Prepared for:

National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Programmatic Environmental Impact Statement

Final PEIS for Hawaiian Monk Seal Recovery Actions

March 2014

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LIST OF ACRONYMS

λ	lambda
%	percent
ACHP	Advisory Council on Historic Preservation
APA	Administrative Procedure Act
APE	Area of Potential Effect
AWA	Animal Welfare Act
BCC	Birds of Conservation Concern
BMP	Best Management Practices
C	Celsius
CALFEX	combined arms live-fire exercise
CDPs	Census-Designated Places
CDV	canine distemper virus
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CI	co-investigator
CITES	Convention on International Trade in Endangered Species
cm	centimeters
CML	commercial marine license
CWB	Clean Water Branch
CWCS	Comprehensive Wildlife Conservation Strategy
CZMA	Coastal Zone Management Act
DAR	Division of Aquatic Resources
DBEDT	Department of Business, Economic Development and Tourism
DDT	dichlorodiphenyltrichloroethane

DLNR	Department of Land and Natural Resources
DOC	Department of Commerce
DOD	Department of Defense
DOH	Department of Health
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENSO	El Niño-Southern Oscillation
EO	Executive Order
EPA	Environmental Protection Agency
ERM	ERM-West, Inc.
ESA	Endangered Species Act
F	Fahrenheit
FEP	Fishery Ecosystem Plan
fm	fathom
FONSI	Finding of No Siginificant Impact
FR	Federal Register
ft	feet
FWCA	Fish and Wildlife Conservation Act
g	grams
GC	glucocorticoids
GIS	Geographic Information System
GnRH	gonadotropin-releasing hormone
GPS	Global Positioning System

HDLNR	Hawai`i Department of Land and Natural Resources
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HISC	Hawaiian Invasive Species Council
HMRFS	Hawai`i Marine Recreational Fishing Survey
HMSRT	Hawaiian Monk Seal Recovery Team
HRS	Hawai`i Revised Statutes
IACUC	Institutional Animal Care and Use Committee
IBA	Important Bird Area
INRMP	Integrated Natural Resource Management Plans
IPCC	Intergovernmental Panel on Climate Change
IQF	Individually Quick Frozen
IUCN	International Union for the Conservation of Nature
K	carrying capacity
kg	kilograms
km	kilometers
km^2	square kilometers
lb	pound
LFX	live-fire exercise
$\lambda_{realized}$	realized growth rate
m	meters
mb	millibar
MBTA	Migratory Bird Treaty Act
MCBH	Marine Corps Base Hawai`i
MHI	Main Hawaiian Islands
ml	milliliters

MLCD	Marine Life Conservations Districts
mm	millimeters
MMC	Marine Mammal Commission
MMHSRP	Marine Mammal Health and Stranding Response Program
MMPA	Marine Mammal Protection Act
MMR	Makua Military Reservation
Monument	Papahānaumokuākea National Monument
MSFCMA	Magnuson-Stevens Fishery Conservation Management Act
N	North
N	mean final abundance
NAO	National Oceanic and Atmospheric Administration Administrative Order
NEPA	National Environmental Policy Act
Nf_{mature}	number of mature females
NGO	Non-Governmental Organization
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
nm	nautical miles
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	National Ocean Service
NPS	National Park Service
NRHP	National Register of Historic Places

NW	Northwest
NWHI	Northwestern Hawaiian Islands
^{o}	degrees
OIRC	Offshore Islet Restoration Committee
ONMS	Office of National Marine Sanctuaries
OPR	Office of Protected Resources
OTC	Office in Tactical Command
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PDO	Pacific Decadal Oscillation
PDV	Phocine Distemper Virus
PEIS	Programmatic Environmental Impact Statement
PI	principal investigator
PIBHMC	Pacific Islands Benthic Habitat Mapping Center
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PIT	Passive Integrated Transponder
PMNM	Papahāunamokuākea Marine National Monument
POP	persistent organic pollutants
ppt	parts per thousand
PRCP	Polluted Runoff Control Program
QFASA	quantitative fatty acid signature analysis
RA	Research Assistant
RFFA	reasonably foreseeable future actions
ROD	Record of Decision

S	South
SGCN	Species of Greatest Conservation Need
SHPD	Hawai`i State Historic Preservation Division
SHPO	Hawai'i State Historic Preservation Officer
SW	Southwest
SWFSC	Southwest Fisheries Science Center
TAC	total allowable catch
U.S.	United States
U.S.C.	United States Code
UDP	Unanticipated Discovery Plan
UH	University of Hawai`i
UME	Unusual Mortality Even
UNESCO	United Nations Education, Scientific, and Cultural Organization
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps
VHF	very high frequency
V_{pop}	population reproductive value
v_x	age-specific reproductive value
W	West
WNV	West Nile Virus
WPRFMC	Western Pacific Regional Fishery Management Council
yr	year

Hawaiian Monk Seal Recovery Actions
Programmatic Environmental Impact Statement
Executive Summary

March 2014

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Abstract: The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NMFS) is the Federal agency responsible for management, recovery and conservation of Hawaiian monk seals (*Monachus schauinslandi*) under the Endangered Species Act (16 United States Code [U.S.C.] 1531 *et seq.*) and the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*). As part of their responsibilities, NMFS funds, permits, and conducts research and enhancement activities on endangered Hawaiian monk seals in the Northwestern Hawaiian Islands (NWHI), main Hawaiian Islands (MHI), and Johnston Atoll. NMFS proposes to implement research and enhancement actions identified in the Hawaiian Monk Seal Recovery Plan (NMFS 2007), with the goal of conserving and recovering the species. This Final Programmatic Environmental Impact Statement (PEIS) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of the proposed program and alternatives to the proposed action.

The agency's recommended Preferred Alternative is Alternative 3 (Limited Translocation). Alternative 3 encompasses a broad scope of research and enhancement activities that would yield greater recovery benefits to the species over the next several years than would be expected under the other alternatives. It is important to note that while Alternative 4 (Enhanced Implementation) was Preferred in the Draft PEIS, Alternative 3 has been selected as the Preferred Alternative in the Final PEIS. The only distinction between these two Alternatives is that Alternative 3 (Preferred) does *not* include any two-stage translocation option that would involve taking weaned pups born in the NWHI and releasing them in the MHI.

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LIST OF ACRONYMS

ESA	Endangered Species Act
FR	Federal Register
MHI	Main Hawaiian Islands
MMPA	Marine Mammal Protection Act
Monument	Papahānaumokuākea National Monument
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NWHI	Northwestern Hawaiian Islands
PEIS	Programmatic Environmental Impact Statement
U.S.	United States
U.S.C.	United States Code
UDP	Unanticipated Discovery Plan
WNV	West Nile Virus

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ES-1.0 INTRODUCTION

This executive summary provides an overview of the Final Programmatic Environmental Impact Statement (PEIS) for Hawaiian Monk Seal Recovery Actions. The PEIS presents:

- The purpose and need for action;
- A reasonable range of alternatives that fulfill the purpose and need for this proposed federal action;
- An overview of public comments received during the August – October 2011 public comment period and how comments were addressed;
- An evaluation of the type and range of direct and indirect effects associated with Hawaiian monk seal research and enhancement activities that may be implemented in future research permits;
- The contribution of research activities to the cumulative effects on species and resources likely to be affected by these activities, including effects from past, present, and reasonably foreseeable future events and activities that are external to the research activities; and
- Recommendations, monitoring plans, and processes for proposed new research and enhancement activities that include considerations for continued and improved stakeholder and community involvement.

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NMFS) is the Federal agency responsible for management, conservation and recovery of Hawaiian monk seals under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of their responsibilities, NMFS funds, permits, and conducts research and enhancement activities on Hawaiian monk seals in the Northwestern Hawaiian Islands (NWHI) and main Hawaiian Islands (MHI).

Hawaiian monk seals have experienced a prolonged population decline. In 1976, Hawaiian monk seals were listed as "endangered" under the ESA (41 Federal Register [FR] 51611) and "depleted" under the MMPA. The Hawaiian monk seal is the most endangered pinniped species in United States (U.S.) waters and the second most endangered pinniped in the world.

The most recently published best estimate of total abundance is 1,212 seals (Carretta *et al.* 2013) in 2010, and the number was estimated to be declining at approximately 4.0% per year. Preliminary unpublished results from more recent years indicate the population is still declining. The population is many times larger in the NWHI than in the MHI. However, the MHI population is increasing and juvenile survival rates are consistently higher than in the NWHI.

Hawaiian monk seals occur on islands, atolls, and emergent reefs throughout the Hawaiian Archipelago, from Kure Atoll to Hawai`i Island, a distance of over 2,500 km (approximately 1,553 miles). The seals forage in and transit the waters surrounding and between all land areas. Intermittent sightings of Hawaiian monk seals have also occurred at Johnston Atoll, approximately 800 km (approximately 497 miles) south of the Hawaiian Archipelago.

ES-2.0 PROPOSED ACTION

NMFS is required by Section 4(f) of the ESA to develop a recovery plan for this critically endangered species. NMFS' proposed action includes permitting and implementing research and enhancement activities (as described in Section ES-5.0, below) identified in the Hawaiian Monk Seal Recovery Plan (NMFS 2007). NMFS considered a reasonable range of alternatives including the most promising actions to improve monk seal survival and provide the best hope for conservation and recovery of the species

ES-3.0 PURPOSE AND NEED

The purpose of implementing recovery activities (research and enhancement) for the Hawaiian monk seal is to promote the recovery of the species to population levels at which ESA protection is no longer needed.

The need for this action is rooted in fundamental biological and ecological factors that are now limiting the population. A comprehensive research program enables NMFS to recognize, and possibly quantify, factors limiting the population in order to designate appropriate actions to minimize human-induced impacts and other factors affecting seal survival. Data and analyses derived from research lead to improved decision-making, and strategic

management and enhancement activities that promote population recovery, prevent harm, and avoid jeopardy or continued disadvantage to the species as required under the ESA. Research and monitoring will continue to play a key role in determining whether enhancement activities achieve their desired outcomes.

ES-4.0 PUBLIC INVOLVEMENT

NMFS initiated public scoping for this PEIS when the Notice of Intent (NOI) was published in the Federal Register on October 1, 2010 (75 FR 60721). The NOI requested public participation in the scoping process and presented information to stimulate public discussion, such as a statement of purpose and need for the proposed action and preliminary alternatives. Scoping comments were summarized in the Scoping Report that was included as Appendix B of the Draft PEIS.

The Notice of Availability (NOA) for the Draft PEIS was published in the *Federal Register* on August 19, 2011 (76 FR 51945), which began the official public comment period for this PEIS. The public comment period lasted for 60 days and concluded on October 17, 2011.

A total of 341 comment submissions were received from agencies and the public on the Draft PEIS. These submissions generated 1,180 substantive comments. Substantive comments received during the public comment process raised issues that have been addressed and incorporated throughout this Final PEIS.

A Comment Analysis Report is included as Appendix B to this Final PEIS. The Comment Analysis Report provides NMFS' responses to issues raised in comments and also refers to specific sections of this Final PEIS where additional information can be found or where changes to the document have been made after consideration of public comments.

Table ES-1 lists issues raised during the comment period and specific sections of this Final PEIS where those issues are discussed. More detailed comment summaries are provided in the Comment Analysis Report in Appendix B.

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Table ES-1 Issues Raised During the Public Comment Period and Where They Are Addressed in the Final PEIS

Issue	Sections in the PEIS Where Issue Is Discussed	General Description of Revisions Made
Alternatives	• 2.6 Alternatives Carried Forward for Analysis • 2.11 Alternatives Not Carried Forward for Analysis • 4.7.1 through 4.8.7 Environmental Consequences of Alternatives for Resources Evaluated • 2.5 Research and Enhancement Components of the Alternatives	• 2.6 - Additional information is provided on the total number of weaned monk seal pups that could be translocated under Alternatives 3 and 4. • 2.11 – Additional information has been added about the rationale for eliminating alternatives such as predator control on the NWHI.
Behavior Modification	• 2.9 Alternative 3: Limited Translocation (Preferred Alternative) • 2.10 Alternative 4: Enhanced Implementation • 4.5 Steps for Identifying Cumulative Effects • 4.8 Social and Economic Environment • 5.4 Plan for Development of a Behavior Modification Program	• 4.8.1 thru 4.8.3 and 4.8.5 – Additional information is provided on the effects of behavioral modification activities or lack thereof (Alternative 2) as they relate to human-seal interactions, including fisheries interactions.
Cumulative Effects	• The following sections present the evaluation of cumulative effects of the Alternatives on subject resources: • 4.7.1.21 Hawaiian Monk Seals • 4.7.3.6 Sea Turtles • 4.7.4.4 Cetaceans • 4.7.5.3 Fish • 4.7.6.5 Birds • 4.7.8.2 Invasive Species • 4.8.1.5 Commercial Fishing • 4.8.2.5 Subsistence Fishing • 4.8.3.5 Recreational Fishing • 4.8.4.5 Cultural Resources and Historic Properties • 4.8.5.9 Recreation and Tourism • 4.8.6. Environmental Justice • 4.8.7.5 Military Activities • 4.9 Summary of Effects	• Table 4.5-2 *Reasonably Foreseeable Future Actions Within the Project Area* has been updated with the most current reasonably foreseeable activities. • Section 4.7.1.21 – additional information provided on levels of take from other activities besides research. • Sections 4.8.1.5 thru 4.8.3.5 – additional activities including the designation of monk seal critical habitat, spinner dolphin protection measures and modifications to the Hawaiian Islands Humpback Whale National Marine Sanctuary are included in the analysis of cumulative effects on fisheries.
Diseases	• 3.3.1.7 Crucial and Serious Environmental and Anthropogenic Stressors/Threats (subheading Infectious Diseases) • 4.7.1.6 Mechanisms for Injury From Translocation • 4.7.1.8 Mechanisms of Injury from Vaccination • 4.7.1.15 Assessment of Beneficial Contributions Toward Conservation Objectives • 4.7.1.19 Direct and Indirect Effects of Alternative 3: Limited Translocation	• Appendix E – has been updated with additional information on what specific events may trigger vaccination of wild seals.

Issue	Sections in the PEIS Where Issue Is Discussed	General Description of Revisions Made
	• 4.7.1.20 Direct and Indirect Effects of Alternative 4: Enhanced Implementation • 5.3 Plan for the Vaccination Process • Appendix E – Vaccination Plan	
Ecosystem	• 3.2 Physical Environment • 3.3 Biological Environment • 4.7 Environmental Consequences – Biological Environment	• 3.3 and 4.7 general information has been updated as necessary.
Fisheries	• 3.4.3 Affected Environment – Commercial Fishing • 3.4.4 Affected Environment – Subsistence Fishing • 3.4.5 Affected Environment – Recreational Fishing • 4.8.1 Environmental Consequences – Commercial Fishing • 4.8.2 Environmental Consequences – Subsistence Fishing • 4.8.3 Environmental Consequences – Recreational Fishing	• 4.8.1 thru 4.8.3 – NMFS has made substantial revisions to the evaluation of fisheries-related impacts of the Alternatives. The analysis relies heavily upon a recently published report (Sprague et al. 2013). This publication evaluates reef fish biomass, monk seal biomass, monk seal consumption of fish, fishery landings and degree of overlap between monk seal prey selection and species targeted by fishers in the MHI. • Revisions also include information about potential costs associated with interactions between seals and fisheries such as increased fuel costs related to avoiding seals or damage to gear by seals.
Hawaiian Monk Seal Biology	• 3.3.1 Affected Environment - Hawaiian Monk Seals	
Human-Seal Interactions	• 3.4.8 Affected Environment – Recreation and Tourism • 3.4.9 Affected Environment – Public Safety • 4.8.1 Environmental Consequences – Commercial Fishing • 4.8.2 Environmental Consequences – Subsistence Fishing • 4.8.3 Environmental Consequences – Recreational Fishing • 4.8.5 Environmental Consequences – Recreation and Tourism • 4.8.6 Environmental Consequences – Environmental Justice	• 3.4.8 – Updates to the number and type of human-seal interactions that have occurred since publication of the Draft PEIS in 2011. • 4.8.1 thru 4.8.6 – Additional evaluation of the potential costs associated with human-seal interactions are provided in each of these sections. For example, the potential costs associated with fishermen attempting to avoid interactions with seals are evaluated.
Management	• 5.1 Implementation of the Hawaiian Monk Seal Recovery Actions PEIS Under NEPA • 5.2 Monitoring Plan for the Two-Stage Translocation Process • 5.3 Plan for the Vaccination Process • 5.4 Plan for Development of a Behavior Modification Program • 5.5 Mitigating Potential Impacts To Cultural Resources And Historical Properties • 5.6 Coordination with Stakeholders and Communities	• 5.1 thru 5.6 – Additional information has been provided on NMFS's implementation of these programs. • 5.6 – Additional detail is provided about NMFS's public outreach program.
Cultural	• 3.4.6 Affected Environment – Cultural Environment • 3.4.7 Affected Environment – Cultural Resources and Historic Properties • Appendix J – Historical and Contemporary Significance of the Endangered Hawaiian Monk Seal in Native Hawaiian Culture	• 3.4.6 thru 3.4.7 - Revisions have been made based on re-evaluation of potential impacts of monk seal research and enhancement activities on cultural and historic properties within the Project Area. • Appendix B – Section 106 Consultation has been completed and results of the evaluation as well as correspondence with the Hawai'i State Historic

Issue	Sections in the PEIS Where Issue Is Discussed	General Description of Revisions Made
	• Appendix B – Final Section 106 Analysis of the PEIS for the Hawaiian Monk Seal Recovery Actions	Preservation Division are provided. • Appendix K – Cultural Impact Assessment has been completed providing a detailed impact assessment and review of references and significance of monk seals in traditional Hawaiian culture.
Public Coordination	• 5.1 Implementation of the Hawaiian Monk Seal Recovery Actions PEIS Under NEPA • 5.2 Monitoring Plan for the Two-Stage Translocation Process • 5.3 Plan for the Vaccination Process • 5.4 Plan for Development of a Behavior Modification Program • 5.5 Mitigating Potential Impacts To Cultural Resources And Historical Properties • 5.6 Coordination with Stakeholders and Communities • Appendix C – Comment Analysis Report	• 5.1 thru 5.6 – Additional information has been provided on NMFS's implementation of these programs. • 5.6– Additional detail is provided about NMFS's public outreach program. • Appendix C – A Comment Analysis Report documenting the public comment period and associated public hearings is appended to the Final PEIS.
Regulatory	• 1.5 Federal Laws and Associated Permits and Authorizations Applicable to Hawaiian Monk Seal Research and Enhancement Activities • 1.6 Why a PEIS is Needed • 1.8 Required Decisions and Other Agencies Involved in this Analysis	• 1.5.2 Clarification has been added about civil penalties associated with the Endangered Species Act. • 1.5.4 An update on the Section 106 Consultation has been added • 1.5.6 An update on coordination with the Coastal Zone Management Program has been added.
Socioeconomic	• 3.4 Affected Environment – Social and Economic Environment • 4.8 Environmental Consequences – Social and Economic Environment	• 3.4 Updates to general social and economic information have been added such as population data, etc. • 4.8 Revisions to analysis of potential impacts of the Alternatives on fisheries, recreation and tourism, public safety, and cultural and historic properties have been made.
Translocation	• 2.5 Research and Enhancement Components of the Alternatives • 4.7.1 Environmental Consequences – Hawaiian Monk Seals • 4.8.1 thru 4.8.3 Environmental Consequences - Fisheries • Appendix F Proposed Translocation Plan	• 4.8.1 thru 4.8.3, 4.8.4 and 4.8.5 - Potential effects of the two-stage translocation (Alternatives 3 and 4) on fisheries, recreation and tourism, and cultural and historic properties have been re-evaluated and these revisions are presented in these sections.

