scalloped hammerhead sharks in this region. In the absence of research surveys, important scientific information would not be collected about various prey species of scalloped hammerhead sharks, including trends in abundance, recruitment rates, and the amount of fish being harvested relative to overfishing metrics. This lack of data would make it much more difficult for fisheries managers to effectively monitor the status of stocks, develop fishery regulations, and rebuild overfished stocks. The indirect contribution of the No Research Alternative to cumulative effects on the scalloped hammerhead shark is difficult to ascertain, but would likely impact long-term monitoring and management capabilities.

5.4.3.2 Target and Other Species

Under the No Research Alternative, PIFSC would no longer conduct or fund research in the HARA, MARA, ASARA, or WCPRA. In the absence of research surveys, important scientific information would not be collected about the status of fish stocks used for fisheries and conservation management, including trends in abundance, recruitment rates, and the amount of fish being harvested relative to overfishing metrics. This lack of data would make it much more difficult for fisheries managers to effectively monitor the status of stocks, develop fishery regulations, and rebuild overfished stocks. PIFSC research also provides information on ecosystem characteristics important for monitoring potential effects from climate change and increases in ocean acidification, which could impact the population and distribution of many fish species. The indirect effects of the No Research Alternative are uncertain and the magnitude of such effects would depend on the availability of alternative sources of data on fish stocks and the marine environment from state agencies, academic institutions, tribal research cooperatives, and other research entities. However, none of these alternative sources of data are likely to be able to replace the scope of work conducted by PIFSC and this could result in adverse effects on fish stocks through a lack of information essential for informed decision making and conservation of fish, their prey, and habitats. The indirect contribution of the No Research Alternative to cumulative effects on any one species is difficult to ascertain, but would likely impact long-term monitoring and management capabilities for ESA-listed species, so would be considered minor to moderate adverse.

5.5 CUMULATIVE EFFECTS ON MARINE MAMMALS

Activities external to PIFSC fisheries research that may potentially affect marine mammals in the HARA, MARA, ASARA, and PRIRA include commercial and recreational fisheries, vessel traffic, ocean discharges, dredging, geophysical activities and oil extraction, other scientific research, military operations, conservation measures, and climate change. These activities and potential effects are summarized in Table 5.5-1 and include:

- Disturbance/behavioral changes or physical effects from anthropogenic noise (e.g., marine vessels of all types, military readiness operations, navigational equipment, construction)
- Injury or mortality due to vessel collisions, entanglement in fishing gear, and contamination of the marine environment
- Changes in food availability due to prey removal, ecosystem change, or habitat degradation
- Contamination from discharges

5.5.1 ESA-listed Species

External Factors in the PIFSC Research Areas

The endangered marine mammal species in the PIFSC research areas include the false killer whale - MHI insular stock, sperm whale, blue whale, humpback whale, fin whale, sei whale, North Pacific right whale, and Hawaiian monk seal. With the exception of the false killer whale, commercial whaling was the greatest historical source of mortality for the endangered whale species found in the PIFSC research areas (Carretta et al. 2011 and citations therein, Perry et al. 1999). Commercial harvests of sperm whales ended worldwide in 1986 (NMFS 2006). Blue and humpback whales were protected in 1966 (NMFS 1998, Perry et al. 1999). The International Whaling Commission (IWC) banned hunting of fin whales throughout the North Pacific in 1976 (Perry et al. 1999) and hunting of sei whales in the eastern North Pacific ended after 1971 and after 1975 in the western North Pacific (Perry et al. 1999). Although right whales received legal protection from commercial whaling in 1935 (Perry et al. 1999), illegal whaling by the Soviet Union continued into the 1960s and nearly extirpated North Pacific right whales in the Gulf of Alaska (Wade et al. 2011).

Human-related mortality has caused two major declines of the Hawaiian monk seal (Ragen 1999). In the 1800s, this species was decimated by sealers, crews of wrecked vessels, and guano and feather hunters (Dill and Bryan 1912; Wetmore 1925; Bailey 1952; Clapp and Woodward 1972). Following a period of at least partial recovery in the first half of the 20th century (Rice 1960), most subpopulations again declined. This second decline has not been fully explained, but long-term trends at several sites appear to have been driven both by variable oceanic productivity (represented by the Pacific Decadal Oscillation) and by human disturbance (Baker et al. 2012, Ragen 1999, Kenyon 1972, Gerrodette and Gilmartin 1990). Currently, human activities in the NWHIs are limited and human disturbance is relatively rare, but the intentional killing of seals in the MHIs is a relatively new and alarming trend and human/seal interactions have become an important issue in the MHIs (Carretta et al. 2014).

In 2009, three Hawaiian monk seals (including a pregnant female) were shot and killed in the MHIs (Baker et al. 2010). In 2010, a juvenile female seal was found dead on Kaua‘i due to multiple skull fractures caused by blunt force trauma. Whether this was an intentional killing or an accidental occurrence (e.g., boat strike) is not known. In 2011, two seals were found dead in the same general area of Moloka‘i, with skull fractures from blunt force trauma. It is extremely unlikely that all carcasses of intentionally killed monk seals are discovered and reported. Studies of the recovery rates of carcasses for other marine mammal species have shown that the probability of detecting and documenting most deaths

(whether from human or natural causes) is quite low (Peltier et al. 2012; Williams et al. 2011; Perrin et al. 2011; Punt and Wade 2010).

Other past, present, and reasonably foreseeable future conservation concerns and threats to recovery are outlined in the respective recovery, take reduction and/or management plans for the ESA-listed species and are cited as follows: false killer whale (NMFS 2010, 50 CFR Parts 229 and 665 2012), sperm whales (NMFS 2006), blue whales (NMFS 1998), humpback whales (NMFS 1991), fin whales (NMFS 2010a), sei whales (NMFS 2011a), North Pacific right whales (NMFS 2013) and Hawaiian monk seals (NMFS 2007 and 2015). Noted conservation concerns and threats include vessel collisions, entanglement in fishing gear, anthropogenic noise, vessel/human disturbance, disease, habitat degradation, competition with fisheries for prey, climate change, and pollutants (including contaminants and oil spills) and pathogens.

Vessel collisions are a threat to endangered large whales, particularly blue, humpback, and fin whales. The contribution of ship strikes to the annual average anthropogenic sources of mortality is noted in Section 3.2.2 under the respective species descriptions. The PIFSC research areas include numerous shipping lanes, vessel traffic and shipping ports, including six major ports, five in the Hawaiian Islands and one in Guam. In addition to the high densities of commercial maritime traffic, there are large naval bases (e.g., Pearl Harbor, and Naval Base Guam), military installations (e.g., Johnston Atoll), and U.S. Coast Guard (USCG) Stations on O‘ahu and Hawaiʻi Island. There have been more than 80 confirmed contacts between vessels and whales in Hawaiian waters over the past 40 years and three quarters of those cases have occurred in the last decade.

Entanglement in fishing gear is a common conservation concern for ESA-listed marine mammals worldwide. A photographic-based scar study of the humpback whales of American Samoa has been initiated and there is some indication of healed entanglement and ship strike wounds, although perhaps not at the levels found in some Northern Hemisphere populations (D. Mattila and J. Robbins, unpublished data). Between 2008 and 2012, two humpback whales (Central North Pacific stock) were reported hooked or entangled in the Hawaiʻi-based shallow-set longline fishery (Allen and Angliss 2015). One sperm whale was observed either hooked or entangled in the Hawaiʻi-based deep-set longline fishery; the lines were cut and the whale swam away with a hook and some line still attached (Bradford & Forney 2013). Both of these species are listed as “endangered” under the ESA and thus by definition, depleted under the MMPA.

The potential effects of commercial fisheries on prey availability are not clear. Direct competition with fisheries for prey is unlikely for blue, fin, and sei whales whose diet consists of 80-100% large zooplankton, primarily krill (Barlow et al. 2008). Humpbacks consume roughly 50% large zooplankton, along with small pelagic and miscellaneous fish. Sperm whales consume about 60% large squid, and a mix of various fish, small squid, and benthic invertebrates. Krill is not commercially harvested, nor are most of the other prey items (Barlow et al. 2008). However, prey consumed by false killer whales include commercially valuable species, such as yellowfin tuna (*Thunnus albacares*), albacore tuna (*T. alalunga*), skipjack tuna (*Katsuwonus pelamis*), broadbill swordfish (*Xiphias gladius*), dolphin fish (or mahimahi, *Coryphaena hippurus*), wahoo (or ono, *Acanthocybium solandri*), and lustrous pomfret (or monchong, *Eumegistus illustrus*) (Baird 2009b).

Military operations within the PIFSC research areas are potential sources of behavioral and habitat disturbance, injury, and mortality. Sonar, active acoustic sources, airguns, weapons firing, explosives, and vessel and aircraft noise could result in Level A or Level B harassment of marine mammals, and vessel collisions and explosives could result in injury or mortality of marine mammals. The Navy coordinated with NMFS, through the consultation and permitting processes, on mitigation measures for all of these activities (DON 2013, NMFS 2013a, NMFS 2013b, NMFS 2014f).

Climate change impacts on ESA-listed species are possible through changes in habitat and food availability. Migration, feeding, and breeding locations influenced by ocean currents and water

temperature could be impacted, which could, ultimately, affect ESA-listed species (NMFS 2010b, NMFS 2011a).

With the exception of the historical sources of population decline, all of the aforementioned effects are likely to continue into the foreseeable future (see Table 5.5-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on ESA-listed marine mammals are discussed in Sections 4.2.4, 4.3.4, 4.4.4, and 4.5.4. The three research alternatives considered in this DPEA include similar scopes of research; the primary differences lie in the number and types of associated mitigation measures for protected species. Although ESA-listed marine mammals continue to be affected by numerous factors external to PIFSC fisheries research and the resulting cumulative effects, contribution to these effects from PIFSC fisheries research activities is comparatively small.

The direct and indirect effects of vessel collisions with marine mammals are discussed in Section 4.2.4. Although there is always risk of vessel strikes during research cruises, the volume of ship traffic generated by PIFSC fisheries and ecosystem research is miniscule compared to the number of other vessels transiting the Pacific Islands Region. Given the relatively slow speeds of research vessels, mitigation measures, and the small number of research cruises, the likelihood of fisheries research vessels causing serious injury or mortality to ESA-listed species (or any other species of marine mammals) due to ship strikes is considered a remote possibility.

There is no documented history of marine mammals being injured or killed due to entanglement or other interactions with research gears during PIFSC research activities. However, based on documented interactions of some ESA-listed species with analogous commercial and non-commercial fisheries, PIFSC is requesting Level A harassment/Mortality and Serious Injury (M&SI) takes of humpback whales and sperm whales in longline gear and humpback whales during instrument deployments (see Appendix C and Table 4.2-7). These takes, if they occurred, would make very small contributions to the total estimated M&SI from all anthropogenic sources relative to each stock's PBR (Table 5.5-1). For the Central North Pacific stock of humpback whales, average annual M&SI from all sources is currently 19.2% of PBR and the PIFSC requested takes, if they occurred, would add an additional 0.5% of PBR. For the Hawaiʻi stock of sperm whales, average annual M&SI from all sources is currently 6.9% of PBR and the PIFSC requested takes, if they occurred, would add an additional 2% of PBR.

The potential effects from the use of active acoustic devices for PIFSC research activities would likely have rare or infrequent and temporary behavioral avoidance effects on ESA-listed marine mammals. Relative to the volume of other ship traffic and other anthropogenic sources of acoustic disturbance, the contribution of noise from PIFSC research would be minor adverse.

Prey removal during fisheries research is very small and likely inconsequential to prey availability for any marine mammal species, particularly the planktivorous or largely planktivorous species.

When considered in conjunction with commercial and recreational fisheries, and aggregated with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the PIFSC research areas, the contribution of PIFSC fisheries research activities to cumulative effects on ESA-listed marine mammals would be minor adverse under all three research alternatives. Additionally, ecosystem research conducted by PIFSC has beneficial effects on marine mammal populations by providing scientific information important to the conservation and management of marine mammals and their prey species.

Contribution of the No Research Alternative

Under the No Research Alternative, PIFSC would no longer conduct or fund the fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on ESA-listed marine mammals in the PIFSC research areas. Indirectly, however, the loss of information obtained through this research, either directly or indirectly, on marine mammal feeding ecology, oceanographic components of their habitat, and status of prey stocks could have minor adverse impacts on management decisions and analysis of ecological trends affecting marine mammal habitat. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species given the availability of other sources of marine mammal and ecosystem information, but could impact monitoring and management capabilities for ESA-listed marine mammals in the region. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the PIFSC research areas, the contribution of the No Research Alternative to cumulative effects on ESA-listed marine mammals would be minor adverse.

Table 5.4-1 Cumulative M&SI Compared to PBR with Requested Take from PIFSC and Other NMFS FSCs for All Stocks of Marine Mammals Shared with PIFSC Request

This table summarizes the known Mortality and Serious Injury (M&SI) from all sources (primarily commercial fishing) compared to PBR for each stock of marine mammal requested for incidental take by PIFSC during fisheries and ecosystem research. The requested take from other NMFS Fisheries Science Centers (FSC) for stocks shared with the PIFSC request are also shown. The Alaska FSC did not request takes for any shared stocks with PIFSC. All population estimates, Potential Biological Removal (PBR) values, and total annual M&SI data are from the most recent stock assessment reports (Carreta et al. 2015 and Allen and Angliss 2015). U=unknown.

Common Name - Stock	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources [A]	Average Annual M&SI as % of PBR	PIFSC Average Annual Take Request	Southwest FSC Average Annual Take Request	Northwest FSC Average Annual Take Request	Total FSC Average Annual Take Request	Total FSC Average Annual Take Request as % of PBR
Beaked whale, Blainville's - Hawaiʿi stock	1,088	11	0	**0**	0.2			0.2	**1.8%**
Beaked whale, Cuvier's - Hawaiʿi pelagic stock	1,142	11.4	0	**0**	0.2			0.2	**1.8%**
Bottlenose dolphin - Hawaiʿi pelagic stock	3,755	38	3.3	**8.7%**	0.6			0.6	**1.6%**
False killer whale - Hawaiʿi pelagic stock or unspecified [B]	935	9.4	22.9	**243.6%**	0.2			0.2	**2.1%**
Humpback whale - Central North Pacific stock [C]	7,890	82.8	15.9	**19.2%**	0.4			0.4	**0.5%**
Kogia spp. (Pygmy and dwarf sperm whale - Hawaiʿi stocks)	U	Undetermined	0	**0**	0.2	0.2	0.2	0.6	**U**
Pantropical spotted dolphin – all stocks [D]	11, 508	115	0.6	**0.5%**	0.6			0.6	**0.5%**
Pygmy killer whale – Hawaiʿi stock	2,274	23	0	**0**	0.2			0.2	**0.9%**

Common Name - Stock	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources [A]	Average Annual M&SI as % of PBR	PIFSC Average Annual Take Request	Southwest FSC Average Annual Take Request	Northwest FSC Average Annual Take Request	Total FSC Average Annual Take Request	Total FSC Average Annual Take Request as % of PBR
Risso's dolphin – Hawaiʿi stock	5,207	42	5.1	**12.1%**	0.2	2.6	1.6	4.4	**10.5%**
Rough-toothed dolphin – Hawaiʿi stock	4,581	46	U	**U**	0.6			0.6	**1.3%**
Short-finned pilot whale – Hawaiʿi stock	8,782	70	0.8	**1.1%**	0.2		0.2	0.4	**0.6%**
Sperm whale – Hawaiʿi stock [C]	2,539	10.2	0.7	**6.9%**	0.2			0.2	**2.0%**
Spinner dolphin, all stocks [E]	329	3.3	U	**U**	0.4			0.4	**12.1%**
Striped dolphin - Hawaiʿi stock	15,391	154	U	**U**	0.6			0.6	**0.3%**

A – Total M&SI includes combined estimates of commercial and non-commercial fisheries interactions, ship strikes, and entanglements in unidentified gear from within and outside U.S. EEZs. All estimates are considered smaller than actual M&SI due to unobserved fisheries and other uncertainties in detecting injured or killed animals.

B - Strategic stock based on total M&SI exceeding PBR. PIFSC fisheries and ecosystem research would not occur within the ranges of other false killer whale stocks.

C - Listed as endangered under the ESA.