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ES-5.0 ALTERNATIVES

Three action alternatives and a no action alternative were developed and analyzed in this PEIS. The four alternatives carried forward for detailed analysis vary in scope and level of activities, including the types of research and enhancement activities and number of animals that would be permitted under each alternative. Different thresholds for "acceptable" levels of mortality are also associated with the range of research activities. Additional detail about the alternatives can be found in Chapter 2.

Alternative 1: Status Quo

Under the Status Quo Alternative, the current NMFS research and enhancement permit (Permit No. 10137) would continue until its expiration in 2014.

New permits or permit amendments for levels and types of research the same as currently permitted would be approved. New permits or amendments would not be approved if it were determined under the ESA that the permitted activities would jeopardize the continued existence of the species or adversely modify critical habitat when expected effects were added to existing research, enhancement, and other activities in the baseline at the time the application was received.

Research and enhancement activities allowed under the Status Quo Alternative are listed in Table 2.10-1 and include those that have been carried out consistently for decades (*e.g.,* land-based surveys and marking), newer research (*e.g.,* de-worming studies), and ongoing mitigation for mortality (*e.g.,* disentanglement).

No new activities nor an expansion of the scope of existing activities would occur under the Status Quo Alternative.

Alternative 2: No Action

The No Action Alternative would only allow Hawaiian monk seal research and enhancement activities to continue until the existing permit expires in 2014. No new permit would be issued to replace permit 10137 when it expires, nor could that permit be amended to allow modifications in research or enhancement activities, sample sizes, or objectives. After expiration of the permit, all research and enhancement activities conducted by NMFS and requiring a permit would cease. Limited enhancement (*e.g.*, entanglement and de-hooking; hazing or translocating seals away from imminently harmful situations) could be accomplished under the separate permit for the Marine Mammal Health and Stranding Response Program (see Section 1.4) and not as part of this research and enhancement program.

Alternative 3: Limited Translocation (Preferred Alternative)

Alternative 3 would include all currently permitted activities and further address the recommendations of the Hawaiian Monk Seal Recovery Plan (2007) by including new research and enhancement activities not currently permitted.

While Alternative 4 (Enhanced Implementation) was preferred in the Draft PEIS, Alternative 3 (Limited Translocation) has been selected as the Preferred Alternative in the Final PEIS. The distinction between these two Alternatives is that Alternative 3 does *not* include any two-stage translocation option that would involve taking weaned pups born in the NWHI and releasing them in the MHI. However, a variety of translocation actions could occur under Alternative 3, including two-stage translocation *within* the NWHI, *within* the MHI, or from the MHI to the NWHI, with the option of returning the seals to their birth location or nearest appropriate site at age 2 years and older.

NMFS would conduct many important seal research and enhancement activities under Alternative 3 and engage the public in an effort to address concerns raised during the Draft PEIS public comment process, especially concerns related to human-seal interactions. Also, monitoring and intervention protocols to minimize undesirable human-seal interactions could be further developed under Alternative 3 (Preferred).

Alternative 3 would build upon the status quo and represents the assessment of steps that could be taken currently to prevent the extinction of the Hawaiian monk seal, based upon the best available scientific data. It encompasses a very broad and ambitious research and enhancement program, including research on population biology, ecology, health studies, foraging research, and a suite of enhancement tools designed to mitigate existing and emerging threats to the species, as identified in the species' recovery plan (NMFS 2007).

Activities currently permitted under the Status Quo that would continue under Alternative 3 (Preferred) are provided in Table 2.10-1 and include, but are not limited to:

- Monitoring via ground, vessel, and aerial surveys; marking and photo ID;
- Health screening and instrumentation;
- De-worming research;
- Specimen collection and import/export of specimens;
- Disentanglement and dehooking;
- Adult male removal for enhancement; and
- Translocation (one-way) for enhancement including:
    - Translocating abandoned nursing pups to a foster mother or their natural mother within their birth island or atoll;
    - Translocating weaned pups from a high risk area (*e.g.*, known shark predation) to a low risk area within the same island or atoll

in the NWHI or Johnston Atoll; translocations in the MHI may be to a different location on the same island or to a different island in the MHI; and

- Translocating weaned pups and juveniles in subpopulations where juvenile survival is low to subpopulations with higher rates of juvenile survival; seals may be translocated among subpopulations within the NWHI.

Activities not currently permitted that would also occur under Alternative 3 are provided in Table 2.10-1 and include, but are not limited to:

- Expanded surveys and use of new research tools (*e.g.*, new telemetry devices).
- Vaccination studies and potential implementation of vaccines to mitigate infectious disease.
- Potential implementation of de-worming as an enhancement tool to improve juvenile Hawaiian monk seal survival.
- Expanded scope and number of seal translocations, including:
    - Translocating seals with unmanageable human interactions from the MHI to the NWHI;
    - Translocating juvenile and older seals from the MHI to NWHI to examine their subsequent survival; and
    - Implementing a two-stage translocation program whereby weaned pups are taken from areas of lower survival to areas of higher survival within the NWHI, within the MHI, or from the MHI to the NWHI. ***This excludes taking weaned pups born in the NWHI to the MHI***. This program would include the option of returning the translocated seals to their birth location or nearest appropriate site at age 2 years or older. Note that seals born in the MHI and previously translocated to the NWHI may be returned to the MHI. Details of the translocations would be determined by a decision framework that is described in Section 5.2 and Appendix F.
- Supplemental feeding at NWHI locations where seals are released after being cared for in captivity.
- Research to develop tools for preventing or minimizing undesirable Hawaiian monk seal behavior (referred to as behavior modification) related to interactions with humans and fishing gear in the MHI. If proven effective by research, these tools would be implemented.
- Decreasing aggressive male monk seal behavior using a drug to reduce testosterone.

NMFS concludes that Alternative 3 would best achieve project goals consistent with the purpose and need statement, and complies with the various goals,

objectives and requirements of the ESA, MMPA, and other applicable laws. Alternative 3 constitutes the most effective implementation of key elements in the Recovery Plan and is the agency's Preferred Alternative. It is a very broad program, including research on population biology, ecology, health studies, foraging research, and a suite of enhancement activities and tools designed to mitigate existing and emerging threats to the species.

Alternative 4: Enhanced Implementation

Alternative 4, the enhanced implementation alternative, would encompass all the activities permitted under Alternative 3 (Preferred), ***with the addition of the option for temporary translocation of weaned pups from the NWHI to the MHI***. At age 2-3 years, any surviving translocatees would be returned to the NWHI.

The decision framework (Section 5.2 and Appendix F) used in Alternative 3 for conducting translocations would also be used under this alternative. A distinguishing factor of Alternative 4 is that seals born in the NWHI may be temporarily translocated from the NWHI to the MHI during the first few years of their lives. While a total of 200 weaned pups could be translocated to the MHI from the NWHI over a 10-year period under this alternative, only a maximum of 60 of these would be in the MHI (or any other host site) at any given time as they will be returned when they reach 2 or 3 years of age.

The ability under Alternative 4 to conduct two-stage translocation from the NWHI to the MHI would allow for maximal flexibility to take advantage of the potential benefits of two-stage translocation, because weaned pups could be moved to wherever their survival chances are best. However, implementing two-stage translocations from the NWHI to the MHI would be infeasible at this time. NWHI pups, once brought to the MHI, could become involved in fishery and other human interactions, just as has occurred among some seals born in the MHI. Capacity and techniques for monitoring translocated seals, and intervening to prevent and mitigate such interactions, must be further developed before this action can be conducted without risking failure as measured both in terms of seal survival and public attitudes toward monk seal conservation. As discussed above, monitoring and intervention activities could be further developed under Alternative 3 (Preferred). Thus, while Alternative 4 was the preferred alternative in the Draft PEIS, it is not the preferred alternative in the Final PEIS.

Alternatives Not Carried Forward for Analysis

The public comment process highlighted other considerations for alternatives. In Section 2.12, two alternatives were considered but were not carried forward for analysis in this PEIS.

One alternative considered but discarded was to reduce populations of large predatory fish in the NWHI (Papahānaumokuākea Marine National Monument [Monument]) as a way to increase survival of Hawaiian monk seals. This proposal is based on the hypothesis that one of the primary factors limiting monk seal recovery in the NWHI is predation and direct or indirect competition with other predatory species such as sharks and jacks.

NMFS currently lacks sufficient information on NWHI food web dynamics to make a reliable prediction whether predator reduction would be an effective method for improving juvenile monk seal survival without unintended consequences. Compared to all other actions proposed in Alternative 3 (Preferred), the results of large-scale predator management/removal is far more uncertain. It is not the ability to remove fish that is uncertain, but rather whether it would benefit monk seals without having unanticipated and undesirable environmental consequences. NMFS is not dismissing this concept indefinitely and plans to investigate it further with other agency and independent scientists outside the context of the PEIS. However, the time required to gather sufficient data in order to understand the impacts and effectiveness of reducing predatory fish populations would not be timely for the recovery of the monk seal – which makes predator reduction inconsistent with the purpose and meed of this PEIS.

Another alternative considered but not carried forward was to construct a research facility or aquarium for breeding, rearing, and feeding monk seals in the NWHI. Human impacts in the Monument are minimized and heavily regulated to protect the native ecosystem. Construction, operation, and maintenance of such a facility in the NWHI would be logistically challenging and several orders of magnitude more costly, making this alternative unreasonable.

ES-6.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

The direct and indirect effects, or environmental consequences, to the human environment were analyzed for each alternative. Each alternative was also evaluated to determine its contribution to cumulative effects on each resource.

Table ES-2 summarizes the direct, indirect, and cumulative effects under each alternative for all resources where environmental consequences were evaluated. Detailed analyses and discussions of effects can be found in Chapter 4.

The effects (both beneficial and adverse) of each alternative on a range of biological and socio-economic resources was analyzed and categorized on a scale ranging from *negligible* through *major*. A summary of the analysis results is

presented in Table ES-2. The totality of these analyses was very complex; for some resources several types of effects (for example, on mortality, reproduction, habitat, etc.) were analyzed, and for each resource direct, indirect and cumulative effects were evaluated. Because of this complexity, it can be a challenge to sort out the main conclusions. In order to do so, it is useful to first present all the effects that were found to be consistent among alternatives, and then to focus on just how the alternatives were distinct in terms of their effects.

Effects on Other Resources – Negligible Effects for All Alternatives

Among the biological resources, all effects on sea turtles, cetaceans, corals, and fish species were found to be *negligible* for all alternatives.

Likewise, among socio-economic resources, all effects on fishing (commercial, subsistence and recreational), environmental justice, and military resources were determined to be *negligible* for all alternatives.

Regarding effects on fisheries (commercial, subsistence and recreational), this PEIS relies upon a recent study (Sprague et al. 2013) regarding the estimated consumption of prey by monk seals compared to available prey biomass, consumption by other apex predators, and commercial and non-commercial fisheries landings. This research indicates that the current population of approximately 200 monk seals in the main Hawaiian Islands consumes a maximum of 0.009% of the estimated available prey biomass. Also, apex predatory fish in the main Hawaiian Islands likely consume over 50 times more prey than the monk seal population. The analysis presented in this PEIS draws on this and other research findings to conclude *negligible* effects on fisheries for all alternatives.

Effects on Other Resources – Variable Effects for Alternatives

Effects on birds, and invasive species ranged from *negligible* to *minor adverse* and were identical for Alternatives 1 (Status Quo), 3 (Preferred) and 4 (Enhanced Implementation). A distinction was that under Alternative 2 (No Action), all effects on birds and invasive species were found to be *negligible*.

Similarly, effects on cultural and historic properties were deemed *minor adverse* to *negligible* and were identical for all the Action Alternatives (1, 3, and 4), and *negligible* for the No Action Alternative (2).

Recreation and Tourism effects were *negligible* for Alternatives 1 and 2, but were *moderate beneficial* for Alternative 3 and 4. The latter result was due to potentially increased wildlife viewing alternatives coupled with reduced negative human-seal interactions as a result of seal behavioral modification and translocation of seals that may become socialized to people.

Effects on Hawaiian Monk Seals

The greatest distinction among the alternatives was their effects on the Hawaiian monk seal, the species which is the subject of the proposed research and enhancement activities. Three types of effects on Hawaiian monk seals were analyzed for each alternative:

- Effects on Mortality;
- Effects on Reproduction; and
- Contributions to Conservation Objectives.

Mortality and reproductive effects are adverse to monk seals. However, those are counter-balanced by the beneficial effects of contributing to conservation objectives and recovery of the species in the long-term.

Effects on Hawaiian Monk Seal Mortality -Vary by Alternative

Mortality effects on monk seals were evaluated by how much the proposed lethal takes of seals allowed under each alternative would likely affect the species population in the future. Because Alternatives 3 and 4 involve a broader array of research and, especially, enhancement activities, there are greater associated risks of mortality. For that reason, **mortality effects on monk seals of Alternatives 3 and 4 were found to be *minor to moderate adverse***, slightly greater than the *minor adverse* effects under Alternative 1. Alternative 2 had *negligible* mortality effects because all permitted take of seals, including mortalities, would cease after 2014. In the context of the many other natural and human-caused sources of monk seal deaths, the cumulative effects of Alternative 1, 3 and 4 mortality was determined to be *negligible*.

Effects on Hawaiian Monk Seal Reproduction – Negligible for All Alternatives

Reproductive effects on monk seals under all alternatives were determined to be *negligible*. This was concluded based upon past research and publications that show the types of activities proposed have not had any detectable reproductive effects on Hawaiian monk seals or other seal species. Also, very cautious protocols that would be used by NMFS (for example, not capturing pregnant or nursing females and minimizing disturbance of mother-pup pairs) make any reproductive impacts exceedingly unlikely.

Contributions to Hawaiian Monk Seal Conservation –Vary by Alternative

Contributions to conservation benefits for monk seals varied among the alternatives. Under Alternative 1, status quo activities would continue to make *moderate beneficial* contributions, but not at a level that would be expected to make significant progress toward recovery. Alternative 2 would clearly lead to

major adverse effects on conservation, because nearly all research and enhancement activities would cease after 2014.

The broader scope of research and enhancement under Alternatives 3 and 4 led to both being categorized as resulting in ***major beneficial* effects for conservation of monk seals**. Among those two alternatives, the only distinction is that Alternative 4 would allow for the option of temporary translocation of weaned pups from the NWHI to the MHI, followed by a return to the NWHI after age 2-3 yr.

Maximum potential benefits might not be realized through the two-stage translocation proposed under Alternative 3 because weaned pups could not be moved from areas of current low survival in the NWHI to current higher survival in the MHI. Weaned pups would only be translocated within each region or from the MHI to the NWHI. This limits the potential effectiveness of the translocation process given current demographic rates. If future conditions are such that translocations from the NWHI to MHI would be even more beneficial than they may be currently, the inflexibility to conduct such translocations would reduce potential conservation benefits of Alternative 3 further. However, monk seal monitoring and intervention capabilities essential for successful two-stage translocation from the NWHI to the MHI (as proposed under Alternative 4) require further development and refinement. Therefore, Alternative 3 is preferred at the present time.

Table ES-2 Summary of Direct/Indirect and Cumulative Effects

		Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative) (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation
HAWAIIAN MONK SEALS					
Mortality	Direct/Indirect Effects	Minor Adverse	Negligible	Minor to Moderate Adverse	Minor to Moderate Adverse
	Cumulative Effects	Negligible contribution			
Reproduction	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
Contribution to Conservation Objectives	Direct/Indirect Effects	Moderate beneficial	Major adverse	Major beneficial	Major beneficial
	Cumulative Effects	Moderate beneficial contribution	Major adverse contribution	Major beneficial contribution	Major beneficial contribution
SEA TURTLES					
Mortality	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
Reproduction	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			

		Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative) (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation
CETACEANS					
Mortality	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
Reproduction	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
FISH					
Mortality	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
BIRDS					
Productivity	Direct/Indirect Effects	Negligible to Minor adverse	Negligible	Negligible to Minor adverse	Negligible to Minor adverse
	Cumulative Effects	Negligible to Minor adverse	Negligible to Minor adverse contribution	Negligible to Minor adverse contribution	Negligible to Minor adverse contribution
Survival	Direct/Indirect Effects	Negligible to Minor adverse (Moderate adverse for Laysan Finch)	Negligible to Minor adverse	Negligible to Minor adverse (Moderate adverse for Laysan Finch)	Negligible to Minor adverse (Moderate adverse for Laysan Finch)
	Cumulative Effects	Negligible to Minor adverse	Negligible contribution	Negligible to Minor adverse contribution	Negligible to Minor adverse contribution

		Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative) (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation
Habitat Alteration	Direct/Indirect Effects	Negligible to Minor adverse	Negligible	Negligible to Minor adverse	Negligible to Minor adverse
	Cumulative Effects	Negligible to Minor adverse	Negligible contribution	Negligible to Minor adverse contribution	Negligible to Minor adverse contribution
CORALS					
Damage to corals and live rock	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
INVASIVE SPECIES					
Spread of Invasive Species	Direct/Indirect Effects	Negligible to Minor adverse	Negligible	Negligible to Minor adverse	Negligible to Minor adverse
	Cumulative Effects	Negligible contribution			
COMMERCIAL FISHERIES					
Commercial Landings	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
SUBSISTENCE FISHERIES					
Subsistence Catch	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
RECREATIONAL FISHERIES					

		Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative) (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation
Recreational Catch	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			
CULTURAL RESOURCES AND TRADITIONAL CULTURAL PRACTICES					
Traditional Fishing and Gathering Resources and Activities	Direct/Indirect Effects	Negligible to Minor adverse	Negligible to Minor adverse	Negligible to Minor adverse	Negligible to Minor adverse
	Cumulative Effects	Negligible contribution			
HISTORIC AND TRADITIONAL CULTURAL PROPERTIES					
Archaeological Sites, and other Historic Sites, and Cultural Properties	Direct/Indirect Effects	Negligible to Minor adverse	Negligible	Negligible to Minor adverse	Negligible to Minor adverse
	Cumulative Effects	Negligible contribution			
RECREATION AND TOURISM					
Recreation Experience and Cost, and Public Safety	Direct/Indirect Effects	Negligible	Negligible	Moderate beneficial	Moderate beneficial
	Cumulative Effects	Negligible contribution			
ENVIRONMENTAL JUSTICE					
Disproportionate	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible

		Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative) (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation
Effects on Minority Populations	Cumulative Effects	Negligible contribution			
MILITARY ACTIVITIES					
Military Activities	Direct/Indirect Effects	Negligible	Negligible	Negligible	Negligible
	Cumulative Effects	Negligible contribution			

COLOR KEY

	Negligible effect
	Negligible to minor adverse effect
	Minor adverse effect
	Minor to moderate adverse effect
	Major adverse effect
	Moderate beneficial effect
	Major beneficial effect

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This PEIS addresses research and enhancement permit activities that are proposed in the foreseeable future. The process for preparing research and enhancement permit applications and how they would be reviewed for NEPA compliance using this PEIS is detailed in Chapter 5.