D – Information presented only for Hawaiʿi pelagic stock, which is the only stock with estimates of population and PBR.

E - Information presented only for the Oʻahu/4-Islands stock, which is the smallest stock for which population and PBR estimates are available. This is used to provide the most conservative impact

5.5.2 Other Cetaceans

External Factors in the PIFSC Research Areas

The cetacean species included in this section are not listed as threatened or endangered. They are all subject to similar types of effects from external activities as described above for ESA-listed species. With the exception of minke and Bryde's whales, the non-ESA listed cetaceans in the PIFSC research areas are odontocetes. Habitats are wide ranging, as are preferred prey items. Interactions with commercial fisheries are likely to have the greatest effect on these species and are generally well-documented (Section 3.2.2).

Military operations in the PIFSC research areas are potential sources of behavioral and habitat disturbance, injury, and mortality. Sonar, active acoustic sources, airguns, weapons firing, explosives, and vessel and aircraft noise could result in Level A or Level B harassment of marine mammals, and vessel collisions and explosives could result in injury or mortality. The Navy coordinated with NMFS, through consultation and permitting processes, on mitigation measures (NMFS 2014f).

Climate change impacts are difficult to predict, but will likely affect non ESA-listed cetaceans through changes in habitat, food availability, and general health factors such as the incidence of disease.

The activities external to PIFSC fisheries research affecting cetaceans are likely to continue into the foreseeable future (Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

In addition, research conducted by the Northwest Fisheries Science Center (NWFSC), Southwest Fisheries Science Center (SWFSC), and Alaska Fisheries Science Center (AFSC) involves some overlap of marine mammal species that migrate across the different research areas and is therefore considered in the set of external factors that contribute to cumulative effects in the PIFSC research areas (see Table 5.5-1). The NWFSC, SWFSC, and AFSC have conducted their own NEPA and MMPA compliance process and requested authorization for incidental take related to their respective Center's research (see Proposed Rule for the SWFSC, 80 FR 8166, 13 February 2015). In most cases, the overlap of species would not include the same stocks, but for the Risso's dolphin, pygmy sperm whale, and dwarf sperm whale, little is known about their distribution and migration patterns, so it is possible overlap could occur between stocks. Table 5.5-1 indicates the requested takes in the PIFSC research areas for species whose stocks could overlap with NWFSC and SWFSC research and are included in this cumulative effects analysis. Note that these are conservative estimates of takes and the actual level of take by both Centers is likely to be much less than these requested takes. In all cases, the contribution of the combined NMFS Fisheries Science Center requests for incidental take, if they occurred, would make small contributions to the total M&SI for these cetacean species.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on non-ESA-listed cetaceans are discussed in Sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research; the primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of PIFSC fisheries research activities to cumulative effects on non-ESA-listed species is likely to be small.

For species with an estimated PBR, the requested average annual Level A/M&SI take by PIFSC is well below 10 percent of PBR for almost all marine mammal species for which takes are requested except for spinner dolphins. The take request for spinner dolphins is two over the five-year authorization period, which is 12.1 percent of PBR for the O'ahu/4-Islands stock, which is the smallest stock for which population and PBR estimates are available, and would be considered moderate in magnitude. This small

stock is used to provide the most conservative estimate of impact but it is unlikely that all future takes of this species, if they occurred, would be from this one stock. Given the lack of historical takes of this species and stock, and the mitigation measures in place, PIFSC does not believe this requested level of take would actually occur.

Although two species for which takes are requested have no PBR calculated, the Centers have included them in their take requests to ensure accounting for a precautionary level of potential take. However, due to their small numbers, the limited research efforts in the restricted geographic ranges, it is very unlikely that future incidental takes would occur at the requested levels. According to the impact criteria described in Table 4.1-1, the level of mortality of the species considered here, if they occurred, would be considered minor in magnitude.

The potential effects from use of active acoustic devices for research activities would likely involve infrequent and temporary behavioral disturbance and avoidance effects, particularly for the mid- and high-frequency hearing odontocetes. Relative to the volume of other ship traffic and anthropogenic sources of acoustic disturbance, the contribution of noise from PIFSC research would be minor.

Although there is some overlap in prey of non-ESA-listed cetaceans and the species collected during PIFSC research surveys, the total amount sampled is minimal compared to overall biomass and commercial fisheries removals. Prey removal during fisheries research is very small and likely inconsequential to prey availability for any marine mammal species. The contribution of research catches to the effects on cetaceans through competition for prey is therefore considered minor adverse.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the PIFSC research areas, the contribution of PIFSC-affiliated fisheries research to cumulative effects on cetaceans would be minor adverse under all three research alternatives.

<u>Contribution of the No Research Alternative</u>

Under the No Research Alternative, PIFSC would no longer conduct or fund the fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on non ESA-listed cetaceans in the PIFSC research areas. Indirectly, however, the loss of information obtained through this research, either directly or indirectly, on marine mammal feeding ecology, oceanographic components of their habitat, and status of prey stocks could have minor adverse impacts on management decisions and monitoring of ecological trends. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but could impact monitoring and management capabilities for cetaceans in the region. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non ESA-listed cetaceans in the PIFSC research areas, the contribution of the No Research Alternative to cumulative effects would be minor adverse.

5.6 CUMULATIVE EFFECTS ON BIRDS

Activities external to PIFSC fisheries research that could potentially affect birds in the HARA, MARA, ASARA, and WCPRA may include commercial and recreational fisheries, ocean disposal and discharges, dredging, coastal development, oil extraction, other scientific research, military operations, climate change, and ocean acidification. The potential effects of these activities are summarized in Table 5.1-1 and may include:

- Mortality from avian by-catch
- Potential for ship collisions
- Alteration or reduction of prey resources
- Loss or injury due to ingestion of or entanglement in marine debris
- Behavioral disturbance

5.6.1 External Factors in the PIFSC Research Areas

Seabirds in the HARA, MARA, ASARA, and WCPRA are affected by numerous past and present human-caused and natural factors.

Anthropogenic factors include: mortality in longline fisheries, ingestion of plastic debris, human use and development of nesting habitat, attraction to and disorientation by artificial lights leading to exhausted birds landing in dangerous situations and colliding with power lines and other structures, habitat destruction, predation by non-native terrestrial mammals, nesting habitat loss and degradation from invasive species, pollution, competition with fisheries for prey species, underwater explosions from industrial and military operations, entanglement in debris, ingestion of marine debris, vessel collisions, and hunting. Some seabird species travel long distances over the ocean and have many potentially adverse interactions with humans and their activities, such as commercial and recreational fisheries, and oil spills from transport vessels and offshore oil wells at locations outside the PIFSC research areas. Human activities on land can also affect them at sea or at inland nest sites, such as coastal development and transportation, dock construction, marine pollution, and dredging, as well as agricultural and urban runoff contamination and land clearing for resource development. Climate change is also likely having effects on seabirds through changes in their prey abundance and distribution, although climate change may have adverse effects on some species while others may actually benefit.

Natural factors include: threats to their nesting habitat, predation on adults, eggs, and young by birds and mammals, and habitat loss due to encroachment of vegetation. Natural factors such as changes in ocean currents, prey availability, and severe weather can drive population fluctuations for many species (Ainley and Hyrenbach 2007).

The factors that have affected seabirds in the CCRA in the past are likely to do so in the future. Reasonably foreseeable future actions include continuation and possible expansion of fisheries activities, military operations, marine vessel traffic, ocean disposal and discharge, climate change, and ocean acidification.

For some species (e.g., ESA-listed species), cumulative effects resulting from external anthropogenic factors (past actions, present actions, and RFFAs) have caused declines in populations that are considered major conservation concerns. For many other species, population trends are not well known and most populations tend to fluctuate normally due to natural factors. Cumulative effects on these species from anthropogenic sources could be minor.

5.6.2 Contribution of the Research Alternatives

None of the three research alternatives are likely to contribute more than minor adverse effects to the cumulative effects on seabirds. Currently, there are no recorded instances of any bird mortalities resulting from fisheries and ecosystem research activities conducted and funded by PIFSC, and likewise, no mortalities would be expected to occur as a result of activities proposed under any of the three research alternatives. It is possible that seabird mortality could occur as a result of ship strikes or interaction with fishing gear, but it is likely that such adverse interactions with seabirds would be rare, and would affect small numbers of birds.