Proposed research and enhancement permit activities identified and analyzed within Alternative 3 (Preferred) will be subject to NEPA compliance review on a regular basis to determine whether activities conducted are within the scope of activities analyzed in this PEIS. Proposed research and enhancement permit activities not identified and analyzed in Alternative 3 (Preferred) will be subject to a separate NEPA compliance review, the level of which will be determined when an application is submitted.

Monitoring Plans for the Two-Stage Translocation Process

The proposed two-stage translocation strategy is an option included in Alternatives 3 (Preferred) and 4, with Alternative 4 allowing the additional option of temporary translocation of NWHI pups to the MHI. For both of these alternatives, two-stage translocation is aimed at improving juvenile Hawaiian monk seal survival.

A multitude of variables exist that contribute to uncertainty of outcomes, thus the translocation program would be monitored and guided by a complex and adaptive decision framework described in Appendix F and summarized in Section 5.2.

Many of the inputs to the decision framework rely on monitoring key indicators such as population status, juvenile survival rates, and results from previous translocations. At various points in the decision framework, researchers would use a computer model (called a stochastic simulation model) updated with the most recent seal population data to estimate the likely range of benefits associated with different choices (that is, different source sites and nursery sites, or different numbers of seals). Existing survival and age/sex structure information will be the primary basis for determining when to conduct translocations and between which subpopulations. Public input would also play

a role in deciding the most appropriate release sites if translocations were done from the NWHI to the MHI (under Alternative 4). Continued monitoring of both translocated and non-translocated individuals will provide the basis for project evaluation, informing the subsequent steps and reducing uncertainties of simulations.

Plan for the Vaccination Process

The proposed vaccination program is somewhat unique among the actions in this PEIS because it is designed to address a potential, rather than a realized, threat to the Hawaiian monk seal. There is great potential for infectious disease to have devastating effects on the species. Morbillivirus and West Nile virus are two viral diseases, with available vaccines, that pose a potential threat to monk seals.

The proposed vaccination activities (detailed in Appendix E) for Hawaiian monk seals involve two primary elements as follows:

1) Continue research to test these vaccines on captive seals, confirm the vaccines' safety, and determine whether the expected immune response occurs by following up with blood tests; and
2) Be prepared with response plans should a "trigger" occur (for example, a case of morbillivirus in a wild monk seal). Even in the case of such a response, vaccinations would be initially limited to the population perceived to be at immediate risk, and would be expanded only after confirmation of safety and efficacy.

Prophylactic (preventative) vaccination may be considered in the future, but only after careful and conservative testing indicates that such an approach would be safe and effective.

Plan for Development of a Behavior Modification Program

Chapter 2 includes a description of a variety of aversive and disruptive (noise, visual, tactile, etc.) stimuli that may be considered for behavioral modification. Behavioral modification techniques will be applied only in situations where wild seals are beginning to regularly demonstrate behaviors that put themselves or humans at risk. Some examples include (but are not limited to): regularly interacting with snorkelers, divers or other ocean users; or regularly interacting with fishermen or fishing gear. The behavior modification program will employ a graduated approach, with escalating levels of aversive stimuli or deterrents (or positive stimuli to redirect behavior) delivered in response to increasing persistence or aggression on the part of the seal.

Mitigating Potential Impacts to Cultural Resources and Historic Properties

NMFS intends to implement activities or mitigation measures (described in Chapter 5) that are specifically designed to mitigate potential adverse impacts to historic and cultural properties. This includes coordination with the Hawai'i

State Historic Preservation Division (SHPD), which is currently updating its Geographic Information System (GIS) database of historic properties located within the MHI. This database will show the exact location of all historic properties for which accurate location coordinates are available. The SHPD GIS database can serve as a useful tool in planning Hawaiian monk seal recovery actions so as to avoid impacting known historic properties. NMFS staff and volunteers conducting monk seal recovery actions will also receive training as needed in the recognition and avoidance of archaeological and cultural sites.

NMFS will further develop a protocol for dealing with the removal of Hawaiian monk seals if they enter traditional fishponds. This protocol would involve consultation with the landowner and/or kahu (caretaker) of the pond, SHPD, local Native Hawaiian Organizations (if appropriate), and other appropriate entities to plan and coordinate the safe removal of the monk seal in a manner that would have the least impact on the structural integrity of the fishpond.

Finally, in the NWHI, permits are required for access to conduct Hawaiian monk seal research and enhancement activities within the limits of the Monument. Any activities associated with monk seal recovery actions undertaken within the NWHI must therefore comply with Monument regulations and the terms and conditions of Presidential Proclamation 8031. Monument regulations state that "permittees [must] attend a cultural briefing on the significance of Monument resources to Native Hawaiians" and that there are "prohibitions against the disturbance of any cultural or historic property" (NOAA 2008b).

Coordination with Stakeholders and Communities

NMFS intends to further develop and maintain close coordination with key stakeholders, community members, and partners to facilitate implementation of the proposed recovery actions. Ocean-oriented stakeholders and community members, such as fishers, surfers, Native Hawaiian practitioners, coastal property managers, etc., are among those most likely to encounter monk seals or most likely to have unique knowledge or experience that would be useful for successful implementation of the proposed activities in the MHI. Government agency and non-government organizations have been, and will continue to be, essential partners in successful recovery action implementation. Chapter 5 summarizes community-based programs NMFS has or will support to the maximum extent possible and discusses how these or similar programs could facilitate implementation of the proposed recovery actions.

NMFS manages the Marine Mammal Response Network in Hawai`i in partnership with several government and non-government partners, and with oversight and authorization from the NMFS National Marine Mammal Health and Stranding Response Program. The network is comprised of island-based response coordinators who oversee the activities of numerous volunteers and partner agency staff. The network responds to monk seals reported as sick, injured, entangled or hooked in the MHI. The network also responds to

"routine" monk seal haulouts and conducts outreach and education activities at schools and community events.

NMFS convened a Hawaiian Monk Seal Recovery Team to support development of the revised Hawaiian Monk Seal Recovery Plan (2007), and is convening a new recovery team to support implementation of the revised recovery plan, including implementation of research and enhancement actions proposed in this PEIS. The role of the new recovery team will be to advise NMFS on a variety of matters concerning the conservation and recovery of the endangered Hawaiian monk seal.

NMFS is developing a MHI Hawaiian Monk Seal Management Plan that will include roles for NMFS and partner government agencies, as well as non-government organizations, communities, and individual stakeholders. The MHI Management Plan will include an Outreach Plan, with the goal to inform citizens and thus enable them to think critically, and make decisions based on sound science and cultural information, about Hawaiian monk seals to facilitate monk seal population recovery. As part of the development of the outreach strategies related to the MHI Management Plan, significant input will be obtained from partners, stakeholders, and other individuals with expertise in conservation outreach and education.

Subject to available funding, the NMFS Pacific Islands Regional Office has and will continue to solicit competitive applications for partnerships supporting activities related to Hawaiian monk seal recovery, in particular activities related to recovery in the MHI. NMFS anticipates that priority will continue to be given to community-based and community- integrated projects or projects with an educational or outreach component geared to elevate public awareness and build capacity from the community level for Hawaiian monk seal recovery.

To support activities proposed in Alternative 3 (Preferred), coordination with community members should continue to draw on extensive two-way communication and information sharing between NMFS and the key stakeholders and community members as discussed above. This would be facilitated by continuing and expanding programs, such as those discussed above, that entail participatory planning and implementation, education and outreach, and other interactive and participatory activities.

ES-8.0 NEXT STEPS

This executive summary is a synopsis of the contents of the Final PEIS for Hawaiian Monk Seal Recovery Actions. Comments received during the public comment period were reviewed and considered when developing this Final PEIS.

Approximately one month after the release of this Final PEIS, NMFS will publish a notification in the *Federal Register* announcing the issuance of the Record of Decision to the public. This decision document will conclude the NEPA process on the proposed action. For updates on the Record of Decision, please visit the NMFS project website at: http://www.nmfs.noaa.gov/pr/permits/eis/hawaiianmonkseal.htm.

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NMFS) is the Federal agency responsible for management of Hawaiian monk seals, under the Endangered Species Act (ESA) (16 United States Code [U.S.C.] 1531 *et seq*.) and the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1361 *et seq*.). NMFS funds, permits, and conducts research and enhancement activities on Hawaiian monk seals in the Northwestern Hawaiian Islands (NWHI) and Main Hawaiian Islands (MHI). The Hawaiian monk seal population has experienced a prolonged decline. In 1976, NMFS listed Hawaiian monk seals as "endangered" under the ESA (41 Federal Register [FR] 51611) and "depleted" under the MMPA. The most recent (2010) best estimate of total abundance is 1,212 seals (Carretta *et al.,* 2013). A detailed description of Hawaiian monk seals is included in Section 3.3.1.

As required under Section 4 of the ESA, NMFS published a Recovery Plan for the species in 1983, which was revised in 2007. Numerous threats to the survival of Hawaiian monk seals are identified in the Recovery Plan including, but not limited to, starvation, predation of pups by sharks, entanglement in marine debris, and threatened terrestrial habitat due to sea level rise. Low juvenile survival over the past two decades is the primary cause of the population's decline. There is insufficient recruitment into the breeding population, and the population decline will likely continue without intervention. Potential disease outbreaks could be devastating to the population. Enhancement activities are being considered to improve juvenile survival and the overall health of the population.

NMFS administers funds that have been designated by Congress and allocated within NMFS' annual budget for the purpose of implementing recovery actions on Hawaiian monk seals. Using these funds, NMFS implements various management, research, and enhancement activities for recovery of the species.

The intent of this Programmatic Environmental Impact Statement (PEIS) is to evaluate, in compliance with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.) and the NOAA Administrative Order (NAO) 216-6, the potential direct, indirect, and cumulative impacts on the human environment of the alternative approaches to implementing recovery actions, including research and enhancement activities and the subset of actions requiring permits, under the Hawaiian monk seal recovery program.

1.2 PURPOSE AND NEED FOR ACTION

The purpose of implementing recovery activities (research and enhancement) for Hawaiian monk seals is to promote the recovery of the species population to levels at which ESA protection is no longer needed. Section 4(f) of the ESA (15 U.S.C. 1533(f) requires the development and implementation of recovery plans, except where such plans will not promote the conservation of the species. The proposed activities in this PEIS have been identified as recovery actions in the Hawaiian Monk Seal Recovery Plan (NMFS 2007).

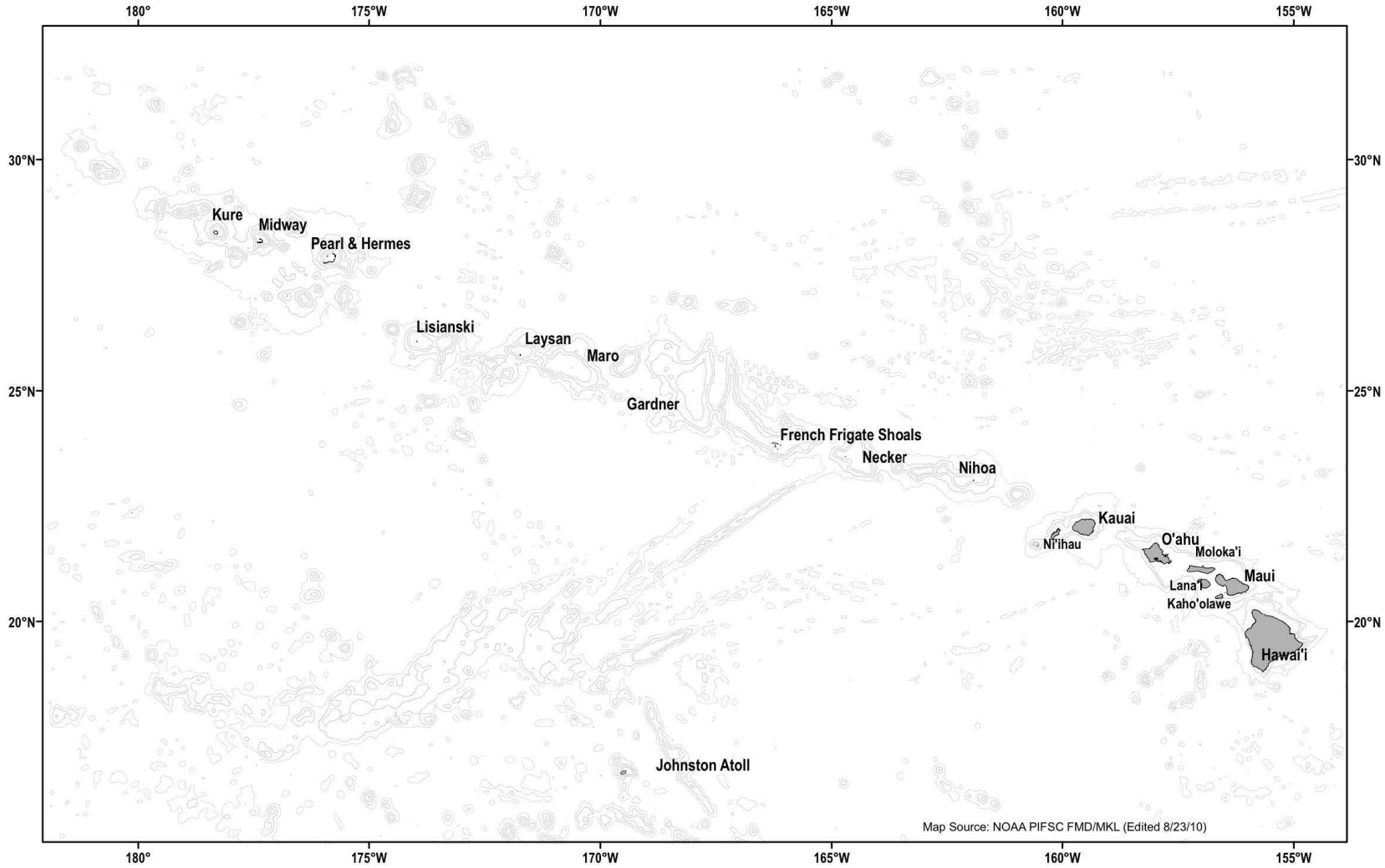
The need for this action is rooted in fundamental biological and ecological factors that are now limiting the population. A comprehensive research program enables NMFS to recognize, and possibly quantify, factors limiting the population in order to designate appropriate actions to minimize human-induced impacts and other factors affecting seal survival. Data and analyses derived from research lead to improved decision-making, and strategic management and enhancement activities that promote population recovery, prevent harm, and avoid jeopardy or continued disadvantage to the species as required under the ESA. Research and monitoring will continue to play a key role in determining whether enhancement activities achieve their desired outcomes.

1.3 DESCRIPTION OF THE PROJECT AREA

The Project Area for this PEIS encompasses the range where Hawaiian monk seals are found throughout the Hawaiian Archipelago including the NWHI, MHI and Johnston Atoll (Figure 1.3-1). More specifically, the Project Area includes portions of the open ocean and nearshore environment where monk seals may be found as well as the shorezone of the islands, islets and atolls that make up the Hawaiian Archipelago and Johnston Atoll. For the purposes of this project, the shore zone generally includes those terrestrial areas 5 meters (m) inland from the line where the shore meets the sea. In addition, secondary use areas, such as research field camps in the NWHI, are also considered for inclusion in the analysis.

In the NWHI, monk seals have six main reproductive sites including Kure Atoll, Midway Atoll, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and French Frigate Shoals. Necker and Nihoa Islands have smaller breeding sub-populations, and monk seals have been observed at Gardner Pinnacles and Maro Reef. Monk seals are also found throughout the MHI where the population appears to be increasing (NMFS 2007). A more detailed description of the distribution of monk seals is provided in Section 3.3.1.

Figure 1.3-1 Project Area Map



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1.4 *CURRENT RESEARCH AND ENHANCEMENT AND ASSOCIATED PERMITS*

MMPA-ESA Permit No. 10137 (as amended) issued to the NMFS Pacific Islands Fisheries Science Center (PIFSC) authorizes research and enhancement activities on Hawaiian monk seals as summarized below.

The PIFSC is authorized to undertake the following activities annually through June 2014 when the permit will expire:

- **Harassment takes**[1] at any location in the Hawaiian Archipelago and Johnston Atoll for research and enhancement purposes:
    - **Monitoring**: 1,440 seals of any age/sex may be closely approached for monitoring activities via ground, aerial or vessel (includes photo-ID and unmanned aerial and amphibious vehicles, installation/maintenance of remote camera systems);
    - **Incidental harassment**: 200 seals of any age/sex may be incidentally disturbed during all other research and enhancement activities; and
    - **Bleach marking**: 1,315 seals may be approached and bleach marked.
- **Capture takes**[1] at locations specified for each activity:
    - **Flipper tagging for population monitoring**: 556 seals of any size or sex except lactating females and nursing pups may be captured, restrained, flipper and Passive Integrated Transponder (PIT) tagged, measured, and flipper plugs sampled; this includes retagging; locations include Hawaiian Archipelago and Johnston Atoll.

[1] Take as defined in the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to do any of those things. Take as defined in the MMPA means to harass, hunt, capture, kill or attempt to do any of those things. Harassment is further defined in the MMPA as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment), or that 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 but which does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment).

- **Sonic tags for monitoring shark predation**: up to 35 weaned pups at French Frigate Shoals may have sonic tags applied, concurrent with and on a flipper tag, annually for up to three years.
- **Health screening and foraging instrumentation research**: 70 healthy seals and 30 unhealthy seals of any age/sex excluding lactating females with pups and nursing pups may be captured, restrained, sedated, sampled for health and disease screening (swabs, blood, blubber biopsies, whisker sampling), measured, weighed, ultrasound measurements taken, and flipper and PIT tagged if necessary; of the healthy seals, 60 may also be instrumented with external telemetry/tracking devices; location is the Hawaiian Archipelago.
- **Translocation for enhancement**: immature seals may be translocated as follows:
    - 20 nursing pups of either sex that are abandoned or have been switched between two lactating females may be captured, restrained by hand or net, and relocated to a prospective foster mother or their natural mother, respectively; multiple attempts may occur to successfully unite pups with appropriate mothers; locations include the Hawaiian Archipelago and Johnston Atoll.
    - 35 weaned pups of either sex may be captured, restrained by hand or net, sedated, sampled for health and disease screening, instrumented, and relocated via boat, vehicle or aircraft from a high risk area (*e.g.*, known shark predation) to a low risk area within the same island or atoll in the NWHI or Johnston Atoll; translocations in the MHI may be to a different location on the same island or to a different island in the MHI; locations include the Hawaiian Archipelago and Johnston Atoll.
    - 6 weaned pups in subpopulations where juvenile survival is low may be translocated to subpopulations with higher rates of juvenile survival; seals may only be translocated among subpopulations within the NWHI.
- **De-worming research**: 200 seals of either sex, up to age 3 years, may be captured, weighed, treated for intestinal parasites, and have ultrasound measurements taken; treatment animals may include those captured for health assessments or foraging studies; location is the Hawaiian Archipelago, although the preponderance of activities occurs in the NWHI.
- **Disentanglement/de-hooking for enhancement**: as warranted, seals may be disentangled and de-hooked to prevent injury or death; location is the Hawaiian Archipelago and Johnston Atoll.