PIFSC fisheries and ecosystem research activities proposed under the three research alternatives would remove very small quantites of potential food for seabirds. The dispersal of research effort over wide areas of sea and the relatively small number of research surveys over time makes it very unlikely that any measureable impacts to the abundance or distribution of seabird prey would occur as a result of research activities proposed under the three research alternatives. This is especially true for the small size classes of fish and pelagic invertebrates favored by most seabirds because of their large biomasses and the minimal amounts taken in research samples (Sections 4.2.3 and 4.2.7). For the same reasons, the amount of food made available through research activities is unlikely to have more than temporary and highly localized beneficial effects on seabirds.

In contrast, ecosystem research conducted by PIFSC has beneficial contributions to seabirds by providing scientific information important to seabird conservation and management. When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting seabirds in the PIFSC research areas, the contribution of PIFSC fisheries research to the cumulative effects on seabirds in the PIFSC research areas is considered minor adverse for all species.

5.6.3 Contribution of the No Research Alternative

The lack of research under this alternative would eliminate any direct effects on seabirds in the PIFSC research areas. However, some of the PIFSC projects that would be eliminated under this alternative would include bird observers as part of the cruise operations, or opportunistically when space is available, and generate a great deal of information on the abundance, distribution, and feeding behaviors of seabirds in the PIFSC research areas. The loss of this information could indirectly affect resource management decisions concerning the conservation of seabirds. There are too many unknown variables to estimate the level of impact this lack of information would have on any particular species of seabirds but the contribution of this alternative to cumulative impacts on seabirds in the CCRA would likely be minor adverse.

5.7 CUMULATIVE EFFECTS ON SEA TURTLES

Activities external to PIFSC fisheries research that could potentially affect sea turtles in the HARA, MARA, ASARA, and WCPRA may include commercial and recreational fisheries, ocean disposal and discharges, dredging, coastal development, other scientific research, military operations, climate change, and ocean acidification. The potential effects of these activities are summarized in Table 5.1-1 and may include:

- Mortality and injury from by-catch in fisheries
- Collisions with ships or small boats
- Alteration or reduction of prey resources through fisheries and climate change
- Loss or injury due to ingestion of or entanglement in marine debris
- Behavioral disturbance from marine vessels and coastal development
- Habitat loss or degradation

5.7.1 External Factors in the PIFSC Research Areas

Sea turtles are susceptible to impacts resulting from natural and anthropogenic factors, both on land and in the water (Table 5.1-1). Effects on breeding beaches involve habitat degradation, habitat loss, injury, and mortality through numerous mechanisms: beach erosion, beach armoring and nourishment, rising sea levels in association with climate change, artificial lighting, increases in human presence, beach cleaning, recreational beach equipment, beach driving, coastal construction, disturbance of beach vegetation, and poaching. Increases in human presence near nesting beaches have led to the introduction of non-native predators including dogs and rats, which may feed on turtle eggs and hatchlings. Adverse impacts to sea turtles also involve habitat degradation, injury, and mortality through numerous mechanisms: coastal development and transportation, dock construction, marine pollution, dredging, underwater explosions, offshore artificial lighting, entanglement in debris (e.g., monofilament, derelict nets), ingestion of marine debris, fishery interactions, boat collisions, and poaching. Increases in diseases such as fibropapilloma tumors have also been observed on sea turtles around Hawai‘i.

Threats to sea turtles in the PIFSC research areas include incidental capture, injury, and mortality during commercial fishing operations. This conservation issue has been the subject of numerous conservation engineering studies. Use of circle hooks instead of ‘J’ hooks in commercial pelagic longline fisheries has reduced sea turtle mortalities. The implementation of time/area restrictions in commercial trawl fisheries has also reduced the level of sea turtle captures and mortality in trawl fisheries. However, capture and entanglement in several types of fishing gear continues to be a major conservation concern (NMFS 2014d).

Multiple past and present actions have affected sea turtles in the PIFSC research areas and many of these impact producing factors are likely to continue for the foreseeable future. All species of sea turtles that occur in the PIFSC research areas are threatened or endangered, and have therefore been subject to major population-level cumulative effects.

5.7.2 Contribution of the Research Alternatives

Fisheries research activities conducted and funded by PIFSC have had no recorded interactions with any sea turtles and removal of potential sea turtle prey is very small and localized. None of the research alternatives are likely to contribute more than minor adverse effects to the cumulative effects on these species. In contrast, ecosystem research conducted by PIFSC has beneficial effects on sea turtle populations by providing scientific information important to sea turtle conservation and management.

Similarly, removal of marine debris has a minor beneficial effect on sea turtles populations by reducing potential capture or entanglement. When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting sea turtles in the PIFSC research areas, the contribution of PIFSC fisheries research to the cumulative effects on sea turtles in the PIFSC research areas is considered minor adverse for all species.

5.7.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to sea turtles that could potentially occur under the research alternatives. However, the elimination of PIFSC fisheries and ecosystem research would also substantially reduce the collection of data important for monitoring the ecological status of the environment important to sea turtles. PIFSC research has also supported management and conservation of designated sea turtle critical habitat. Under the No Research Alternative, the loss of information currently provided by PIFSC research activities would have a minor to moderate contribution to adverse cumulative impacts to sea turtles in the PIFSC research areas through indirect effects on management decisions important to the conservation and recovery of these species.

5.8 CUMULATIVE EFFECTS ON INVERTEBRATES

Activities external to PIFSC fisheries research that could potentially affect invertebrates in the HARA, MARA, ASARA, and WCPRA may include other scientific research, commercial and recreational fisheries, recreation and tourism, military operations, vessel traffic, disposal and discharges, dredging, coastline development, geophysical activities, climate change and ocean acidification, and natural events. The potential effects of these activities are summarized in Table 5.1-1 and may include:

- Loss or displacement due to habitat disturbance, turbidity, or contamination
- Coral reef damage and bleaching
- Localized benthos disturbance
- Competition or predation from invasive species
- Removal and mortality of individuals and biomass
- Creation of new hard substrate habitats on structures
- Bioaccumulation of contaminants
- Disruption due to changes in water temperature resulting from climate change
- Decreased calcification due to ocean acidification

5.8.1 External Factors in the PIFSC Research Areas

Marine invertebrates continue to be susceptible to natural and anthropogenic effects including exploitation through commercial and recreational fishing, habitat degradation, pollution, and climate change. Because marine invertebrates do not regulate their body temperature, changes in water temperature may affect the distribution of certain species as well as affect growth rates, reproductive ability and survival (Harley et al. 2006, Fogarty et al. 2007). In addition, warmer water temperatures affect pH, dissolved oxygen and conductivity of sea water, all of which may have adverse effects on invertebrate species.

Degradation of invertebrate habitat can occur as a result of commercial and recreational fisheries that involve gear coming into contact with the sea floor (See Section 4.2.7). Other sources of habitat disruption identified in the RFFAs (Table 5.1-1) include recreation and tourism, military operations, ocean disposal, dredging, and coastline development. In addition, pollution can negatively affect water quality and chemistry. While intentional discharges of pollutants (including fuel and oil) are relatively rare, accidental discharges may be rather common in some areas and have the potential to cause habitat degradation or direct mortality of invertebrates. Effects include decreased foraging ability and reproductive success and increased mortality (Milligan et al. 2009). Most accidental discharges are likely to be small and localized but some accidental discharges with large vessels or industrial activities may affect large geographic areas and impact benthic habitats for years.

Overexploitation of undersized or immature individuals can have serious implications for the sustainability of stocks, and the overall body size of individuals in a fished population may also change with intense fishing pressure on a single size class (Donaldson et al. 2010). Some commercially and recreationally valuable species of invertebrates (e.g., spiny and slipper lobster) have had population declines in the past due to overharvest. The NWHI lobster fishery was closed in 2000 and remains closed due to historical overfishing (50 CFR Part 665). Commercial and recreational fishing is likely to be the dominant factor in cumulative effects on these species in the future, although climate change may also have substantial effects on some species.