- **Specimen collection and import/export for research**: necropsies may be performed on all carcasses; samples (molt, scat, spew, urine, placentae) may be collected opportunistically from beaches; samples may be exported and re-imported for analysis (worldwide); location of necropsies and sample collection is the Hawaiian Archipelago and Johnston Atoll. After necropsy, tissue may be used as bait to mitigate shark predation when conducting permitted shark removals.

The following activities are authorized in the Hawaiian Archipelago and at Johnston Atoll over the 5-year duration of the permit (valid through June 2014):

- **Adult male removal for enhancement**: 10 adult males may be translocated, removed into permanent captivity, or euthanized to enhance survival of immature animals and adult females.
- **Euthanasia for research**: 10 moribund seals of any age/sex may be humanely euthanized or die incidental to handling during health assessments.
- **Incidental mortality during research and enhancement activities**: 4 incidental mortalities may occur during research and enhancement activities over 5 years, with no more than 2 occurring in a single year.

MMPA-ESA Permit No. 932-1905/MA-009526 issued to the NMFS Marine Mammal Health and Stranding Response Program (MMHSRP) authorizes enhancement activities on wild monk seals and research and enhancement activities on captive and rehabilitating monk seals through June 2014; an amendment to extend the duration of the permit to June 2015 is in-process.

The following is authorized under the MMHSRP permit, as warranted, to respond to emergencies. Note: the term "emergencies" generally refers to health emergencies involving marine mammals and includes, but is not limited to, stranding events, entanglements, disease outbreaks, and exposure to biotoxins.

- Response (including ground, aerial and vessel surveys), rescue, rehabilitation, and release of stranded seals;
- Health-related research on captive and rehabilitating seals (excluding vaccination research); and
- Hazing or translocating seals away from imminently harmful situations.

Certain activities authorized under PIFSC Permit No. 10137 are also authorized under the MMHSRP permit. These include, but are not limited to:

- Disentanglement/de-hooking;
- Euthanasia of moribund seals;
- Incidental harassment and incidental mortality; and

- Specimen collection (*e.g.*, necropsies).

Coordination between PIFSC and the MMHSRP for activities authorized under both permits is discussed in Section 1.9.3.

1.5 FEDERAL LAWS AND ASSOCIATED PERMITS AND AUTHORIZATIONS APPLICABLE TO HAWAIIAN MONK SEAL RESEARCH AND ENHANCEMENT ACTIVITIES

This section summarizes federal laws applicable to Hawaiian monk seals research and enhancement activities, and federal permits, licenses, approvals, and consultation requirements for implementing the Preferred Alternative (Alternative 3).

1.5.1 National Environmental Policy Act

NEPA (42 U.S.C. 4321 *et seq*.) requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. NEPA is applicable to "major" federal actions affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted or approved by a federal agency. NMFS' issuance of research and enhancement permits represents federal approval and regulation of activities. Federal funding is necessary for the PIFSC to conduct the recovery actions. Procedural requirements under NEPA are provided in the Council on Environmental Quality's (CEQ) implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508).

NMFS has, through NAO 216-6, established agency procedures for complying with NEPA and implementing regulations issued by the CEQ. NAO 216-6 specifies that issuance of scientific research permits under the MMPA and ESA is among a category of actions that are generally exempted (categorically excluded) from further environmental review, except under extraordinary circumstances.

When a proposed action that would otherwise be categorically excluded is the subject of public controversy based on potential environmental consequences, has uncertain environmental impacts or unknown risks, establishes a precedent or decision in principle about future proposals, may result in cumulatively significant impacts, or may have an adverse effect upon endangered or threatened species or their habitats, preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required. NMFS is preparing a PEIS for the proposed action, as further discussed in Section 1.6.

1.5.2 *Endangered Species Act*

The ESA (16 U.S.C. l53l *et seq*.) was established to conserve and protect threatened and endangered species. Section 2 of the ESA sets forth the purposes and policy of the Act, which include providing a means to conserve endangered and threatened species' ecosystems and providing programs for the conservation of such species. It is the policy of the ESA that all federal agencies must seek to conserve threatened and endangered species and use their authorities to further the purposes of the ESA.

Section 4(f) of the ESA requires NMFS to develop and implement a recovery plan for the conservation and survival of this critically-endangered species. NMFS' proposed action includes implementation of recovery actions identified in the Hawaiian Monk Seal Recovery Plan (NMFS 2007), with the goal of conserving and recovering the species.

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the United States Fish and Wildlife Service [USFWS]) for federal actions that "may affect" a listed species or adversely modify critical habitat. NMFS' issuance of a permit and carrying out research and enhancement activities affecting ESA-listed species or designated critical habitat, directly or indirectly, are federal actions subject to these consultation requirements. NMFS is required to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species. Such determinations must be made using the best scientific and commercial data available. Regulations specifying the procedural requirements for these consultations are found at 50 CFR Part 402.

Appendix A includes correspondence regarding consultation under Section 7 of the ESA for effects to NMFS and USFWS species. Each agency completed Biological Opinions. NMFS concluded in its Biological Opinion that the implementation of the proposed program and issuance of the permit is not likely to jeopardize the continued existence of the Hawaiian monk seal or result in the adverse modification or destruction of its critical habitat (NMFS 2014). The USFWS concluded in its Biological Opinion that implementation of the proposed action would not likely jeopardize the continued existence of Laysan finch (*Telespyza cantans*) (USFWS 2014). No critical habitat has been designated for this species; therefore, none will be affected (USFWS 2014).

Section 9 of the ESA prohibits the take of endangered and threatened species unless a lawful exception is made, such as by issuance of a permit.

Under Section 10(a)(1)(a) of the ESA, NMFS may grant permits to take ESA-listed species for scientific purposes or for the purpose of enhancing the survival of the

species. In consideration of the ESA's definition of conserve, which indicates an ultimate goal of bringing a species to the point where listing under the ESA is no longer necessary (for example, the species is recovered), permits issued pursuant to Section 10 of the ESA must be for activities that are likely to further the conservation of the affected species. The NMFS PIFSC applied for a scientific research and enhancement permit (File No. 16632) pursuant to Section 10(a)(1)(A) of the ESA to carry out activities described in Alternative 3 (Preferred). Public notice of receipt the application for a new 5-year permit was published in the *Federal Register* on March 1, 2013 for a 45 day comment period (78 FR 13863).

NMFS' regulations implementing the permit provisions of the ESA can be found at 50 CFR Part 222. Regulations specifying requirements for issuance of ESA scientific research and enhancement permits are found at 50 CFR 222.308. According to 50 CFR 222.308(b), permits for endangered marine mammals must be issued according to MMPA regulations (50 CFR Part 216).

Section 10(d) of the ESA requires that, for NMFS to issue permits under Section 10(a)(1)(A) of the ESA, the Agency must find that the permit:

- Was applied for in good faith;
- If exercised will not operate to the disadvantage of the species; and
- Will be consistent with the purposes and policy in Section 2 of the ESA.

Section 11(a)(3) of the ESA states that "no civil penalty shall be imposed if it can be shown by a preponderance of the evidence that the defendant committed an act based on a good faith belief that he was acting to protect himself or herself, a member of his or her family, or any other individual from bodily harm, from any endangered or threatened species" (U.S. Code, Title 16, Chapter 35, §1540 (a)(3)).

1.5.3 Marine Mammal Protection Act

The MMPA (16 U.S.C. 1361 *et seq*.) prohibits takes of all marine mammals in the United States (U.S.) (including territorial seas) with few exceptions. Permits for *bona fide*[2] scientific research on marine mammals and permits to enhance the

[2] The MMPA defines bona fide research as "scientific research on marine mammals, the results of which – (A) likely would be accepted for publication in a refereed scientific journal; (B) are likely to contribute to the basic knowledge of marine mammal biology or ecology; or (C) are likely to identify, evaluate, or resolve conservation problems."

survival or recovery of a species, issued under Section 104 of the MMPA, are two such exceptions. The NMFS PIFSC has applied for a scientific research and enhancement permit (File No. 16632) pursuant to Section 104 of the MMPA [and Section 10(a)(1)(A) of the ESA] to carry out activities described in Alternative 3 (Preferred). As noted above, public notice of receipt the application was published in the *Federal Register* on March 1, 2013 (78 FR 13863).

NMFS' Office of Protected Resources (OPR) issues permits for research and enhancement of Hawaiian monk seals. These permits must specify:

- The number and species of marine mammals authorized to be taken or imported;
- The manner (for example, methods, including but not limited to, capture, care, and transportation), location, and duration of the activities; and
- Any other terms or conditions NMFS deems appropriate.

Applications for MMPA permits must be reviewed by the Marine Mammal Commission (MMC). NMFS may issue a permit under Section 104 of the MMPA if the activities are consistent with the purposes of the MMPA and applicable regulations at 50 CFR Part 216. NMFS must also find that the manner of taking is "humane"[3] as defined in the MMPA. If lethal taking of a marine mammal is requested, the applicant must demonstrate that using a non-lethal method is not feasible. For depleted species such as Hawaiian monk seals, NMFS must also determine activities resulting in lethal take will directly benefit the species or otherwise fulfill a critically important research need. Persons permitted to take marine mammals must submit reports on activities undertaken each year.

Under Section 104 of the MMPA, a permit may be issued for enhancing the survival or recovery of Hawaiian monk seals if the activity:

- Is likely to contribute significantly to maintaining or increasing distribution or numbers necessary to ensure the survival or recovery of the species; and
- The activity is consistent with the Hawaiian monk seal recovery plan (NMFS 2007).

Regulations specifying general issuance requirements for permits issued under Section 104 of the MMPA (50 CFR 216.34) and specific requirements for issuance

[3] The MMPA defines humane in the context of taking a marine mammal, as "that method of taking which involves the least possible degree of pain and suffering practicable to the mammal involved."

of scientific research and enhancement permits (50 CFR 216.41) are included in Section 2.11.

Section 109(h) of the MMPA authorizes Federal, State and local government employees, or NMFS Stranding Agreement holders, to take a marine mammal in a humane manner (including euthanasia) if it is for:

- The protection or welfare of the individual animal;
- The protection of public health and welfare; or
- The nonlethal removal of nuisance animals.

NMFS regulations implementing MMPA Section 109(h) are found at 50 CFR 216.22 and 50 CFR 216.27. For threatened and endangered marine mammals, an ESA Section 10(a)(1)(A) enhancement permit is also required to undertake such activities. Therefore, such activities on ESA-listed species must be consistent with the ESA and carried out to enhance the survival of the species.

Also under the MMPA, it is not unlawful for persons to use NMFS-approved methods to deter a marine mammal from endangering personal safety [Section 101(a)(4)(A)] or take a marine mammal if imminently necessary in self-defense or to save the life of a person in immediate danger [Section 101(c)].

1.5.4 National Historic Preservation Act

The goal of the National Historic Preservation Act (NHPA) (16 U.S.C. 470 *et seq.*) is to empower Federal agencies to act as responsible stewards of U.S. cultural resources when agency actions affect historic properties. The NHPA established the Advisory Council on Historic Preservation (ACHP), an independent Federal agency that promotes the preservation, enhancement, and productive use of our nation's historic resources, and advises the President and Congress on national historic preservation policy. The NHPA also authorized the Secretary of the Interior to expand and maintain a National Register of Historic Places composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture.

Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In carrying out their responsibilities under Section 106, NHPA requires that Federal agencies consult with Indian tribes and Native Hawaiian Organizations that attach traditional religious and cultural significance to eligible or listed historic properties that may be affected by the agency's actions. The intent of the consultation is to identify historic properties potentially affected by the undertaking and to seek ways to avoid, minimize, or mitigate any adverse effects

on those properties.

The Federal Code that implements the NHPA (36 C.F.R. §§ 800 *et seq*.) specifies the process for Section 106 consultation. The provision for consultation required under Section 106 applies when a project 1) includes a federal or federally licensed action, and 2) the action has the potential to affect properties that are listed in or are eligible for listing in the National Register of Historic Places.

NMFS has determined that the proposed Federal agency actions to recover the Hawaiian monk seal have the potential to affect listed or eligible historic properties. In fulfilling its responsibilities under Section 106 of the NHPA NMFS undertook a program of consultation with Native Hawaiian Organizations (NHO) and individuals that attach traditional religious and cultural significance to eligible or listed historic properties that have the potential to be affected by the undertaking associated with monk seal recovery as outlined in this PEIS. The intent of the consultation was to identify historic properties potentially affected by the undertaking and to seek ways to avoid, minimize, or mitigate any adverse effects on those properties.

The NHPA Section 106 consultation was completed in compliance with the NHPA and a determination of no historic properties affected was made. NMFS completed a separate document (Appendix B), describing the results of the Section 106 consultation process. This document was sent to the Hawaii State Historic Preservation Officer (SHPO) on November 12, 2013 (see Appendix A). No response was received from SHPO. On November 14, 2013, NMFS made the report available to the public, via its website: http://www.fpir.noaa.gov/PRD/prd_hms_how_noaa_helps.html#hms_management. The document describing the NHPA 106 process (Appendix B) was also sent to all consulting parties on November 19, 2013.

1.5.5 *Magnuson-Stevens Fishery Conservation and Management Act*

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the MSFCMA offer resource managers a means to accomplish the goal of giving heightened consideration to fish habitat in resource management. NMFS OPR is required to consult with NMFS Office of Habitat Conservation for any action it authorizes (such as, research permits), funds, or undertakes, or proposes to authorize, fund, or undertake that may adversely affect EFH. This includes renewals, reviews or substantial revisions of actions.

NMFS has determined that the proposed activities will not affect designated EFH. Activities described in the alternatives are directed at Hawaiian monk seals and do not affect fish habitat. The activities do not involve alteration of substrate as no activities that could affect substrate, such as trawling, would occur. No other interactions with physical features of ocean and coastal habitat that could affect EFH would occur during research and enhancement activities.

1.5.6 Coastal Zone Management Act

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 *et seq*.) to protect the coastal environment from growing demands associated with residential, recreational, commercial and industrial uses (such as, State and Federal offshore oil and gas development). Coastal states with an approved Coastal Zone Management Plan, which defines permissible land and water use within the state's coastal zone, can review Federal actions, licenses or permits for "Federal consistency." Federal consistency is the requirement that those Federal permits and licenses likely to affect any land/water use or natural resources of the coastal zone be consistent with the State program's enforceable policies.

The State of Hawai`i law for implementing the federal CZMA is Hawai`i Revised Statutes (HRS) 205A: Coastal Zone Management. The following state enforceable policies are potentially applicable to the activities in Alternative 3 (Preferred):

- HRS 195D and HAR 13-124: Conservation of Aquatic Life, Wildlife, and Land Plants (endangered species);
- HRS Chapter 6E: Historic Preservation; and
- HRS 342D and HAR 11-54: Water Pollution and Water Quality Standards.

Implementation of any of the alternatives would be conducted in a manner consistent with Hawaii's Coastal Zone Management Program in accordance with Section 307(c)(1) of the CZMA. A letter to this effect was sent to the State of Hawaii for comment on April 8, 2013 and a response was received on April 16, 2013 (see Appendix A). In the letter received on April 16, 2013, the Hawaii CZM Program indicated they would not be responding to the NMFS coastal consistency determination for the proposed activities due to the preemption of Hawaii CZM enforceable policies that are relevant to the taking of marine mammals.

1.5.7 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) (32 U.S.C. 1431 *et seq*.) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance. The National Marine Sanctuary Program, operating under the NMSA and administered by NOAA's National

Ocean Service (NOS) has the authority to issue special use permits for research activities that would occur within a National Marine Sanctuary. Obtaining special use permits is the responsibility of individual researchers. However, as a courtesy, the NMFS OPR consults with NOS when proposed permitted activities would occur in or near a National Marine Sanctuary. The NMFS OPR sent a copy of the PIFSC permit application (File No. 16632) to NOS during the public comment period (78 FR 13863) and no comments were received from NOS.

1.5.8 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) was enacted to ensure protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, of any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit. The responsibilities of Federal agencies to protect migratory birds are set forth in Executive Order 13186 (see below). USFWS is the lead agency for migratory birds. The USFWS issues permits for takes of migratory birds for activities such as scientific research, education, and depredation control, but does not issue permits for incidental take of migratory birds. Thus, no MBTA permits are necessary.

1.5.9 Convention on International Trade in Endangered Species of Wild Fauna

The Convention on International Trade in Endangered Species (CITES) is an international agreement between governments with the goal of ensuring international trade in specimens of wild animals and plants does not threaten their survival. All import, export, re-export and introduction from the sea of species covered by CITES must be authorized through a licensing system. In the U.S., the USFWS is the Management Authority for CITES. Obtaining CITES permits from the USFWS is the responsibility of individual researchers prior to import or export of CITES-listed species.

1.5.10 Animal Welfare Act

The Animal Welfare Act (AWA) (7 U.S.C. 2131–2156) sets forth standards and certification requirements for the humane handling, care, treatment and transportation of mammals. Each research facility is required to establish an Institutional Animal Care and Use Committee (IACUC), which reviews study areas and animal facilities for compliance with the AWA standards. The IACUC also reviews research protocols and provides written approvals for those that comply with AWA requirements. Enforcement of these requirements for non-federal facilities is under jurisdiction of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service. For federal research facilities, the head of the federal agency is responsible for ensuring compliance with the AWA

requirements. It is the responsibility of researchers to seek and secure IACUC reviews and approvals for their research and adhere to other requirements of the AWA related to care and transport of marine mammals. NMFS researchers applying for permits must submit with a permit application verification of IACUC approval and the protocols reviewed by the IACUC. The NMFS PIFSC submitted with their permit application File No. 16632 such verification. Additional information on IACUC requirements is provided in Section 2.11.7.

1.5.11 Administrative Procedure Act

The Administrative Procedure Act (APA) (5 U.S.C. 551 *et seq*.) is the law under which federal regulatory agencies, including NMFS, create the rules and regulations necessary to implement and enforce major legislative acts such as the MMPA and ESA. The APA also provides for judicial review of agency final actions and regulations. Under the APA, courts may set aside agency actions as arbitrary and capricious, an abuse of discretion, unconstitutional, beyond statutory authority, unsupported by substantial evidence or unwarranted by the facts.

A decision by NMFS to issue or deny a permit is subject to judicial review based upon the administrative record. For this reason, NMFS maintains a thorough written record documenting the information reviewed and relied upon in making its conclusions, as well as a written record of the process by which the information was used.

1.5.12 Executive Orders

An Executive Order (EO) is an order having the force of law issued by the president of the U.S. to the army, navy, or other part of the executive branch of the government. An EO directs federal agencies in the execution of congressionally established laws or Executive policies. The following Presidential EOs are relevant to this analysis.

1.5.12.1 Executive Order 12898 - Environmental Justice

EO 12898 requires Federal agencies to consider the impacts of their actions on minority and low-income populations. Section 4.8.6 addresses such impacts.

1.5.12.2 Executive Order 13089 - Coral Reef Protection

EO 13089 requires Federal agencies whose actions may affect U.S. coral reef ecosystems to:

a. Identify their actions that may affect U.S. coral reef ecosystems;

b. Use their programs and authorities to protect and enhance the conditions of such ecosystems; and

c. To the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

Coral species in the project area are described in Section 3.3.7, and potential impacts from the various alternatives and mitigation to prevent impacts to these species are provided in Section 4.7.7.

1.5.12.3 *Executive Order 13112 - Invasive Species*

EO 13112 requires Federal agencies to use authorities to prevent introduction of invasive species, respond to and control invasions in a cost-effective and environmentally-sound manner, and to provide for restoration of native species and habitat conditions in ecosystems that have been invaded. Section 3.3.9 provides information on invasive species in the Hawaiian Archipelago relative to the proposed action and associated project area. Section 4.7.8 describes the potential effects of the various alternatives on introduction or spread of invasive species.

1.5.12.4 *Executive Order 13158 - Marine Protected Areas*

EO 13158 requires Federal agencies to identify actions that affect natural or cultural resources within marine protected areas (MPA). It further requires Federal agencies, in taking such actions, to avoid harm to the natural and cultural resources that are protected by an MPA. Section 3.4.11 describes the Papahānaumokuākea Marine National Monument in the NWHI, one of the world's largest MPAs. The effects of the various alternatives to the resources within the Monument are described in Chapter 4.

1.5.12.5 *Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds*

Several international, bilateral conventions on migratory birds, of which the U.S. is a co-signatory, impose substantive obligations on the U.S. for the conservation of migratory birds and their habitats. Through the MBTA, the U.S. has implemented these migratory bird conventions with respect to the U.S. This EO directs executive departments and agencies to take certain actions to further implement the MBTA. Section 4.7.6 discusses mitigation measures required for the conservation of migratory birds and their habitats.

1.6 *WHY A PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT IS NEEDED*

Research and enhancement activities on Hawaiian monk seals considered in this PEIS require NMFS funding, permitting and execution, all of which constitute federal actions requiring NEPA compliance. A PEIS is typically a broad-scale environmental evaluation that examines a program, such as Hawaiian monk seal recovery actions, on a program level as well as analyzing specific research and enhancement procedures. A PEIS may be used to evaluate an ongoing program and alternative directions that the program may take in the future.

To streamline the NEPA process and avoid repetition, the CEQ regulations encourage federal agencies to develop a tiered approach to their analyses (40 CFR 1502.20). For example, future research and enhancement activities would be evaluated, in part, based on the analyses presented in this PEIS. This allows subsequent Memorandums, Categorical Exclusions, EAs or EISs to incorporate much of the detailed analyses presented herein as a means of streamlining (40 CFR 1500.4[I]).

To satisfy NEPA, a Memorandum would be prepared for future research and enhancement activities that fall within the range of activities analyzed in this PEIS. Site-specific activities will be evaluated against the analyses presented herein for future NEPA compliance and the appropriate level of NEPA review will be completed accordingly, as described in Chapter 5. Should NMFS need to evaluate potential effects of a new procedure not currently analyzed in this PEIS, or a procedure that may need to be expanded on or modified, the agency would tier a Categorical Exclusion, EA, or EIS.

NMFS' own guidelines, NAO 216-6 Section 5.09a, state that "a programmatic environmental review should analyze the broad scope of actions within a policy or programmatic context by defining the various programs and analyzing the policy alternatives under consideration and the general environmental consequences of each (alternative)" (NOAA 1999).

1.7 *RELATED NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTS THAT INFLUENCE THE SCOPE OF THIS ENVIRONMENTAL IMPACT STATEMENT*

Section 1508.25 of CEQ's guidance on NEPA states that the scope of an individual EIS may depend on its relationship to other EAs or EISs and the evaluations considered therein. NEPA documents that have recently been published that influence the scope (in other words, issues considered) of this PEIS are described briefly in Table 1.7-1. To streamline the NEPA process and avoid duplication, pertinent information presented in these previous evaluations has been incorporated by reference where appropriate in this PEIS as cited. In

addition, the analysis of cumulative effects presented in Chapter 4 of this document includes the activities listed below.

Table 1.7-1 Related NEPA Documents That Influence the Scope of this PEIS

Title	Year	Issues Evaluated	Associated Permit (if applicable)
EA on Issuance of Permits for Research and Enhancement on Threatened and Endangered Captive Pinnipeds	2006	Issuance of scientific research and enhancement permits under Section 104 of the MMPA and Section 10(a)(1)(A) of the ESA to facilities maintaining captive ESA-listed pinnipeds. A Finding of No Significant Impact (FONSI) for research and enhancement activities was signed in 2006.	NMFS Permit Nos. 116-1786, 455-1760, 881-1745, 898-1764
EA on Issuance of a Permit for Field Research and Enhancement Activities on the Endangered Hawaiian Monk Seal	2009	Issuance of Permit No. 10137 to the NMFS Pacific Islands Fisheries Science Center Marine Mammal Research Program to conduct field research and enhancement activities on Hawaiian monk seals to support recovery efforts. A FONSI for research and enhancement activities was signed in 2009. Two supplemental EAs were prepared and FONSIs signed in 2010.	NMFS Permit 10137 as amended (Current Permit active through June 2014)
Programmatic Environmental Impact Statement on the Marine Mammal Health and Stranding Response Program	2009	NMFS national oversight and collaboration of the MMHSRP including the following activities specific to Hawaiian monk seals: • Response, rescue, rehabilitation, and release of stranded seals; • Health-related research on captive and rehabilitating seals (excluding vaccination research); and • Hazing or translocating seals away from imminently harmful situations; and • Translocation of MHI seals in imminent danger or otherwise for their protection. The Record of Decision for the MMHRP PEIS was signed in 2009. http://www.nmfs.noaa.gov/pr/health/eis.htm	NMFS Permit 932-1905

Title	Year	Issues Evaluated	Associated Permit (if applicable)
Environmental Assessment (EA) Issuance of Annual Conservation and Management Permits to NMFS PIFSC PSD and PIRO PRD for Conducting Hawaiian Monk Seal Conservation and Management Activities in PMNM	2012	NMFS PIFSC proposed action analyzed in this EA included (1) monitoring Galapagos sharks adjacent to seal pupping areas and (2) conducting fishing activities to lethally remove up to 18 Galapagos sharks observed near seal pupping areas. A FONSI for research activities to reduce shark predation was signed in 2012.	PMNM Permit 2013-017

1.8 *REQUIRED DECISIONS AND OTHER AGENCIES INVOLVED IN THIS ANALYSIS*

NMFS must decide if issuing permits and permit amendments for conducting research and enhancement on Hawaiian monk seals would be consistent with the purposes and policies of the MMPA, ESA, and their implementing regulations.

Although NMFS has sole jurisdiction for issuance of research and enhancement permits for Hawaiian monk seals, NMFS consults with the MMC, NOAA's NOS, the USFWS, and other pertinent federal and state agencies in reviewing permit applications. In addition, other agency permits for access to lands and waters around the Hawaiian Archipelago are required for Hawaiian monk seal research and enhancement and are subject to separate NEPA compliance. However, other agencies may also choose to formally adopt this PEIS by publishing a separate Record of Decision (ROD). If another federal or state agency adopts this PEIS, NMFS does not represent that this document satisfies state HRS Chapter 343 requirements. Section 1.5 provides an overview of permits, authorizations and consultations necessary for monk seal research and enhancement activities.

1.8.1 *Cooperating Agencies*

Lead agencies, such as NMFS, preparing a NEPA document are required to do so in cooperation with other federal, state, and/or local agencies with jurisdiction by law or with special expertise with respect to an environmental impact involved in the proposal (40 CFR 1508.5). Outside of the scoping process, this cooperation can be formalized between the lead agency and another agency with a Memorandum of Understanding that formalizes the cooperating agency status and responsibilities.

On September 14, 2010, NMFS invited the USFWS and the Hawai`i Department of Land and Natural Resources (DLNR) to be cooperating agencies in the PEIS

process. In a letter dated April 19, 2011, DLNR declined the invitation to be a cooperating agency. The USFWS also declined the invitation to be a cooperating agency. In correspondence with NMFS in the fall of 2011, USFWS stated "USFWS does not have, nor does it expect, any major concerns regarding either the process or the proposed work addressed in the PEIS." Cooperating agency correspondence is included in Appendix A.

1.8.2 Commenting Agencies

After release of the Draft PEIS in August 2011, an invitation to an Agency Meeting was provided to multiple federal, state and local agencies that were considered to have interest in the proposed action. This purpose of this meeting was to provide these agencies with an opportunity to comment on the document. The Agency Meeting was held at the NMFS PIRO offices September 12, 2010; 11 agency representatives attended (Table 1.8-1 Agency Meeting Attendees). Coordination with these agencies has continued throughout the PEIS process.

Agencies such as the United States Coast Guard (USCG) D14, USFWS, NOS including NOAA Sanctuaries, National Park Service (NPS), and others, dedicate resources each year to assisting NMFS in protecting Hawai`ian monk seals including coordinating with the Marine Mammal Stranding Response Network working under the MMHSRP permit when monk seals become entangled or stranded. The MMHSRP permit is separate from the research and enhancement permit analyzed in this PEIS, as described in Section 1.9.

Table 1.8-1 Agency Meeting Attendees

Agencies
Federal Agencies
NOAA Hawai`ian Islands Humpback Whale National Marine Sanctuary
NOAA National Ocean Service, Papahānaumokuākea Marine National Monument
U.S. Navy, Naval Facilities Engineering Command, Hawai`i
U.S. Navy, Pacific Fleet
Western Pacific Regional Fishery Management Council
State of Hawai`i Agencies
Department of Land and Natural Resources, Division of Aquatic Resources
Department of Health, Environmental Management Division
Department of Transportation, Harbors Division

1.9 NOAA ACTIONS NOT INCLUDED WITHIN THE SCOPE OF THIS PEIS

During public scoping meetings and public comment hearings, many stakeholders expressed confusion about whether monk seal critical habitat, NOAA Sanctuary actions or other NOAA initiatives in the Pacific Islands were part of this project. This section is provided to help clarify confusion about these projects. Each of the subsections in 1.9 references the cumulative impact assessment in Chapter 4 where these actions are considered in the analysis.

NOAA is currently undertaking other management actions within or near the Project Area that are not within the scope of this PEIS. While these projects are considered separate federal actions, the PEIS project team is coordinating with managers responsible for these other projects. This coordination allows NMFS to share information about the PEIS that may be pertinent to other projects as well as gain an understanding of how other activities may influence the decision-making process for Hawaiian monk seal research and enhancement actions. Descriptions of these other NOAA actions follow.

1.9.1 National Marine Fisheries Service Hawaiian Monk Seal Critical Habitat Revision

Critical habitat was originally designated in 1986 (51 FR 16047; April 30, 1986), and revised shortly thereafter in 1988 (53 FR 18988; May 26, 1988). The current revision uses new information, available since the 1988 designation, to describe monk seal habitat needs.

On July 9, 2008, NMFS received a petition to revise the Hawaiian monk seal critical habitat designation under the ESA to include additional areas in the NWHI and new areas in the MHI. In accordance with procedures outlined in the ESA (16 U.S.C. 1533), NMFS found that a revision was warranted and announced its intent to revise Hawaiian monk seal critical habitat on June 12, 2009 (74 FR 27988). Critical Habitat is defined under the ESA (16 U.S.C. 1532) and may include the following:

- Specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features essential to conservation, and which may require special management considerations or protection; and
- Specific areas outside the geographical area occupied by the species if the areas are determined essential for conservation.

On June 2, 2011 (76 FR 32026) NMFS proposed to revise critical habitat for the monk seal by extending the current designation in the NWHI and by designating new areas in the MHI. While critical habitat is essential to the recovery of the species, evaluation and subsequent revisions to habitat areas is considered a

federal action separate from research and enhancement activities covered in this PEIS.

Existing monk seal critical habitat is described in more detail as part of the environmental baseline (Chapter 3) and is evaluated as part of the cumulative effects assessment presented in Chapter 4. Additional information about the critical habitat revision process can be found at: http://www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/hawaiianmonkseal.htm.

1.9.2 *National Ocean Service Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Review*

The Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) was established in 1992 as a marine sanctuary to protect the winter breeding, calving and nursing range of the largest Pacific population of the endangered humpback whale (*Megaptera novaeangliae*). HIHWNMS is managed by the NOAA NOS, Office of National Marine Sanctuaries (ONMS), under the National Marine Sanctuaries Act (NMSA) in co-management partnership with the State of Hawai‘i DLNR. Additional information about the HIHWNMS is provided in Section 3.4.11.

The purposes and policies of the National Marine Sanctuaries Act (NMSA, 16 U.S.C. 1434(e)) requires NOAA to periodically review and evaluate the implementation of management plans and goals for each national marine sanctuary. Accordingly, NOAA must revise management plans and regulations as necessary to ensure that national marine sanctuaries continue to best conserve, protect, and enhance nationally significant living and cultural resources. The current management plan review began in 2010, and the process will result in a new management plan for the sanctuary. The management plan review process will help to evaluate gaps in existing marine conservation efforts in Hawai'i, and identify potential roles for the sanctuary in future management. The target for completing a draft revised management plan is late 2013, and a final revised plan is targeted for completion in 2014.

As part of the review process, Sanctuary management engaged the Sanctuary Advisory Council (SAC) for recommendations to address priority issues identified during a 90-day public scoping period that was held in summer of 2010. In January 2012, the SAC recommended that the HIHWNMS future management plan adopt an integrated approach to management that considers the entire ecosystem, including Hawaiian monk seals. The Sanctuary management will consider this and other recommendations in developing the revised management plan, with additional opportunities for public input. NMFS and the Sanctuary would coordinate closely on any issues related to Hawaiian monk seals. NMFS will continue to coordinate with the

HIHWNMS management review team to discuss details of the PEIS and Sanctuary Management Plan.

While HIHWNMS management changes are separate from actions considered in this PEIS, the HIHWNMS is located within the PEIS Project Area. Therefore, anticipated Sanctuary management changes will be considered as part of the cumulative effects assessment presented in Chapter 4 of this PEIS. Additional information about the HIHWNMS Management Plan revision can be found at: http://hawaiihumpbackwhale.noaa.gov/.

1.9.3 National Marine Fisheries Service Marine Mammal Health and Stranding Response Program

As discussed in Section 1.4, the NMFS MMHSRP currently has a permit (MMPA-ESA Permit No. 932-1905/MA-009526) for activities specifically related to marine mammal (including Hawaiian monk seal) health and stranding response. The PIRO Stranding Coordinator, working under the MMHSRP permit coordinates closely with PIFSC on Hawaiian monk seal research and enhancement activities to ensure efforts undertaken to protect seals are not duplicative and are in the best interest of seals. While information from the MMHSRP PEIS has been incorporated by reference, the scope of this PEIS does not include all stranding and response activities. Captive care is currently covered under the MMHSRP PEIS (http://www.nmfs.noaa.gov/pr/health/eis.htm) as a tool for rehabilitating seals that need medical assistance due to such things as entanglement, illness, or other injuries.

Vaccinations of seals, while in temporary captive care for rehabilitation under the MMHSRP permit, are proposed under Alternatives 3 and 4 in this PEIS to be conducted under the PIFSC research and enhancement permit. In addition, some seals kept in temporary captive care under the MMHSRP permit could receive supplemental feeding after they have been released from captivity. Post-release supplemental feeding would be covered under the research and enhancement activities proposed under Alternatives 3 and 4 of this PEIS. This PEIS analyzes quarantine and disease screening procedures necessary for some translocations.

In general, all response activities in the MHI for seals in need of protection or medical attention are carried out under the MMHSRP permit in coordination with PIFSC. However, if PIFSC is conducting health assessment research in the MHI and discovers a captured seal needs to have a hook removed, this could all be done under the PIFSC permit to minimize the need for a second capture. PIRO and PIFSC share resources (equipment and personnel) to accomplish rescues and conduct necropsies in the MHI under the MMHSRP permit. PIFSC currently conducts all disentanglements and necropsies in the NWHI under Permit No. 10137.

1.9.4 *National Marine Fisheries Service Hawaiian Monk Seal Community-Based Activities, Education and Outreach*

In addition to the recovery actions presented in this PEIS, NMFS will continue or initiate several community-based activities supporting monk seal recovery. These activities, which are described in more detail in Section 5.6, include:

- Engaging the Hawaiian Monk Seal Recovery Team, pursuant to the ESA, to obtain advice regarding recovery program development, implementation and evaluation from a wide variety of subject matter experts.
- Developing and implementing a strategic plan for managing monk seals in MHI using a community-based, participatory planning methodology.
- Developing and implementing an outreach plan designed to enhance public understanding and support for recovery actions through both overarching and specific outreach strategies.
- Supporting a grant program for partnership projects designed to enhance community participation in Hawaiian monk seal recovery.
- Developing and implementing additional program activities that incorporate community feedback into Hawaiian monk seal research and enhancement activities.

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2.0 ALTERNATIVES

2.1 INTRODUCTION

This chapter describes a reasonable range of alternatives that meet the purpose and need of the proposed action to implement recovery activities involving research and enhancement on Hawaiian monk seals. Evaluation of these proposed alternatives is presented in Chapter 4.

The National Marine Fisheries Service (NMFS) has, in accordance with guidance from the Council on Environmental Quality (CEQ) on implementing the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Part 1500), developed four alternatives for evaluation in this PEIS. These include the no action alternative as well as an array of activities involving various levels of research and enhancement on Hawaiian monk seals. According to CEQ, "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" (CEQ 1981). The four alternatives analyzed in this Programmatic Environmental Impact Statement (PEIS) were developed in light of this guidance.

Section 1502.14 of NEPA requires federal agencies to explore all reasonable alternatives including the alternative of no action. The no action alternative provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives. In addition to No Action (Alternative 2), NMFS has evaluated three other alternatives: Alternative 1 Status Quo (*e.g.,* what is currently permitted), Alternative 3 Limited Translocation (an expanded research and enhancement program with limited scope of seal translocations, and Alternative 4 Enhanced Implementation (same as Alternative 3 but with expanded scope of translocation).

As described in Section 2.4, and in line with CEQ guidance (40 CFR 1501.7), NMFS has considered comments received during the scoping period and public comment period on the Draft PEIS in determining the significant issues related to the proposed action to be considered during development of the alternatives presented herein.

2.2 RELATION OF ALTERNATIVES EVALUATED TO THE STATEMENT OF PURPOSE AND NEED

The alternatives evaluated in this PEIS must achieve the objectives of the proposed action as stated in the purpose and need (Section 1.2), without

violating federal environmental statutes and regulations described in Section 1.5. Thus, comparing the alternatives to the stated purpose and need, as well as technical and economic practicality and feasibility, serves as a means to filter alternatives that may be carried forward for detailed analysis. Any alternative that fails to meet the agency's purpose and need or federal environmental statutes and regulations, need not be carried forward for further consideration in the PEIS. NEPA states that for alternatives eliminated from detailed study in the PEIS, the agency must describe reasons for why alternatives were eliminated (Section 2.12). As previously stated, evaluation of the no action alternative is required in a PEIS (40 CFR 1502.14).

2.3 RELATION OF ALTERNATIVES TO THE RECOVERY PLAN

The Hawaiian Monk Seal Recovery Plan (NMFS 2007) provides guidance to the agency on specific information needs and actions that may contribute towards species recovery. The recovery plan serves as a guide only and does not commit the agency to the actions listed in the plan, nor does it bind the agency to only those activities listed as long as proposed activities may justifiably contribute towards species recovery. The research and enhancement priorities listed in the 2007 Hawaiian Monk Seal Recovery Plan provided a general framework for activities listed in the range of alternatives analyzed in this PEIS. For additional detail on the Hawaiian Monk Seal Recovery Plan, please refer to Section 3.3.1.8.