Extreme weather events (e.g. cyclones and hurricanes), vessel groundings, and coastal construction activities represent a chronic threat to live coral habitat. Effects of weather events include coral fragmentation, sediment deposition onto coral colonies, introduction of marine debris, and coral bleaching through hyposaline conditions caused by intense rain events. Vessel groundings physically destroy or injure corals in ways similar to cyclones. Vessel anchors can also cause similar types of damage to corals, but the effects are often smaller in scale and more frequently inflicted. Coastal construction and development can increase local turbidity levels and harm corals or slow growth (Brainard et al. 2011).

5.8.2 Contribution of the Research Alternatives

PIFSC research surveys remove small numbers of invertebrates from all four research areas, primarily lobsters, coral fragments, and miscellaneous sessile invertebrates. Mortality resulting from PIFSC fisheries research under each of the research alternatives would make minor contributions to adverse cumulative effects on invertebrates. The contributions of PIFSC research activities to habitat contamination, climate change, and ocean acidification are expected to be insubstantial. PIFSC fisheries research would contribute to future management decisions related to invertebrate populations in all four research areas where commercial and recreational fisheries target coral and lobsters. When combined with the impacts of past, present, and reasonably foreseeable future actions, the direct contribution of PIFSC research activities to cumulative effects on invertebrates would be minor and potentially adverse under each of the research alternatives. However, research conducted by PIFSC on invertebrates in all four research areas contributes to sustainable management of certain species and this contribution to cumulative effects would be beneficial.

5.8.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to invertebrates that could potentially occur under the research alternatives. However, increased adverse effects could result indirectly from a loss of scientific information necessary for sustainable fisheries management and conservation of invertebrates and their habitats. Data from PIFSC research activities are used to inform science-based decisions related to the management of commercially and recreationally fished invertebrates in all four research areas. Without the input of PIFSC data, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect physical properties of the environment would soon become obsolete. Resource management agencies would have to adequately compensate for this loss of information through changes in management scenarios based on greater uncertainty. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but would likely impact long-term monitoring and management capabilities for commercially important invertebrates in the research areas. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting invertebrates in the HARA, MARA, ASARA, and WCPRA, the contribution of the No Research Alternative to cumulative effects on invertebrates would be minor to moderate.

5.9 CUMULATIVE EFFECTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT

Activities external to PIFSC fisheries research that could potentially affect the social and economic environment in the HARA, MARA, ASARA, and WCPRA may include commercial and non-commercial fisheries, shipping, coastal development, oil extraction, other scientific research, military operations, climate change, and ocean acidification. The potential effects of these activities are summarized in Table 5.1-1 and may include:

- Provision of jobs and economic opportunity
- Changes in commercial fishing opportunities
- Economic costs of changes in resource availability due to climate change and ocean acidification

5.9.1 External Factors in the PIFSC Research Areas

This section describes the contribution of PIFSC research activities to cumulative effects on the social and economic environment from past, present, and reasonably foreseeable future actions (RFFA). The intent of this section is to describe the contribution of PIFSC fisheries research activities to the social and economic environment of fishing communities throughout the Pacific Ocean both internationally and domestically. The cumulative effects of fisheries research and management associated with the PIFSC research area are closely related to socioeconomic conditions of Hawaiʻi and other Pacific island territories, and nations. Overall, as stated in Section 3.3.3, in 2012 Hawaiʻi's seafood industry generated $855 million in sales impacts, $262 million in income impacts, and approximately 11,000 full- and part-time jobs (NMFS 2014b). Potential future socioeconomic cumulative effects from developments in non-fishing industries, such as tourism, oil extraction, shipping commerce, or climate change cannot be feasibly estimated with available data, but would be expected to dominate the economy in the future.

In regard to fishing opportunity, cumulative fishing and non-fishing industry actions would be more noticeable in coastal communities. Specific fisheries management decisions, to which the PIFSC research program contributes, could also have an effect over time. Reductions in certain stocks as a result of ocean ecosystem changes, or overfishing, which results in commercial or recreational area closures, would result in noticeable changes in the socioeconomic status of communities.

RFFAs that could contribute to cumulative effects to the social and economic environment include updates to species take reduction plans, and fishery management measures. Species take reduction plans could include measures that would lead to increased costs for fishermen through required gear modifications. These plans could also call for time and/or area closures that could affect fishing fleet locations.

5.9.2 External Factors on Cultural Resources

The cumulative effects on social and cultural issues for fishing communities and related industries closely parallel the effects on the socio-economics of commercially or non-commercially exploited fish and invertebrates. These include both natural factors such as climate change (including changes in ocean characteristics), and activities associated with offshore development, contamination, and commercial and non-commercial fishing. Since much of these communities' cultural ties are centered around a seafaring lifestyle and can be dependent on the abundance and location of commercially or non-commercial exploitable fish and invertebrates, factors that influence fish and invertebrate stocks also influence the cultural well-being of the fishing communities. Therefore, the effects of overfishing and the resultant declines in fish stocks, followed by the imposition of sometimes severe limits on fishing opportunities under FMPs, could potentially have major adverse social and cultural effects on fishing communities in the Pacific Island Region.

Likewise, historic cultural resources such as sites listed on the NRHP, shipwrecks, burial sites, and fishponds, could be influenced by external factors such as increased vessel traffic, recreation and tourism, military operations, or other scientific research activities. The resulting effects would potentially interact with the effects of PIFSC research activities proposed under each of the action alternatives, resulting in additive or possible synergistic impacts to historic cultural resources.

In a similar fashion, culturally important marine resources within the PIFSC research areas, such as sea turtles and sharks, would be influenced by factors described in Section 5.4 (Cumulative Effects to Fish) and Section 5.7 (Cumulative Effects to Sea Turtles). The effects to sharks, sea turtles, and other culturally important contemporary marine resources would potentially interact with the effects of PIFSC research activities proposed under each of the action alternatives, resulting in additive or possible synergistic impacts to contemporary cultural resources.

The importance of federally managed fisheries in the social and cultural environment of Pacific Island communities varies substantially from place to place. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting the socioeconomic environment in the Pacific Island region, the contribution of the research alternatives to cumulative effects on the sociocultural environment would be similar, moderate and beneficial, in that continued research would support science-based sustainable fisheries management, and provide information important to the assessment of potential effects on fishing communities from climate change, recreation and tourism endeavors, as well as military operations.

5.9.3 Contribution of the Research Alternatives

The fundamental purpose of fisheries management is to monitor and counteract the contribution of commercial and non-commercial fishing to the adverse cumulative effects on fish stocks from past, present, and reasonably foreseeable actions. PIFSC research is one of the most effective mechanisms to monitor the status of fish stocks and changes in the marine environment, providing substantial beneficial contributions to cumulative effects through scientific input to fishery management and other environmental decision-making processes. Continuation of this research would provide consistent data to allow evaluation of fish stock trends and the effects of actions not related to fishing.

In all research alternatives, at-sea and laboratory research, and cooperative fisheries research activities that are currently funded by PIFSC would continue. This would help promote sustainable fish populations and have substantial benefits for local economies dependent on stable fishing opportunities. Long-term sustainable catches would be promoted, increasing stability in the fishing communities and reducing boom and bust cycles related to over-exploitation of target species.

In addition, research results that identify effects not related to commercial or non-commercial fishing that could threaten species recoveries and sustainable yield levels would be identified in sufficient time to take corrective action before population level effects would be noticed by fishers in the form of reduced abundance and lower catches. The cumulative effect to the social and economic environment of Pacific Island Region fisheries as a result of Alternatives 1 and 2 would have the same relative contribution, which is minor to moderate beneficial considering all past, present, and RFFAs.. Mitigation measures in Alternative 3 that reduce the ability of PIFSC to sample fish and invertebrate stocks in certain places and times could represent a slightly reduced benefit, as at-sea sampling operations would be reduced from the current level of comprehensiveness.

The socioeconomic effects of non-fishing industry actions are likely to dominate any cumulative effects on the socioeconomic environment of the HARA, MARA, ASARA, and WCPRA. The research alternatives would contribute minor to moderate beneficial effects to the cumulative effects because PIFSC research provides a substantial portion of the information needed to determine if fisheries management actions are successful, and therefore balance the needs for stock recovery and sustainable catch quotas that minimize impacts to fishing communities. Likewise, PIFSC research activities provide

information essential to the sustainable management of ecosystems that support culturally important historic and contemporary marine resources. The at-sea surveys also provide measures to detect the result of cumulative changes contributed by non-fishing industries and climate change. The contribution of the research alternatives to cumulative effects on the socioeconomic environment and cultural resources would be minor to moderate and beneficial in that PIFSC research reduces the potential for negative cumulative effects on commercial and non-commercial fisheries, as well as potential impacts to historic and contemporary cultural resources.