2.4 PUBLIC COMMENTS CONSIDERED IN DEVELOPING ALTERNATIVES

The Hawaiian Monk Seal Recovery Actions Draft PEIS was released for public review on August 12, 2011 on the project website: http://www.nmfs.noaa.gov/pr/permits/eis/hawaiianmonkseal.htm. The Notice of Availability (NOA) for the Draft PEIS was published in the *Federal Register* August 19, 2011 (76 Federal Register [FR] 51945), which began the official public comment period for this PEIS. The public comment period lasted for 60 days and concluded on October 17, 2011.

The alternatives presented in the Draft PEIS were based on comments received during the scoping period (October 1 – November 30, 2010) and on permitted past and existing research and enhancement activities. The alternatives also included new concepts that have not yet been permitted, but based on existing information, may contribute to species recovery.

Substantive comments received on the Draft PEIS during the scoping process and the public comment period raised issues that have been addressed or incorporated into this PEIS and the alternatives evaluated. Table 2.4-1 below provides an overview of substantive comments received on the PEIS alternatives and indicates where they are addressed in the Final PEIS. The complete Comment Analysis Report is included in Appendix C and it includes additional

information about the public comments received and provides agency responses to comments. The report summarizing comments received during the scoping process was included in the Draft PEIS and is available on the project website: http://www.nmfs.noaa.gov/pr/permits/eis/scoping_summary_report.pdf.

Table 2.4-1 ***Summary of public comments on alternatives and section where comments on alternatives are addressed in this Final PEIS.***

Comment Summary	Sections in the PEIS Where Issue Is Discussed	General Description of Revisions Made
Support or opposition to specific alternatives	• 2.6 Alternatives Carried Forward for Analysis	• 2.6 - Additional information is provided on the total number of weaned monk seal pups that could be translocated under Alternatives 3 and 4.
Support for including predator control and captive seal rehabilitation facility in the NWHI	• 2.12 Alternatives Not Carried Forward for Analysis	• 2.12 – Additional information has been added about the rationale for eliminating alternatives such as predator control on the NWHI.
Issues associated with impact analysis of alternatives	• 4.8.1 through 4.8.4 Environmental Consequences of Alternatives for Resources Evaluated	• 4.8.1-4.8.3 – Additional information and analysis of fishery impacts. • 4.8.4 – Additional information and analysis of impacts to cultural resources and historic properties.

2.5 *RESEARCH AND ENHANCEMENT COMPONENTS OF THE ALTERNATIVES*

The following is a narrative describing each of the research and enhancement components found in the alternatives.

Land-based surveys and observations: Population monitoring of Hawaiian monk seals is fundamentally based upon visual sightings of uniquely identifiable seals. The seals are identifiable by natural characteristics (scars, pelage marks, etc.) or applied marks (flipper tags, temporary pelage bleach marks). The accumulation of resightings are used to estimate abundance, age- and sex-structures, survival and reproductive rates, cause of mortality, movement rates, behavior, etc. Land-based surveys are the source of most of the observations. This typically involves a researcher walking the shoreline where seals are on land or swimming nearshore, approaching seals to read tags or taking photographs to document identifying marks.

Observers remain as far away as possible from seals during monitoring activities to obtain the necessary data, using binoculars and telephoto lenses as necessary for documentation, and only approach closely, *e.g.*, within 1 meter (3 feet [ft]), when necessary. The field staff is trained to be unobtrusive and use techniques to avoid disturbance appropriate to the environment in which the seal is

encountered whenever seals may alert to human presence. Seals are specifically given a wide berth when they are judged especially susceptible to disturbance, such as lactating females or molting individuals. Data recorded on land-based surveys include date, time, location, and a variety of information about each individual seal encountered (size, sex, tag information [letter/number, condition, color, tag location], bleach marks, body condition, molt status, whether the seal was disturbed by the researcher, association with other seals, any injuries, and sometimes behavior). Digital photographs help identify each seal by matching with previous photographs catalogued in a multi-year digital image database. During land surveys, researchers also opportunistically collect fecal and spew samples for diet analysis, shed (molted) skin for genetic studies, and on rare occasions, urine for health studies.

All alternatives allow for expanded use of remotely-operated cameras set up at seal landing areas in order to augment surveillance with minimum human presence. Cameras would be placed at designated vantage points and powered with photovoltaic systems. Images would be transmitted via satellite or stored digitally on site for later retrieval. Remote camera systems would allow for greater vigilance at sites where specific threats are a concern (*e.g.,* male aggression, shark predation) and would also augment basic population data in sites that are difficult for observers to access (*e.g.,* Nihoa Island). These systems have the advantages of efficiently collecting large amounts of data while reducing the level of human disturbance.

Autonomous, amphibious rover vehicles could be used improve assessment and monitoring operations in certain situations (*e.g.*, crowded narrow pupping beaches, islands that are difficult to land on). Terrestrial rovers with mounted video cameras could be used to identify and photograph monk seals or potentially assess injuries at a distance of approximately 3 ft. The use of rovers has not been tried with monk seals so their application would be in two phases. The first would be to test the vehicles suitability in near shore environments for collecting current or better quality assessment data and monitor their potential for disturbing monk seals and other wildlife. If the rovers prove successful they will be used more broadly on an "as needed" basis to supplement traditional methods.

Vessel surveys and observations: Typically, these are conducted from small boats that may cruise shorelines from several hundred feet or more offshore until seals are sighted. The boat then approaches more closely at a slow speed to allow for observation through binoculars and photographic documentation. The current permit allows a minimum approach distance of 33 ft. To mitigate disturbance, any indication of seal response or awareness of vessels are carefully observed and approach is adjusted to minimize the potential for disturbance. Vessel-based surveys are usually conducted in cases where researchers cannot land safely either due to sea conditions or terrain or in sites with restricted access. Also, surveys may be conducted from boats as a precaution if researchers

judge that landing (*e.g.,* on a tiny sand spit) might cause unnecessary disturbance to seals. The data collected on vessel surveys are similar to that collected on land-based surveys, except that typically less detail can be recorded for each seal because visibility is limited.

Aerial surveys and observations: Surveys are conducted from aircraft (airplanes and helicopters) in areas difficult to reach otherwise. Aerial surveys can be an efficient method to survey long stretches of shoreline with sparse seal presence in a short period of time. Aerial surveys are mostly conducted in the Main Hawaiian Islands (MHI), where aircraft and fuel are much more available compared to the NWHI. Typically, surveys are conducted by flying offshore of shorelines until a seal is spotted, then circling (or hovering, if helicopter-based) to observe and photograph. Minimum distance from the survey aircraft to seals under the current permit is 500 ft (vector combination of vertical and horizontal distance). This distance may be reduced in proposed Alternative 3 or 4 because experience has shown that monk seals rarely take notice of aircraft that approach much more closely, probably because unlike other pinnipeds (*e.g.,* harbor seals), monk seals have not evolved with aerial predators. Also, surveys may be conducted from small, unmanned remotely operated aircraft which have even less potential to disturb. In rare occurrences when a seal may appear to respond to aircraft presence, aircraft distance is increased until the seal settles down. Like vessel surveys, data collected on aerial surveys are similar to that collected on land-based surveys, except that lesser detail can typically be recorded for each seal because visibility is limited.

Sample collection and use of tissues from opportunistically encountered carcasses: Dead seals provide information on the health and ecology of the species. Examination of tissue samples can reveal illnesses which afflicted the seal, the cause of death, exposure to other pathogens, provide genetic material for a variety of applications, provide samples for assessing contaminant exposure and information on diet. Carcasses of seals are necropsied in a standard manner and specific to Hawaiian monk seals, with protocols refined as appropriate for specific samples to be taken, appropriate method of sample storage, and sample analyses. Specimens are retained according to the condition of the carcass. If the animal has recently died and the carcass is in good condition, samples from all major organs are retained and life history and morphometric data are recorded. If the carcass is in poor condition, a limited set of data is collected, including size (measurements), sex, and general description. Skulls are retained for subsequent measurement and additional skeletal materials may be retained. In most cases, carcasses are found in isolation and can be obtained and examined without risk of disturbing any other seals. In cases where other seals are present, researchers approach stealthily and remove the carcass to an isolated area to minimize incidental disturbance. In the NWHI, carcasses are typically buried; in the MHI, they are usually buried, cremated or disposed of at a waste facility. Salvaged parts may be used to enhance survival of pups (after necropsy, using seal tissue as bait for permitted shark removals).

Protocols for capture and handling: Many of the research and enhancement activities described below necessarily involve capturing, restraining and handling the seals. NMFS has developed extremely conservative protocols for seal handling that are designed to achieve the research or enhancement objectives, while minimizing disturbance to other seals in the area, and the risk of harm to the seal and the human handlers. These protocols have been developed over a long and successful history of safely handling seals with very low risk to the animals involved (Baker and Johanos 2002). Capture and handling protocols consider factors such as environmental conditions, status and health of the seals, capabilities of the capture team and presence of other seals in the area. Procedures conducted on captured seals minimize pain, risk of physical harm, and chance of disease transmission.

NMFS has a long-standing conservative approach to disturbance or capture of adult female seals. For example, no adult female is captured if she appears to be pregnant or is otherwise thought likely to be well into a pregnancy even if it is not visually apparent. The only exception is for a life-threatening situation such as a severe entanglement. Also, great pains are taken to minimize the disturbance of mother-pup pairs.

These protocols are arguably the most conservative and risk averse for any seal species in the world. Many prospective capture events are delayed or aborted entirely due to how conservatively perceived risks are assessed before the activity. Activities described below are performed using these conservative, risk-averse protocols.

Marking (tagging, bleaching): Researchers apply a variety of marks to facilitate both short- and long-term identification of individual seals, which is the most critical foundation of the population monitoring database. The most commonly applied marks are lettered and numbered flipper tags. Flipper tags are applied to weaned pups and to older individuals that may not have been tagged previously. Under some alternatives, pre-weaned pups may be flipper-tagged if pups are still nursing at the time researchers depart field camps in the NWHI. Tags would be re-applied to individual seals whose tags have become lost, broken, or excessively worn, in order to maintain the individual identities of these animals.

When captured for flipper tagging, seals are manually restrained by hand or in a net, then two plastic Temple Tags® (4 centimeters [cm] x 2 cm) are inserted through holes punched in the webbing between two digits of each rear flipper. During retagging old broken or unreadable tags may be removed. Restraint time averages approximately 5 minutes and does not exceed 15 minutes. After flipper tags have been applied, but while the seal is still under restraint, a Passive Integrated Transponder (PIT) tag is typically injected. These are the same kind of "chip" commonly inserted in domestic dogs and cats to facilitate identification. Most PIT tags would be injected just below the skin in the lateral lumbar area.

The injection site is cleansed with Betadine® and alcohol prior to PIT injection. The unique identifying code of each chip can later be determined using portable, hand-held readers, thereby providing long-term maintenance of identity even if flipper tags are lost.

A limited number of weaned pups may also be marked with a small sonic tag. Galapagos shark predation at French Frigate Shoals has drastically decreased pup survival for more than a decade. The primary purpose of sonic tagging is to gain information to aid in reducing this predation on weaned pups. Movements of pups and proximity to sonic-tagged sharks for the time period just after weaning is monitored via sonic tags attached to flipper tags. Receiving stations "listen" for both shark and seal sonic tags and record them when they are in range. These data are used to better inform management actions aimed at reducing shark predation, such as culling sharks. Sonic tags are deployed concurrent with standard flipper tagging of weaned pups. The sonic tag is attached onto one additional flipper tag during standard tagging procedures. The sonic tags are 2.4 cm long and weigh 3.6 grams (g). The sonic tag is about the size of the temple tag and is attached to the flipper tag with two small zip ties and epoxy.

Bleach marking seals' pelage (fur) is another integral part of individual monk seal identification. An over-the-counter cosmetic hair lightener is applied from a squeeze applicator (similar to a condiment dispenser) usually without disturbance to seals asleep on the beach. Marks remain on the seals' pelages until the annual molt, with a maximum duration of one year. Bleach is never applied to a part of the pelage that the seal could reach with a fore flipper, to ensure that the animal cannot rub any bleach on its face or in its eyes. Most of the seals to which marks are applied have been previously tagged and have an identity assigned. The presence of a highly visible bleach mark facilitates re-identification of an individual from a much greater distance than would otherwise be the case if researchers relied on flipper tags alone. Thus, there is less need to approach bleached seals closely, thereby reducing disturbance.

The technique for marking monk seals in the wild involves moving stealthily towards a sleeping seal and applying a unique identifier (usually a number) to the seal's pelage on the back or side. A bleach ring or "girdle" is also applied over the seal's circumference in the vicinity of the tail. The purpose of the girdle is to facilitate subsequent detection by observers that a seal has been bleached, even if the animal is lying on the previously applied number.

Collect measurements to determine body condition of individuals:
Measurements of axillary girth and dorsal straight length are indicators of Hawaiian monk seal health and body condition. These data have proven especially useful for comparing condition of seals in different subpopulations and provide insight into the factors that affect survival and population trends. The measurements are typically made with a flexible tape measure. Seals are also

sometimes weighed by suspending the seal in a hoop or stretcher net from a hanging scale supported by a tripod. Blubber depth measurements are sometimes collected using a portable imaging ultrasound by applying light pressure to the skin to obtain images along the sides and back of the animal. Blubber depth measurements indicate condition and nutritional state by assessing fat stores in the body.

These measurements are almost always conducted along with other activities that involve capture and restraint. For example, girth and length are measured at the same time weaned pups are captured for tagging. Older animals are measured when they are captured for instrumentation, health screening or other reasons. Thus, these measurements (morphometrics, weights, and ultrasound) usually do not increase the number of seals captured or disturbed.

Sample collection from captured animals to determine health status and diet: A suite of samples is collected from live-captured monk seals. Seals may be sampled for standard health screening, which is normally done opportunistically whenever a seal is captured and sedated for other reasons (*e.g.*, telemetry studies); or, the seal may have a particular health issue that is being investigated (*e.g.,* an abscess or illness). Also, tissue samples can be instrumental in determining the dietary habits of monk seals through fatty acid and stable isotope analyses. Samples collected include blood, blubber biopsies, viral and microbial swabs from body orifices (eyes, nose, mouth, anus, genital orifice) and external wounds, and whiskers (for diet and hormone studies).

Seals captured for health screening are usually sedated with diazepam administered intravenously in the extradural vein or with an intramuscular injection of midazolam. Up to 90 milliliters (ml) of whole blood is collected from the extradural vein using a standard syringe and external T-connector. Blubber core samples (through the full depth of the blubber layer) are collected from the dorsal pelvic region using a sterile 6 millimeter (mm) biopsy punch. One or two whiskers may be collected by snipping them at the base (if seal is not sedated) or plucking (if sedated).

Total handling time varies depending upon the procedure, but would range from approximately 5 to 20 minutes. Seals may be captured for focused health investigations, but these samples are routinely collected from any seal sedated for any reason (*e.g.,* instrumentation described below). By combining sample collection with other procedures, the maximum information is obtained with the minimum risk and disturbance to seals.

Appendix D provides a list of the drugs currently used or proposed to be used in Hawaiian monk seals, possible adverse effects including any observed in Hawaiian monk seals, and the pharmacokinetics of each drug (*i.e.,* known information on how the body affects the drug, including how the drug is absorbed, distributed, the rate of action and duration of effect, chemical changes

in the body, and effects and routes of excretion of metabolites). Information in the table is from Plumb (2008) or other references if noted. More detailed information on each drug can be found in Plumb (2008). Over the next 10 years, new drugs may become available or other drugs may be prescribed for use in Hawaiian monk seals by the attending veterinarian. Information on such new drugs would be provided by PIFSC to the OPR Permits Division and may be incorporated into the protocols if indicated by the attending veterinarian.

In addition to the drugs in Appendix D supportive fluids such as electrolytes, dextrose and sodium bicarbonate may be administered at the discretion of the attending veterinarian in response to adverse reactions to capture, handling and drug administrations.

Infectious Disease Mitigation: Current information suggests infectious disease is not limiting recovery of the Hawaiian monk seal. However, the species is rare, has very low genetic diversity and may have been buffered from exposure to many mammalian diseases due to its isolation in the Hawaiian Archipelago for millions of years. Together, these factors raise great concern that outbreaks of diseases to which monk seals have not been previously exposed could have devastating impacts.

Presently, the only permitted infectious disease mitigation (other than surveying exposure through sample collection described above) involves capturing seals with abscesses in order to open, drain and flush the affected area with water and hydrogen peroxide or similar disinfectant. This is rarely done, and usually involves weaned pups that develop infections presumably as a result of bite wounds inflicted by aggressive male seals. In many cases, the treatment allows the wound to heal and enhances the probability that affected seals will survive. Alternatives 3 and 4 involve the use of modern long-acting antibiotics to augment treatment of abscesses.

Alternatives 3 and 4 also include more proactive efforts to mitigate the potential or eventual negative effects of infectious disease on monk seals. Activities would include vaccination studies to determine the safety and efficacy of vaccines against specific pathogens considered most likely to spread to monk seals (*e.g.*, morbillivirus and West Nile virus). Captive studies would include both monk seals and surrogate species, and potentially free-ranging Hawaiian monk seals. If such research indicates that such vaccines are safe and effective, they may be administered preventatively or in response to an outbreak. Details on the Vaccination Plan can be found in Appendix E.

Conduct genetic sampling: Tissue (usually skin) samples are collected for genetic studies. Most genetic samples consist of small cylindrical skin punches that are a byproduct of flipper tag application. Genetic material may also be obtained from skin samples collected from carcasses or from shed molt samples

(see land-based surveys, above). Collection of genetic samples, therefore, does not require any additional handling or disturbance.

Attachment of scientific instruments: A variety of instruments are attached to monk seals in order to track their movements, assess habitat use, and study foraging and haulout behavior. Seals are captured, restrained and sedated with diazepam or midazolam, and health screening is conducted as described above. Instruments are then glued to the dorsal pelage using 10-minute epoxy or a similar adhesive. Instruments are either recovered during a subsequent recapture or fall off before or during molt. Total restraint time averages approximately 25 minutes, and does not exceed 60 minutes.

The type of instruments attached include but are not limited to Very High Frequency (VHF) radio tags, time-depth recorders, satellite- or cell-phone-linked (Global Positioning System [GPS] or Argos system) location or dive recorders, and seal-mounted video cameras (*e.g.,* Crittercam). These instruments provide a wealth of information and are used to research seals and are also sometimes applied during translocation procedures (see below) or in other cases where the movements of seals are of particular interest (*e.g.,* to monitor the near-term survival, movement and behavior of seals that have had fish hooks surgically removed). New and improved instruments are constantly being developed and will be utilized as appropriate.

De-worming: Gastro-intestinal parasites are common in pinnipeds, including Hawaiian monk seals. In young seals that are struggling to find sufficient prey, parasites may impact the seals' energy and nutrition available for maintenance, growth, development and ultimately, survival. NMFS is conducting research on the feasibility and effectiveness of reducing parasite burdens in free-ranging juvenile monk seals by administering de-worming drugs periodically, then measuring whether treated and control seals differ in their subsequent growth rates or survival. Seals are captured in a net, weighed, and either given a dose of de-wormer (treatment) or simply released (controls). Two different drugs were initially tested (fendbendazole and praziquantel), administered either orally or via intra-muscular injection. Repeated treatments are given to help ascertain the most effective regimen. To reduce the number of captures required for administering drugs, a topical de-wormer is being tested, because this method reduces the need for capture and disturbance.