5.9.4 Contribution of the No Research Alternative

Under the No Research Alternative, PIFSC would not contribute to the information base needed for sustainable management of fisheries and culturally important historic and contemporary marine resources. Fisheries research activities conducted by state and private organizations are not likely to be sufficient to identify trends in target fish stocks and set sustainable fishery harvest limits without the contribution from PIFSC. Some commercially and culturally important species would likely receive attention from state and private research efforts, so potential adverse effects would not likely be uniform across the fishing communities. Some fishers that target commercially-important species may continue to benefit from sustainable fisheries management without the contribution from PIFSC activities, but others may be affected by lack of information on their target species. Lack of consistent data input into the fisheries management process would have moderate adverse effects on the quality of the management analyses, and subsequently to the value of the management process. This lack of consistent data input would also result in potentially adverse effects to the management of contemporary cultural resources, as well as decreased levels of information potentially useful to sustain the preservation of historic cultural resources. Elimination of at-sea operations would reduce science-based input into fisheries management decisions, which would increase the potential for negative cumulative effects on socioeconomic and cultural resources.

The No Research Alternative would contribute a moderate adverse effect to the cumulative effects on socioeconomic and cultural environment. This is due to the discontinuance of at-sea research efforts of PIFSC, many of which are designed to detect and anticipate cumulative effects on fisheries resources. These activities are important for fisheries management decisions that strongly influence the socioeconomic conditions of fishing communities, as well as the preservation of historic and contemporary cultural resources.

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6.1 THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

In 1976, Congress passed the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq.*). This law authorizes the United States (U.S.) to manage its fishery resources in an area extending from the seaward boundary of a state's territorial sea (generally 3 nautical miles [5.6 kilometers] from shore) out to 200 nautical miles (370 kilometers) from shore. This area is termed the Exclusive Economic Zone (EEZ). The MSA was updated in 2006, and is now known as the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act.

Two of the main purposes of the MSA are to promote domestic commercial and recreational fishing under sound conservation and management principles, and to provide for fishery management plans (FMPs). The FMPs are intended to achieve and maintain, on a continuing basis, the optimum yield from each fishery. The MSA standards require that FMPs contain certain conservation and management measures. The standards include measures necessary to prevent overfishing; rebuilding overfished stocks; ensuring conservation; facilitating long-term protection of Essential Fish Habitat (EFH); and realizing the full potential of the nation's fishery resources. Furthermore, the MSA also declares that the National Fishery Conservation and Management Program must utilize the best scientific information available; involves, and is responsive to the needs of interested and affected states and citizens; considers efficiency; and draws upon federal, state, and academic capabilities in carrying out research, administration, management, and enforcement.

Certain stocks of fish have declined to the point where their survival is impacted, and other stocks of fish have been substantially reduced in number such that they could become similarly affected as a consequence of (a) increased fishing pressure, (b) the inadequacy of fishery resource conservation and management practices and controls, or (c) direct and indirect habitat losses which have resulted in a diminished capacity to support existing fishing levels.

The fisheries and ecosystem research activities conducted by PIFSC are designed to meet the requirements of the MSA by providing the best scientific information available to fishery conservation and management scientists and managers. This supports a management program that is able to respond to changing ecosystem conditions, and manages risk by developing science-based decision tools. NMFS emphasises that according to the MSA definition of fishing, scientific research activities are not fishing (74 FR 42787, August 25, 2009). There are several PIFSC research projects that may use contracted fishing vessels for research purposes in the future. In order to avoid confusion about the nature of the activity, commercial fishing versus scientific research, PIFSC may seek to obtain a Letter of Acknowledgement for research conducted on chartered fishing vessels. Per 50 CFR 600.745, persons planning to conduct scientific research activities in the EEZ are encouraged to request a Letter of Acknowledgement from the Regional Administrator or Science Director. If the Regional Administrator or Science Director determines that the activity does not constitute scientific research (50 CFR 600.512) but rather fishing, then an Exempted Fishing Permit (EFP) may be required.

The U.S. Commission on Ocean Policy has identified the need for more holistic assessments of the status of marine ecosystems. The President's Ocean Action Plan has endorsed the concept of marine Ecosystem-Based Management. Sustained ecosystem monitoring programs are essential for tracking the health of marine ecosystems as part of this overall approach. The individual PIFSC surveys comprise a broader ecosystem monitoring program that meets this emerging critical need.

The EFH provisions of the MSA require federal agencies to consult with National Marine Fisheries Service (NMFS) when their actions or activities may adversely affect habitat identified by regional fishery management councils or NMFS as EFH. In addition, NMFS must provide recommendations for conserving and enhancing EFH, which is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". There is no separate permit or authorization process;

EFH consultation is typically addressed during the NEPA process and incorporated into other permits. PIFSC has begun consultation with the Pacific Islands Region EFH Coordinator to assess the impacts of PIFSC fisheries and ecosystem research activities on EFH and this will be completed in the near future.

Section 404 of the MSA requires the Secretary of Commerce to initiate and maintain, in cooperation with the Fishery Management Councils, a comprehensive program of fishery research to carry out and further the purposes, policy, and provisions of the MSA. Substantial parts of the proposed action meet the MSA's definition of scientific research activity, and the proposed action is part of a comprehensive program to address this requirement.

1996 amendments to the MSA require assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

The Sustainable Fisheries Act of 1996 (Public Law 104-297) is also an amendment to the MSA. Sections 104 and 105 clarify issues surrounding highly migratory fish, and the international agreements that govern fisheries. Among the topics covered by these sections are fishing in international waters of the Atlantic and Pacific oceans; fishing in the Bering Sea, shared with Russia; and congressional rules setting time limits on approval of international fishing treaties. Sections 116 to 406 of the Sustainable Fisheries Act describe the management measures and research necessary to implement the act. These sections specify the agencies responsible for research and the nature of the research to be conducted in each of several specific fishing areas, including the Pacific Ocean.

6.2 MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 *et seq*.), as amended, prohibits the "take"[15] of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the Endangered Species Act (ESA). The secretary is required to give full consideration to all factors regarding regulations applicable to the take of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations.

Section 101(a)(5)(A-D) of the MMPA provides a mechanism for allowing, upon request, the "incidental," but not intentional, taking, of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing or directed research on marine mammals) within a specified geographic region. The NMFS Office of Protected Resources (OPR) processes applications for incidental takes of small numbers of marine mammals. Authorization for incidental takes may be granted if NMFS finds a negligible impact on the species or stock(s), and if the methods, mitigation, monitoring and reporting for takes are permissible.

[15] The MMPA defines take as: "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." Harassment means any act of pursuit, torment, or annoyance which, 1) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or 2) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment).

The purpose of issuing incidental take authorizations is to provide an exemption to the take prohibition in the MMPA, and to ensure that the action complies with the MMPA and NMFS's implementing regulations. ITAs may be issued as either: (1) regulations and associated Letters of Authorization (LOAs) under Section 101(a)(5)(A) of the MMPA; or (2) Incidental Harassment Authorizations (IHAs) under Section 101(a)(5)(D) of the MMPA. An IHA can only be issued when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. Pursuant to Section 101(a)(5)(A) of the MMPA, NMFS, upon application from PIFSC, may propose regulations to govern the unintentional taking of marine mammals, by harassment, incidental to the proposed fisheries research activities by PIFSC in the Pacific Ocean. The issuance of MMPA incidental take regulations and associated LOAs to PIFSC is a federal action, thereby requiring NMFS to analyze the effects of the action on the human environment pursuant to NEPA and NMFS's NEPA procedures.

After an application is submitted, the NMFS OPR may authorize incidental takes of marine mammals through either a one-year IHA, or through LOAs, which may cover activities for up to five years. PIFSC will be applying for an LOA for the small number of incidental takes of marine mammals that could occur during their fisheries research surveys. This DPEA will provide informational support for that LOA application and provide NEPA compliance for the authorization.