If de-worming proves feasible and effective, under some alternatives it may be applied as an enhancement tool in the wild population and as a complement to translocations (see below) and captive care for rehabilitation (conducted by the MMHSRP).

Translocate animals to improve survival or alleviate male aggression: According to the "IUCN Guidelines for Reintroduction," translocation is defined as "*deliberate and mediated movement of wild individuals or populations from one part*

of their range to another." Hawaiian monk seals are translocated to address a variety of threats:

Nursing, or pre-weaned pups separated from their mothers may be captured, and relocated to a prospective foster mother or back to their natural mother, respectively. Young pups that are prematurely weaned or otherwise separated from their mother suffer high rates of mortality. In these cases, intervention to restore nursing can enhance the pup's survival.

Weaned pups in locations where there is a severely reduced chance of survival, such as areas of high shark predation (*e.g.,* some islets at French Frigate Shoals), disease or contaminant exposure, or likelihood of human interaction (*e.g.,* hooking, entanglement, socialization, disturbance in the MHI), may be moved to locations which present less risk. In such cases, pups born within the NWHI are translocated to other sites within the same NWHI atoll, and pups born within the MHI are moved to other beaches or islands in the MHI.

Weaned pups and juvenile seals in subpopulations where juvenile survival is low may be translocated to subpopulations with higher rates of juvenile survival. Survival at the original site may be relatively low due to insufficient prey availability (thought to be the primary cause of juvenile mortality), but may also be affected by other factors. The current permit allows for such translocations only among subpopulations *within* the NWHI. Alternative 4 would allow for more flexible application of this tool to move seals anywhere within the monk seal range. Alternative 3 would allow translocations anywhere within the monk seal range except Alternative 3 would not include translocating weaned pups from the NWHI to the MHI.

Also, Alternatives 3 and 4 allow for a return translocation of individuals back to their natal subpopulations once they have reached an age (2-3 years) when their survival probability is universally quite high. Details on this approach, referred to as *two-stage translocation*, can be found in Appendix F. The Health Screening and Quarantine Protocols for Hawaiian Monk Seal Translocation between Subpopulations is presented in Appendix G.

Alternatives 3 and 4 would allow for the experimental translocation of MHI-born seals age 2 years and older to the NWHI. This activity would approximate the return portion of two-stage translocation, and thus provide information on that aspect of the strategy without waiting for translocated seals to reach age 3 years. That is, it would evaluate how well seals that have grown up in favorable conditions (currently prevailing in the MHI) fare when taken at age 2 years or older to an area with less favorable conditions (currently prevailing in the NWHI).

Seals with unmanageable human interactions may be taken from the MHI to the NWHI under Alternatives 3 and 4. Occasionally, individual seals in the MHI develop habitual patterns of seeking out humans and interacting with them,

sometimes in ways that constitute a public safety risk and a risk to individual seals. Research to develop tools to prevent and mitigate human interactions with individual seals is proposed (see below). However, there are likely to be cases in the future, as there have been in the past, where despite all efforts to alter seal or human behavior, the interactions persist. In such cases, unmanageable seals could be translocated from the MHI to the NWHI, where they could continue to live in a wild population that is isolated from human contact.

Aggressive male monk seals, either acting singly or in groups, can severely injure other monk seals of any age or sex, but typically their victims are either weaned pups or adult females. When such males are identified as confirmed or highly suspect aggressors, they may be translocated to alternate sites where they would be less likely to cause harm. Other tools for mitigating male aggression include hazing, removal to permanent captivity or, as a last resort, lethal removal. Under some alternatives, chemical alteration to reduce aggression may be explored (see discussion about behavior modification).

Appropriate methods for translocation vary greatly depending upon the age and size of the animals involved and the distances and geographic circumstances. For example, nursing pups are typically captured by hand and may be carried on foot to lactating females, whereas aggressive adult males may need to be captured in a hoop net, sedated, placed in a cage and transported great distances in a combination of small boats, large sea-going ships, airplanes or automobiles. Protocols have been developed by the NMFS over the past several decades to safely and successfully transport live seals (Baker *et al*. 2011b).

During translocation projects, it will sometimes be necessary to temporarily hold seals captive on the beach (especially in the NWHI). For example, when collecting seals from a given subpopulation, the subjects may need to be gathered together over the course of several days so that they can subsequently be efficiently and safely transported to a ship or plane. Likewise, seals may be held at their destination for some time prior to release. The primary structure for temporary holding (longer than approximately 2 days) will be shoreline pens, measuring up to approximately 24 ft x 80 ft. Approximately 30 percent (%) of the surface area will include water at least 2 ft deep at lowest tide. The remainder of the pen would be intertidal and dry resting area above the high water line. No more than 5 seals would be held in a pen at any one time. In some instances requiring short temporary captivity (*e.g.,* less than 2 days), a shaded holding pen may be erected in the vicinity of the field station, and seals would be wetted down periodically.

Pens will be constructed from plastic or metal (typically mesh) material, approximately 4-ft high, supported by approximately 10 ft x 2-3 in diameter steel pipe driven into the sand at approximately 8-10 ft intervals. Pipe or water filled fire hose will be used to secure the bottom of the fencing material. Plastic ties will fix the fencing to the support piping and bottom weights, and windbreaks will be

erected along the fence as necessary. Fence perimeters (in and out of water) will be monitored at least twice daily, and will be repaired or changed as necessary to prevent escape or injurious entrapment. Alternate but comparable construction materials or pen configurations may be used within the range of dimensions described above. Finally, temporary holding cages with a much smaller footprint (*e.g.,* less than 8-ft long x 4-ft wide x 4-ft high) may be used for transport and holding (*e.g.,* up to one week in cage for transport and holding). Pens would be erected only when needed and dismantled as soon as they are no longer required.

Supplemental feeding following captive care: Captive care or rehabilitation of Hawaiian monk seals in need of medical attention (*e.g.,* stranded, prematurely weaned or emaciated seals), can be conducted under the authority of the NMFS Marine Mammal Health and Stranding Response Program (MMHSRP). Thus, this type of captive care is not an activity proposed in this PEIS. However, Alternatives 3 and 4 do propose to complement captive care with supplemental feeding of seals after they have been released in the NWHI. The concept is to provide a more gradual transition from captivity (where seals will have been fed) to independence (where seals will need to forage for themselves). The training to take food from people in captivity would be bridged to a wild context, such that released seals could be gradually "weaned" from human support rather than making an abrupt transition. This may improve the survival prospects of seals following captive care.

Such supplemental feeding of wild seals would occur only in the NWHI where human presence is minimal. It would not be conducted in the MHI, to avoid the problem of these seals approaching members of the public as a food source. Supplemented seals would receive Individually Quick Frozen (IQF) herring in quantities of up to 5% of body weight as frequently as once per day or at longer intervals for up to 1 year. This technique has not been tried with monk seals to date. Much would depend on the seals' behavior, as they would need to make themselves available to be fed.

To "wean" the animal while keeping it in good body shape, feeding may be more regular (daily) and involve higher rations at the start of the supplementation, then gradual reduction. It is important to note that the supplemented seals would be pre-trained to approach on cue for feeding, thus non-target seals would very likely not try to obtain provisions. Any uneaten portion of herring offered to a seal would be collected and disposed of properly to keep any waste out of the natural environment.

Mitigate fishery and human/domestic animal interactions: Marine debris and derelict fishing gear have been well documented to entangle Hawaiian monk seals, which have one of the highest documented entanglement rates of any pinniped species. Marine debris entanglement causes harm to seals by drowning,

causing severe wounds, and restricting behavior (including swimming, diving and foraging). Whenever it can be safely accomplished, seals are disentangled.

Monk seals also get hooked by derelict and actively fished gear, almost exclusively in the MHI. Hooks may be embedded in the body, in and around the mouth or are sometimes ingested. Hookings can cause pain, injury and mortality in monk seals and, like entanglement, hooks are removed whenever it can be accomplished safely.

Seals which are observed to be entangled by nets, lines, or other marine debris are freed by either of two methods: (1) Animals would be captured by hand or net, restrained, disentangled (by hand or by using a cutting implement), and freed; or (2) The entangling item would be cut free using a cutting implement by hand (while the seal is asleep) or attached to a pole, with no restraint of the animal. The selected technique depends upon the particular circumstances of each case. Hooks would be removed from seals by similarly restraining the animal and removing the hook by hand, often with the aid of de-hooking tools designed specifically for this purpose. The seals sometimes require sedation on the beach, and, if necessary, are brought into temporary captivity for surgical hook removal by a veterinary staff, requiring general anesthesia.

Behavior Modification: In addition to entanglement and hooking interactions, seals in the MHI sometimes become socialized or habituated to people or domesticated animals. Such interactions may involve humans provisioning seals with food, seals taking catch from fishers, play or aggressive behavior between people, pets and seals, etc. These interactions can be dangerous for all participants. Historically, NMFS typically intervenes by first attempting to haze or harass habituated seals away from high-risk areas, and then, if the behavior persists, by translocating the seal to locations where there are more seals and less human interaction. As each interaction situation entails a unique set of circumstances and complications, a variety of methods may be necessary to resolve each situation, including a suite of methods generally referred to as behavioral conditioning or behavior modification.

Alternatives 3 and 4 involve research to prevent or reduce these interactions. Techniques may involve aversive conditioning, where seals behaving in an undesirable fashion are exposed to unpleasant (but not harmful) experiences in order to discourage the undesired behavior. A variety of aversive and disruptive stimuli may be considered for behavioral modification. While the specific stimuli would be varied they would fall under the following general categories:

- Visual and aural disruptive stimuli: These are stimuli that are intended to stop a seal from its current behavior. It could be any type of aural or visual stimulus (like waving palm fronds) that disrupts a behavior or displaces a seal from an area.

- Tactile harassment: This includes any technique that repels seals or stops a behavior by direct contact, including prodding with blunt objects (*e.g.*, poles), crowding boards, or low-velocity objects tossed or projected, etc.

- Acoustic harassment and deterrents: designed to cause temporary annoyance, discomfort or to frighten seals to displace them from specific locations where conflict occurs. This could include seal crackers (similar to a small firework), underwater speakers, etc.

- Chemical: This includes any chemical that may be used to alter the taste of prey seals obtain in an undesirable ways (*e.g.,* by depredating fishers' catch, bait or gear) or is used to cause temporary minor discomfort to seals to displace them from an area or stop particular behaviors.

In addition to aversive stimuli, positive reinforcers may also be researched and developed to replace the reinforcement of interacting with humans. Tools and techniques would be developed in a careful experimental fashion, and if proven safe and effective, applied as appropriate. If behavioral modification allows a seal that might otherwise be translocated or brought into captivity to live out its life in the wild, it could be a valuable tool for species recovery.

In addition, aggressive adult male seals may be hazed away from conspecific victims by field staff approaching, vocalizing or otherwise making noise, prodding with a long pole, or throwing objects (*e.g.*, rocks, coral, sticks, debris). Care will be taken not to harm or cause severe pain to the male. The objective is to distract the target animal and frighten him away rather than to cause harm or pain. However, the risk of death to a conspecific outweighs any risk of injury to the adult male.

Mortality incidental to research activities: Despite NMFS's excellent record of safely handling Hawaiian monk seals, there is always some finite risk of mortality inherent in research activities that involve handling seals. Since 2000, one such unintentional research-related mortality has occurred.

In addition to unintentional mortalities, moribund/unhealthy seals may be humanely euthanized or die incidental to handling. Most health screening research involves sampling seals that appear healthy. Severely ill or compromised seals are very rarely encountered. Yet such seals may be critical to sample in order to understand the source of their illness and, more importantly, to recognize disease outbreaks that may threaten the broader population. Euthanasia may occur if an experienced on-site veterinarian determines there is a high probability of the death of an animal due to the injury or disease condition. In such instances, seals would be captured, sedated and biologically sampled as described above for health assessments. Thereafter, seals would be injected with a lethal dose of Beuthanasia® (sodium pentobarbital) into the extradural vein at a dose of 1 ml/10 pounds (lb). Immediately after the animal has succumbed, a complete necropsy would be conducted, with samples saved from all major

organs. Because of the presence of barbiturates in the carcasses, all soft parts not retained would be collected in plastic bags for subsequent environmentally safe disposal (*e.g.,* incineration).

Mortality or removal from wild population for enhancement activities: As described above, aggressive male monk seals can cause serious injuries or mortality to other seals, most notably adult females and weaned pups. When males are identified as having seriously injured or killed another seal, they may be translocated as described above. However, if translocation is not a preferred option, aggressive males may be brought into permanent captivity or, as a last resort, humanely euthanized following the procedures outlined in the previous section.

Some of the alternatives involve ambitious efforts to enhance Hawaiian monk seal populations, through means such as two-stage translocation, de-worming, vaccination, and behavioral modifications. All of these activities involve increased handling of seals and some involve temporary captivity and transport. These activities would be undertaken to improve monk seal survival, but also entail additional risks. Therefore, there is potential that seals may die unintentionally as a result of these enhancement activities. Since 2000, two monk seals have died in captive facilities during enhancement activities (one weaned pup awaiting disease screen results associated with a translocation, and one juvenile held for captive care).

Mitigate adult male aggression using chemical intervention: Adult male aggression is of particular concern when the perpetrator displays an abnormal focus on young animals, with frequent, repeated, and severely aggressive behavior that threatens the young animals' life. As described above, the NMFS is permitted to mitigate adult male seal aggression by a variety of means. Males identified as aggressors may be hazed, translocated, brought into permanent captivity or as a last resort, lethally removed. Each of these methods has drawbacks.

Translocation works best if the aggressors can be taken somewhere where they do not persist in harming other seals or elicit other problems. In the past, male monk seals were translocated from the NWHI to Johnston Atoll (1984 and 1998) or to the MHI (1994), sites chosen because they harbored few or no other seals. Currently, Johnston Atoll is the only site within the species natural range which has few or no seals. However, past experience suggests that seals taken to Johnston Atoll do not persist there. Permanent captivity is effective; however, captive facilities that are willing and able to indefinitely care for adult male monk seals are rare. Lethal removal is also effective, but the NMFS has used this extreme measure very judiciously and considers it a regrettable last resort. Adult males may be euthanized if they have been identified as killing or seriously injuring a conspecific, and if translocation and permanent captivity were not feasible options.

All the above approaches can also be logistically complex and quite expensive, factors which also limit their viability. Finally, in cases where the identity of male aggressors is suspected, but not unequivocal, permanent removal efforts (captivity and euthanasia) are not appropriate. It would be desirable to develop another tool for mitigating male aggression that was effective, humane, feasible, affordable and reversible.

In the 1990s, some experimentation to chemically alter testosterone levels of adult male Hawaiian monk seals using a gonadotropin-releasing hormone (GnRH) agonist (decapeptyl) was done with both captive and wild seals. The results indicated that treated males usually responded by exhibiting lower testosterone levels (Atkinson *et al.* 1986; Atkinson and Gilmartin 1992). However, the studies did not address whether or not aggressive behavior was reduced. Other drugs (*e.g.,* Desolorelin) have also been used in a variety of species to reduce testosterone production and aggression. Alternatives 3 and 4 include research to better elucidate the potential use of GnRH agonists as a tool for mitigating adult male monk seal aggression. Research would likely involve both captive trials and research on free-ranging male seals. If the method proves effective, it could be used as an alternative to temporarily alter aggressive behavior of specific male seals in order to enhance survival of adult females and immature seals.

Captive holding for research and enhancement: Seals may be held in temporary captivity for various reasons. For example, aggressive adult male seals removed from the wild for permanent captivity may be held in temporary holding facilities and cared for until transport to a permanent holding facility occurs. Or, seals may be brought into temporary captivity for specific research studies such as taste aversion trials (as part of the behavioral modification program). Research studies described in this section may also occur on seals already in permanent captivity (NMFS 2006). As mentioned above, during translocations, seals may be held in temporary pens or facilities prior to transport or for quarantine. However, captive care for purposes of rehabilitation is not included in the alternatives (this type of captive care is covered by the MMHSRP's permit and PEIS; NMFS 2009a).

2.6 ALTERNATIVES CARRIED FORWARD FOR ANALYSIS

The four alternatives carried forward for detailed analysis in Chapter 4 vary by the nature and extent of recovery activities, including the types and level (*i.e.,* number of animals or procedures) of research and enhancement that would be permitted under each different policy. These alternatives represent a reasonable range of research and enhancement options in accordance with the purpose and need described in Chapter 1 and fulfill the NEPA requirements for analyzing the No Action alternative.

There are two broad categories of research and enhancement activities that require permits:

(1) Research and enhancement that does not involve capture, handling or collection of tissue from live animals; and

(2) Research and enhancement that requires capture, handling or intrusive procedures on live animals.

Both categories have some potential for direct and indirect mortality. Table 2.6-1 contains additional detail on what general types of monk seal research and enhancement activities fall into each of these two categories. The type and amount of these activities would vary across the alternatives.

Table 2.6-1 Research and Enhancement Activities Requiring Permits

General Categories of Research and Enhancement Activities	
Activities that Do Not Require Capture, Handling, or Collection of Tissue from Live Animals	**Activities that Require Capture, Handling, or Collection of Tissue from Live Animals**
• Aerial, vessel, and ground surveys – conducted to count animals, bleach mark and resight animals that have been tagged or bleach-marked, and to document behavioral observations. • Scat and spew collection – occurs on islands/atolls and is used to identify recent prey consumed and intestinal parasites. Molted fur collected from islands/atolls is used for genetic analysis. • Collection of tissue samples from animals found dead; used for health/disease studies. • Hazing animals for their protection or the protection of conspecifics.	• Collection of morphometric measurements – includes external measurements of an animal (*e.g.,* length and girth). • Collection of tissue samples – *e.g.*, skin, blubber, or blood. Swabs from the eyes, nose, mouth, anus, genital orifice, and external wounds may be taken for health/disease screening. • Treatment of abscesses by manually lancing the abscess and flushing with water and hydrogen peroxide or similar disinfectant. • Treatment for parasites with injectable drugs. • Permanent or temporary marking of animals – includes plastic tags secured on the rear flippers, which are used to monitor animals, to facilitate recapture of sampled animals, and to determine vital rates. • Attachment of telemetry instruments – used to collect information on movement patterns and foraging behavior. • Translocation – transport of animals over ground, by vessel or airplane to areas to improve survival. • Temporary captivity – *e.g.*, temporary holding for quarantine during translocation.

Note: This table is meant to provide a general overview of these activities by category and does not include all activities. Additional detail on the proposed alternatives is provided in Table 2.10-1.

2.7 *ALTERNATIVE 1: STATUS QUO*

Under the Status Quo Alternative, the current NMFS Research and Enhancement Permit (10137, as amended) would continue until its expiration in 2014, and subsequent permits would be issued to continue research and enhancement activities according to the scope and methods currently permitted, with restrictions and mitigation measures required by the MMPA, ESA, and NMFS implementing regulations. In addition to these statutory and regulatory permit restrictions, the impact of proposed research and enhancement activities for Hawaiian monk seals must remain at a level below that which would jeopardize the continued existence of the species or result in adverse modification of critical habitat, as required by Section 7 of the ESA.