6.3 ENDANGERED SPECIES ACT

The Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531, *et seq.*), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The statute is administered jointly by NMFS and the USFWS, with some exceptions - NMFS oversees marine mammal species, marine and anadromous fish species, and marine plant species; and the USFWS oversees walrus, sea otter, seabird species, and terrestrial and freshwater wildlife and plant species.

The listing of a species as threatened or endangered is based on the biological health of that species. Threatened species are those likely to become endangered in the foreseeable future (16 U.S.C. 1532[20]). Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range (16 U.S.C. 1532[20]). Species can be listed as endangered without first being listed as threatened.

In addition to listing species under the ESA, the appropriate expert agency (NMFS or USFWS) must designate critical habitat of the newly listed species within a year of its listing to the "maximum extent prudent and determinable" (16 U.S.C. 1533[b] [1] [A]). The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily cetaceans (whales), which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species. An assurance of this is that federal actions, activities, or authorizations must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the federal action agency with the appropriate expert agency. Informal consultations are conducted for federal actions that have no adverse effects on the listed species and typically result in letters of concurrence from the expert agency. In cases where a proposed action may affect listed species or critical habitat, the action agency prepares a biological assessment to determine if a proposed action would adversely affect listed species or modify critical habitat. The biological assessment contains an analysis based on biological studies of the likely effects of the action on the species or habitat. The expert agency either concurs with the assessment or provides its own analysis to continue the consultation.

If the action agency or expert agency concludes that a proposed action may have adverse effects on a listed species, including take[16] of any listed species, they must enter formal consultations under section 7 of the ESA. The expert agency must then write a Biological Opinion (BiOp) that determines whether a proposed action places the listed species in jeopardy of extinction or adversely modifies its critical habitat. If the BiOp concludes the proposed (or ongoing) action will cause jeopardy to the species or adversely modify its critical habitat, it must also include reasonable and prudent alternatives that would modify the action so it no longer poses jeopardy to the listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it is to proceed. Regardless of whether the BiOp reaches a jeopardy or no jeopardy conclusion, it often contains a series of mandatory and/or recommended management measures the action agency must implement to further reduce the negative impacts to the listed species and critical habitat (50 CFR 402.24[j]). If a proposed action would likely involve the taking of any listed species, the expert agency may append an incidental take statement to the BiOp to authorize the amount of take that is expected to occur from normal promulgation of the action. PIFSC will use this DPEA to initiate section 7 consultation on the proposed action with the Protected Resource Offices of both NMFS and USFWS, as applicable.

Section 4(f) of the ESA directs NMFS to develop and implement recovery plans for threatened and endangered species, unless such a plan would not promote conservation of the species. According to the statute, these plans must incorporate, at a minimum:

- a description of site-specific management actions necessary to achieve recovery of the species
- objective, measurable criteria which, when met, would result in a determination that the species be removed from the list
- estimates of the time and costs required to achieve the plan's goal

NMFS's Program on Cooperative Conservation with States (section 6 of the ESA) was developed to assist states that have a cooperative agreement with NMFS in developing and implementing their conservation program for species listed in that agreement, including providing funding for management, research and monitoring that has a direct conservation benefit to the species. Conservation actions may also be carried out by federal agencies as part of their obligations under section 7(a)(1) of the ESA, or as a means to minimize activities that adversely affect a species as part of an interagency consultation. States, local agencies and private entities may conduct conservation actions as a means to minimize or mitigate "incidental take" of species as part of a Conservation Plan under section 10 of the ESA.

In order to meet these requirements and to support recovery plan development, PIFSC conducts research aimed at determining recovery criteria and assessing threats that may potentially impede the recovery of threatened and endangered species. In addition, these activities enable NMFS, state and local agencies, and private entities to fulfill the conservation requirements outlined within the ESA.

6.4 MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA) protects approximately 836 species of migratory bird species from any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof, unless permitted by regulations (i.e. for hunting and subsistence activities). Compliance with the MBTA does not require a permit or authorization; however, the USFWS often requests that other agencies incorporate MBTA mitigation measures as stipulations in their permits. In addition, a Draft Memorandum of Understanding (MOU) between NMFS and USFWS focuses on avoiding and minimizing, to the extent practicable, adverse impacts on migratory birds through enhanced interagency collaboration. In compliance with the MOU, PIFSC has identified and evaluated the impacts

[16] The ESA defines take as: to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct.” (16 U.S.C. 1538[a][1][B])

of the proposed actions on migratory birds. NMFS will provide a copy of this DPEA to the USFWS and will consider all comments from USFWS concerning compliance with the MBTA as necessary.

6.5 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) requires USFWS and NMFS to consult with other state and federal agencies in a broad range of situations to help conserve fish and wildlife populations and habitats in cases where federal actions affect natural water bodies (16 U.S.C. 661 1934). Specific provisions involve conservation or expansion of migratory bird habitats related to water body impoundments or other modifications. FWCA requires consultation among agencies and the incorporation of recommended conservation measures if feasible, but does not involve a separate permit or authorization process. NMFS will provide a copy of this DPEA to the state fish and wildlife agencies in every state affected by the fisheries research activities examined in this Draft EA. NMFS will consider all comments from these agencies and take steps to comply with FWCA as necessary.

6.6 NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the National Historic Preservation Act (NHPA) requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties. Federal agencies must allow the State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation, a federal agency, to comment on a project. NMFS will provide a copy of this DPEA to the SHPOs in every state affected by the fisheries research activities examined in this Draft EA. NMFS will consider all comments from the SHPOs and take steps to comply with NHPA.

6.7 EXECUTIVE ORDER 13158, MARINE PROTECTED AREAS

The purpose of this order is to strengthen and expand the Nation's system of marine protected areas (MPAs) to enhance the conservation of our Nation's natural and cultural marine heritage and the ecologically and economically sustainable use of the marine environment for future generations. The order encourages federal agencies to use science-based criteria and protocols to identify and prioritize natural and cultural resources in the marine environment that should be protected to secure valuable ecological services and to monitor and evaluate the effectiveness of MPAs. Each federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA.

6.8 EXECUTIVE ORDER 12989, ENVIRONMENTAL JUSTICE

Executive Order 12898 directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law. No such effects are identified in this Draft EA.

6.9 EXECUTIVE ORDER 12114, ENVIRONMENTAL EFFECTS ABOARD OF MAJOR FEDERAL ACTIONS

EO 12114, Environmental Effects Abroad of Major Federal Actions, requires federal agencies to assess whether federal actions have the potential to "significantly affect" the environment of the global commons or the environment of a foreign nation not participating with the United States or "otherwise involved in the action." PIFSC participates in several fisheries technology development projects in foreign territorial seas that include bycatch reduction, electronic monitoring (EM), coral reef research and monitoring, and other fishing technology research projects. These projects take place within 12 nm of the foreign country. These projects collect data necessary to evaluate the efficacy of various fisheries technologies. For

example, bycatch reduction projects are designed to develop and refine gear technologies that have shown potential to reduce bycatch interactions in fisheries (e.g., net, trawl, seine, longline, handline, or hook-and-line fisheries). By collaborating with local (in-country) fishers, international scientists and managers, NGOs, universities, and government fishery scientists, PIFSC contributes to such fisheries research in a manner that is conducted under typical fishing operations and without increasing fishing effort in the fishery. Depending upon the project and the location, the respective foreign governments or fishery agencies may participate directly or indirectly in these research activities (e.g., research partnerships, approved permit, agreements).

6.10 INFORMATION QUALITY ACT

Pursuant to NOAA guidelines implementing Section 515 of Public Law 106-554 (the Data Quality Act), all information products released to the public must first undergo a Pre-Dissemination Review to ensure and maximize the quality, objectivity, utility, and integrity of the information (including statistical information) disseminated by or for federal agencies. The following sections address these requirements.

6.10.1 Utility

The information presented in this document is helpful to the intended users (the affected public) by presenting a clear description of the purpose and need of a proposed action, the measures proposed, and the impacts of those measures. This document is the principal means by which the information contained herein is available to the public. The information provided in this document is based on the most recent available information from the relevant data sources. The development of this document and the decisions made by NMFS to propose an action are the result of a multi-stage public process. This document is available in several formats, including printed publication and CD-ROM, upon request.

6.10.2 Integrity

Prior to dissemination, information associated with an action, independent of the specific intended distribution mechanism, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to or modification of such information. All electronic information disseminated by NMFS adheres to the standards set out in Appendix III, “Security of Automated Information Resources,” of Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Act. All confidential information (e.g., dealer purchase reports) is safeguarded pursuant to the Privacy Act; Titles 13, 15, and 22 of the U.S.C. (confidentiality of census, business, and financial information); the Confidentiality of Statistics provisions of the MSA; and NAO 216-100, Protection of Confidential Fisheries Statistics.

6.10.3 Objectivity

For purposes of the Pre-Dissemination Review, this document is considered to be a “Natural Resource Plan.” Accordingly, the document adheres to the published standards of the MSA; Operational Guidelines of the FMP Process; EFH Guidelines; National Standard Guidelines; and NAO 216-6, Environmental Review Procedures for Implementing NEPA.

This document uses information of known quality from sources acceptable to the relevant scientific and technical communities. Stock status (including estimates of biomass and fishing mortality) are based on either assessments subject to peer-review through Stock Assessment Review Committees or on updates of those assessments prepared by scientists of PIFSC. Landing information is based on information collected through the PIFSC Commercial Fisheries database. In addition to these sources, other information is presented that has been accepted and published in peer-reviewed journals or by scientific organizations.

Despite current data limitations, the measures proposed for this action were selected based upon the best scientific information available. The data used in the analyses provide the best available information on the landings of the relevant species in the Pacific Islands Region.

The supporting science and analyses, upon which the policy choices are based, have been documented. All supporting materials, information, data, and analyses within this document have been, to the maximum extent practicable, properly referenced according to commonly accepted standards for scientific literature to ensure transparency.

The review process used in preparation of this document involved staff from PIFSC and NMFS Pacific Islands Regional Office. PIFSC's technical review was conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. All stock assessment data used in this document have been subjected to the Stock Assessment Workshop/Stock Assessment Review Committee review process. Review was conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law.

6.11 EXECUTIVE ORDER 13112, INVASIVE SPECIES

This order (64 CFR 6183, February 3, 1999) directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. The Executive Order established the National Invasive Species Council.

6.12 NATIONAL MARINE SANCTUARIES ACT

The Marine Protection, Research and Sanctuaries Act (MPRSA) (16 U.S.C. 1431) prohibits all ocean dumping (except that allowed by permits) in any ocean waters under U.S. jurisdiction, by any U.S. vessel, or by any vessel sailing from a U.S. port. MPRSA authorizes the Secretary of Commerce (through NOAA) to coordinate a research and monitoring program with the EPA and the U.S. Coast Guard (USCG). The MPRSA established nine regional marine research boards for the purpose of developing comprehensive marine research plans, considering water quality and ecosystem conditions and research and monitoring priorities and objectives in each region. It also launched a national coastal water quality monitoring program that directs the EPA and NOAA together to implement a long-term program to collect and analyze scientific data on the environmental quality of coastal ecosystems, including ambient water quality, health and quality of living resources, sources of environmental degradation, and data on trends. Results of these actions are used to provide the information required to devise and execute effective programs under the Clean Water Act and Coastal Zone Management Act (CZMA).

The National Marine Sanctuaries Act (also known as Title III of the MPRSA) 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, archeological, educational, or esthetic qualities as national marine sanctuaries. The primary objective is to protect marine resources, such as coral reefs, sunken historical vessels or unique habitats.

Section 304(d) requires interagency consultation between the NOAA Office of National Marine Sanctuaries and federal agencies taking actions that are "likely to destroy, cause the loss of, or injure a sanctuary resource." In compliance with the MPRSA, PIFSC has identified and evaluated the impacts of the proposed actions on National Marine Sanctuaries. NMFS will provide a copy of this DPEA to the Office of National Marine Sanctuaries and will consider all comments from them concerning compliance with the MPRSA as necessary. PIFSC will use this DPEA as a sanctuary resource statement to initiate consultation with the Office of National Marine Sanctuaries.

6.13 COASTAL ZONE MANAGEMENT ACT

The principal objective of the CZMA is to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interest in the coastal zone. Section 307(c) of the CZMA requires federal activity affecting the land or water uses or natural resources of a state's coastal zone to be consistent with that state's approved coastal management program, to the maximum extent practicable. NMFS will provide a copy of this DPEA and a consistency determination to the state coastal management agency in every state with a federally-approved coastal management program whose coastal uses or resources are affected by these fisheries research activities. Each state has sixty days in which to agree or disagree with the determination regarding consistency with that state's approved coastal management program. If a state fails to respond within sixty days, the state's agreement may be presumed.

6.14 PACIFIC INTERNATIONAL CONVENTIONS, TREATIES, AND LAWS

PIFSC participates in international forums for the assessment of the status of some stocks in accordance with the relevant rules of international law. NMFS, working through PIFSC, conducts research to support U.S. commitments to international fisheries management, including provision of stock assessment and management advice for the conventions and treaties outlined below.

6.14.1 Tunas Convention Act

The Tunas Convention Act of 1950 (16 U.S.C. 951-961; Act of September 7, 1950, as amended) addresses and codifies the obligations of the U.S. under the Inter-American Tropical Tuna Commission (IATTC) and authorizes the Secretary of Commerce to issue regulations for implementing recommendations of the Commission. The act permits limiting the size and quantity of catches and limiting or prohibiting incidental catch of regulated species.

The IATTC was established in 1949 to monitor the long-term conservation and sustainable use of tunas, billfish, dolphins, turtles, non-target finfish, sharks, and others) that may be affected either directly or indirectly by fishing operations. In 2003, the Convention's scope was broadened, and is now known as the Antigua Convention. The Antigua Convention applies to waters of the Pacific Ocean including areas off California, Oregon and Washington, and encompasses significant U.S. fisheries, such as the troll fishery targeting albacore. The IATTC is currently made up of 21 nations and fishing entities. The Secretary of Commerce has directed NMFS to conduct research and provide scientific input into stock assessments and conservation and management recommendations for target and non-target stocks in the convention area.

The International Scientific Committee for Tuna and Tuna-like Species (ISC) in the North Pacific Ocean was established in 1995 for the purpose of enhancing scientific research and cooperation for conservation and rational utilization of tuna and tuna-like species of the North Pacific Ocean. Through a Memorandum of Understanding, the ISC provides scientific support for the work of the Northern Committee of the WCPFC. As a member, the U.S. supports obligations to the Committee through scientific research conducted by NMFS.

6.14.2 International Whaling Commission

The International Convention for the Regulation of Whaling was established in 1946. The International Whaling Commission is composed of members of 89 countries. In 1986 the Commission introduced zero catch limits for commercial whaling, which remains to present. The Commission sets catch limits for aboriginal subsistence whaling. It also addresses the conservation or whales, and promotes the recovery of depleted whale populations by reviewing ship strikes or entanglement events, habitat, and protocols for whalewatching. The Whaling Convention Act of 1949 (16 U.S.C. 916-9161; Act of August 9, 1950, as amended) authorizes the secretary of commerce via NOAA and NMFS to provide and collect scientific

data, and enforce the provisions of the International Convention for the Regulation of Whaling and to issue regulations necessary for this purpose.

6.14.3 Fishermen's Protective Act

The Fishermen's Protective Act of 1967 (22 U.S.C. 1971-1980; Pub. L. 90-482, as amended) authorizes the Secretary of Commerce to establish an insurance fund for the reimbursement of owners or charterers of fishing vessels which incur damage, loss, or destruction while engaged in any fishery under U.S. exclusive management, or are damaged by a vessel other than a U.S. vessel. The 1971 Pelly Amendment to the Fishermen's Protective Act authorizes the Secretary of Commerce, upon determination that foreign nationals are conduction fishing operations in a way that diminishes the effectiveness of international fishery conservation programs, to certify such to the President. The Secretary also has the responsibility to certify to the President when foreign nationals are engaging in trade or taking in a manner which diminishes the effectiveness of any international program for endangered or threatened species.

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[Note: This work was primarily completed by consultants from URS Corporation in Anchorage, Alaska. In October 2014, URS was purchased by AECOM, Inc. and the final stages of the project were completed by some of the listed personnel as AECOM staff, although the service contract remained under the URS name.]

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