The levels and types of research and enhancement activities would be commensurate with what has previously been permitted as defined by the active NMFS permit 10137. New permits or permit amendments for levels and types of research the same as currently permitted would be approved unless it were determined that issuance would exceed the ESA jeopardy or adverse modification threshold when expected impacts were added to existing research, enhancement and other activities in the baseline at the time the application was received.

Research and enhancement activities allowed under the Status Quo Alternative are listed in Table 2.10-1 and include those that have been carried out consistently for decades (*e.g.,* land-based surveys and marking), newer research (*e.g.,* de-worming studies), and ongoing mortality mitigation (*e.g.,* disentanglement). In brief, the Status Quo Alternative activities include:

- Monitoring via ground, vessel, and aerial surveys; marking and photo ID;
- Health screening and instrumentation;
- De-worming research;
- Specimen collection and import/export of specimens;
- Disentanglement and dehooking;
- Adult male removal for enhancement; and
- Translocation for enhancement including:
    - Translocating abandoned nursing pups to a prospective foster mother or their natural mother within their birth island or atoll;

- Translocating weaned pups from a high risk area (*e.g.*, known shark predation) to a low risk area within the same island or atoll in the NWHI or Johnston Atoll; translocations in the MHI may be to a different location on the same island or to a different island in the MHI;

- Translocating weaned pups in subpopulations where juvenile survival is low to subpopulations with higher rates of juvenile survival; seals may only be translocated among subpopulations within the NWHI.

No new activities or expanded scope of existing activities would occur under the Status Quo Alternative.

2.8 ALTERNATIVE 2: NO ACTION

The No Action Alternative, which must be considered in an EIS according to CEQ regulations (40 CFR 1502.14), would only allow for status quo research and enhancement activities on Hawaiian monk seals to continue until the current permit (10137) expires in 2014. Thereafter the only research and enhancement activities carried out would be those that either do not require a new permit or are allowed under the provisions of the MMPA's MMHSRP (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. No new permit would be issued to replace Permit No. 10137 when it expires, nor could that permit be amended to allow modifications in research or enhancement activities, sample sizes or objectives.

When the existing permit expires, all research and enhancement activities that require a permit would cease except for those activities covered under the MMHSRP permit as described in Sections 1.4, 1.7, and 1.9.3. Under the MMHSRP permit, NMFS could still respond to stranded or injured wild seals. No research on the wild population would occur under Alternative 2 including population monitoring, genetics, health assessment, and foraging research. Seals could not be approached nor captured to collect any new research data, and activities such as two-stage translocations to enhance survival and vaccination research and enhancement could not be conducted under this program.

Limited enhancement activities such as disentanglements and de-hooking seals, and hazing or translocating seals away from imminently harmful situations could be conducted under the MMHSRP permit. Incidental or intentional mortality due to enhancement activities would only be authorized during emergency response activities under the MMHSRP permit.

Scat and spew samples could be collected from vacant beaches, and seals could only be observed and photographed at distances and under conditions that are not likely to result in takes (and therefore would not require permits). Permits

and grants could also be awarded for receipt and use of tissues from animals that have been found dead and collected under the MMHSRP. Analysis of previously-collected samples and data could be conducted.

2.9 *ALTERNATIVE 3: LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Under Alternative 3, all activities currently permitted under the status quo would continue, and new permits would be granted with expanded scope and methods, with restrictions and mitigation measures required by the MMPA, ESA, and NMFS implementing regulations.

As under Alternative 1, the impact of proposed research and enhancement activities for Hawaiian monk seals must remain at a level below that which would jeopardize the continued existence of the species or result in adverse modification of critical habitat, as required by Section 7 of the ESA.

Alternative 3 includes activities described in Section 2.7 in the Status Quo as well as new and expanded activities. These are provided in more detail in Table 2.10-1. The new and expanded activities include, but are not limited to:

- Vaccination studies and potential implementation of vaccines to mitigate infectious disease.
- Potential implementation of de-worming as an enhancement tool to improve juvenile Hawaiian monk seal survival.
- Expanded scope and number of seal translocations in addition to those in the status quo, including:
    - Taking seals with unmanageable human interactions from the MHI to NWHI.
    - Taking juvenile and older seals from the MHI to NWHI to examine their subsequent survival.
    - Implementing a two-stage translocation program whereby weaned pups are taken from areas of lower survival to areas of higher survival (within the NWHI, within the MHI, or from the MHI to NWHI, **but not from the NWHI to MHI**), with the option of returning them to their natal location or nearest appropriate site at age 2 years and older (see Figure 2.9-1). Note that seals originally born in the MHI and translocated to the NWHI may be returned to the MHI. Under this program, a maximum of 200 weaned seal pups could be translocated over a 10-year period (only 20 pups per year). While this number is the maximum number of seals allowable under an Alternative 3 permit, the actual number of weaned seal pups

potentially translocated as part of this two-stage program would likely be much lower.

  - Details of the translocations would be determined by a decision framework as described in Section 5.2 and Appendix F.

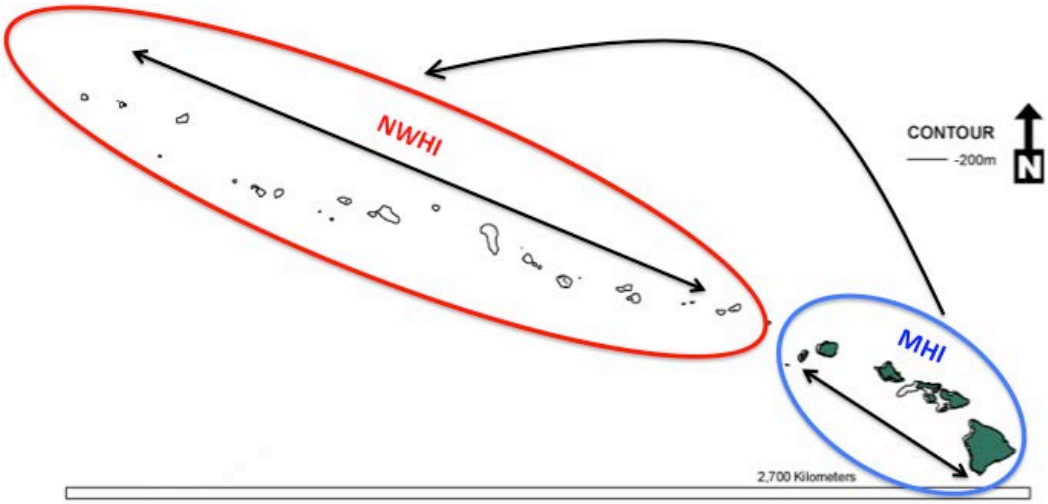
- Supplemental feeding of monk seals in NWHI locations where seals are released after being cared for in captivity (post-rehabilitation).
- Research to develop tools for modifying undesirable Hawaiian monk seal behavior related to interactions with humans and fishing gear in the MHI. If proven effective by research, these tools would be implemented.
- Chemical alteration of aggressive male monk seal behavior using a drug to reduce testosterone.

Relative to the status quo (Alternative 1), the new and expanded elements encompassed by Alternative 3 reflect the perspective of the 2007 Recovery Plan that actions over and above the status quo will be needed if the Hawaiian monk seal population is to stop declining and eventually recover. As such, this alternative maintains the activities currently permitted as well as the above list of new actions. It is important to recognize that all elements of the alternative, both status quo and novel, reflect recommendations of the Recovery Plan. The degree to which each element of this alternative would be implemented would depend upon funding levels and varying needs for specific actions, which will be informed by research and monitoring.

The distinctive feature of Alternative 3 is that while translocation as a tool for conserving Hawaiian monk seals would be expanded, translocations of weaned pups from the NWHI to the MHI would not be permitted. However, seals born in the MHI and previously taken to the NWHI may be returned to the MHI in the second stage of two-stage translocations.

Public notice of receipt of a new 5-year permit application submitted by PIFSC (File No. 16632) was published in the *Federal Register* on March 1, 2013 for a 45-day comment period (78 FR 13863). This permit application includes all activities for Alternative 3 described in Table 2.10-1 and Appendix H. This includes activities in the status quo as well as the new and expanded activities listed above.

Figure 2.9-1 Alternative 3 Limited Translocation Options (Preferred Alternative). Weaned pups may be moved from areas of lower to higher survival within the NWHI, within the MHI, or from the MHI to NWHI. Seals may be returned to their natal area after they are 2 years old.



2.10 ALTERNATIVE 4: ENHANCED IMPLEMENTATION

The enhanced implementation alternative would encompass all the activities permitted under Alternative 3 listed in the previous section, with the addition of the option for temporary translocation of weaned pups from the NWHI to the MHI as follows.

- Expanded scope and number of seal translocations, including:
    - Implementing a two-stage translocation program whereby weaned pups are taken from areas of lower survival to areas of higher survival anywhere within the Hawaiian Archipelago, ***including between NWHI and MHI (i.e., greater flexibility than under Alternative 3)***. This could equate to a total of 200 weaned seal pups translocated over a 10-year period with a maximum of 60 translocated seal pups potentially located in the MHI during year 3 of the translocation process. Similar to Alternative 3, while this number is the maximum number of seals allowable under Alternative 4, the actual number of weaned pups potentially translocated as part of this 2-stage program would likely be much lower.
    - At age 2 or 3 years, any surviving translocatees would be returned to the NWHI (see Figure 2.10-1). Details of the translocations would be determined by a decision framework as described in Section 5.2 and Appendix F.

The only difference between Alternative 4 and Alternative 3 (Preferred) is that Alternative 4 would also allow for two-stage translocation of weaned pups from the NWHI to the MHI and their subsequent return at age 2 or 3 yr to the NWHI. This distinction would allow for maximal flexibility to take advantage of the potential benefits of two-stage translocation, because weaned pups could be moved to wherever their survival chances are best. The same, strict quarantine protocols identified in Alternative 3 would be required for returning seals to the NWHI from the MHI, where seals are exposed to domestic and feral mammals.

Figure 2.10-1 Alternative 4 Translocation Options. Weaned pups may be moved from areas of lower to higher survival within the NWHI, within the MHI, from the NWHI to the MHI or from the MHI to NWHI. Seals may be returned to their natal area after they are 2 years old. Identical to Alternative 3 options except that weaned pups can be moved from the NWHI to the MHI.

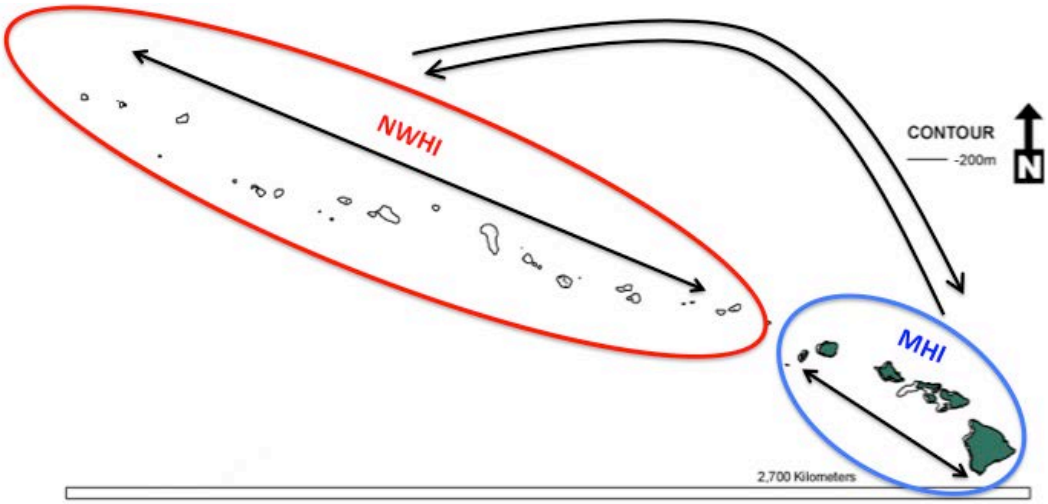


Table 2.10-1 Proposed Alternatives

Classification	Research/Enhancement Activity	Alternative 1 - Status Quo; Currently-permitted activities would continue after 2014 with no increased efforts or new activities allowed.	Alternative 2 - No Action; No Permit after 2014; activities currently permitted would not be authorized after 2014.	Alternative 3 - Limited Translocation (Preferred Alternative)	Alternative 4 - Enhanced Implementation Alternative
Activities that do not involve capture, handling, or collection of tissues from live animals	*Land-based surveys and observations* *(Research)*	• Currently-permitted land-based surveys in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Continue annual monitoring, including close approach for observing, counting and photographing marked and unmarked seals, in the NWHI, and analyze and report findings. • Collection of molt, scat, spew and placentae and could continue after 2014. • Up to 1,440 seals may be approached annually (total for aerial-, vessel- and land-based surveys.) • Installation, operation and maintenance of remote cameras to obtain photographs and video images of seals to augment data otherwise requiring researcher presence on site • Use of small, unmanned amphibious vehicles (*e.g.*, rover).	• Same as Status Quo except no new permits or authorizations after 2014.	• Same as Status Quo **plus**: • Additional surveys above number permitted in Status Quo could be authorized.	• Same as Alternative 3
	Sample collection and use of tissues from encountered carcasses *(Research)*	• Currently-permitted necropsies, sample collection, worldwide export/import of necropsy samples for analysis, and studies on carcasses would continue after 2014. • Use salvaged tissue as bait for permitted shark removals.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo.	• Same as Status Quo
	Vessel surveys and observations *(Research)*	• Currently-permitted vessel-based surveys in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Continue vessel surveys including close approach for observing, counting and photographing marked and unmarked seals. • Up to 1,440 seals may be approached annually (total for aerial-, vessel- and ground-based surveys.)	• Same as Status Quo except no new permits or authorizations after 2014.	• Same as Status Quo, **plus**: • Additional surveys above number permitted in Status Quo could be authorized.	• Same as Alternative 3
	Aerial surveys and observations *(Research)*	• Currently-permitted aerial surveys in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Continue aerial surveys including approach from 500 ft for observing, counting and photographing marked and unmarked seals. • Optimize survey techniques using small, unmanned aerial vehicles to conduct aerial surveys (from ≥ 10 ft) where access is limited. • Up to 1,440 seals may be approached annually (total for aerial-, vessel- and ground-based surveys.)	• Same as Status Quo except no new permits or authorizations after 2014.	• Same as Status Quo, **plus**: • Additional surveys above number permitted in Status Quo could be authorized. • Approach closer than 500 ft may be authorized based on typically observed lack of seal response to aircraft.	• Same as Alternative 3
	Incidental harassment during any Research or Enhancement Activity	• Currently-permitted incidental harassment in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Non-target seals may be harassed incidental to research and enhancement (e.g., during captures, non-target seals nearby may be disturbed). • Up to 200 seals may be incidentally harassed annually.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, **plus**: • Additional harassment above number permitted in Status Quo could be authorized.	• Same as Alternative 3

Classification	Research/Enhancement Activity	Alternative 1 - Status Quo; Currently-permitted activities would continue after 2014 with no increased efforts or new activities allowed.	Alternative 2 - No Action; No Permit after 2014; activities currently permitted would not be authorized after 2014.	Alternative 3 - Limited Translocation (Preferred Alternative)	Alternative 4 - Enhanced Implementation Alternative
Activities that require capture, handling, or procedures on wild seals	*Marking (tagging, bleaching)* *(Research)*	• Currently-permitted marking of seals in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Approach seals to mark fur with temporary bleach marks. • Capture, restrain, and sedate (if needed), seals to apply flipper, PIT and sonic tags. • Up to 536 seals of any size or sex (except lactating females and nursing pups) can be tagged. Up to 35 weaned pups at French Frigate Shoals can be tagged with sonic tags annually for up to 3 years. • Up to 1,315 seals may be approached and bleached.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, plus: • Number of animals above that permitted in Status Quo could be authorized for marking. • Pre-weaned pups could be tagged if still nursing at end of field season.	• Same as Alternative 3
Activities that require capture, handling, or procedures on wild seals	*Collect measurements to determine body condition* *(Research)*	• Currently-permitted morphometric measurements in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Seals may be captured (by hand or net) and restrained to obtain weight, length, girth, and blubber thickness via ultrasound • Performed concurrently with flipper tag marking, health assessments, and de-worming.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, **plus**: • Number of animals above that permitted in Status Quo could be authorized for body condition assessment. • Captive seals could be used to test methods.	• Same as Alternative 3
	Sample collection from captured seals to determine health status and diet *(Research)*	• Currently-permitted sample collection from captured seals in the Hawaiian Archipelago would continue past 2014. • Up to 70 healthy and 30 unhealthy seals (except lactating females and nursing pups) annually may be captured, restrained, handled, sedated and sampled (skin/blubber biopsy, blood, whiskers, swab all orifices). • Flipper tagging and ultrasound performed in conjunction with sampling.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, **plus**: • Additional number of seals, samples/procedures above number permitted in Status Quo could be authorized. • Captive seals could be sampled.	• Same as Alternative 3
	Infectious Disease Mitigation *(Research and enhancement)*	• Currently-permitted mitigation of infectious disease would continue after 2014. • Lance and treat abscesses on up to 30 seals annually. • Monitor for disease as part of other tissue collection and morphometric studies as described above.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, **plus:** • Conduct vaccination studies including research on safety and efficacy of vaccines for infectious diseases. • Studies could include captive studies with surrogate species, captive studies with Hawaiian monk seals and free-ranging Hawaiian monk seals. • If research indicates vaccination is safe, conduct wide-spread vaccination of wild seals as either a stand-alone activity or in conjunction with translocation and deworming, or with captive care for rehabilitation under the Marine Mammal Health and Stranding Response Program. • Treat injured seals in the wild with antibiotics. • Additional samples/screening above number permitted in Status Quo could be authorized as deemed necessary.	• Same as Alternative 3
	Conduct Genetic Sampling *(Research)*	• Currently-permitted genetic sampling in the Hawaiian Archipelago and Johnston Atoll would continue after 2014. • Skin samples may be obtained during flipper tagging and tissue sampling activities, and shed molted skin may be collected.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo **plus**: • Number of animals above that permitted in Status Quo could be authorized for genetic sampling. • Captive seals could be sampled.	• Same as Alternative 3

Classification	Research/Enhancement Activity	Alternative 1 - Status Quo; Currently-permitted activities would continue after 2014 with no increased efforts or new activities allowed.	Alternative 2 - No Action; No Permit after 2014; activities currently permitted would not be authorized after 2014.	Alternative 3 - Limited Translocation (Preferred Alternative)	Alternative 4 - Enhanced Implementation Alternative
	Attachment of scientific instruments *(Research and enhancement)*	• Currently-permitted attachment of scientific instruments in the Hawaiian Archipelago would continue after 2014. • Capture, restrain, and sedate seals to attach (glue to pelage) telemetry devices, including but not limited to: GPS, satellite trackers, dive recorders, VHS tags and "Crittercam." • Up to 60 healthy seals (except lactating females and nursing pups) can be instrumented in conjunction with health and disease studies. • Some translocated seals may be instrumented.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo, **plus:** • Additional instrumentation above number and type permitted in Status Quo could be authorized. • Captive seals could be used to test instruments.	• Same as Alternative 3
Activities that require capture, handling, or procedures on wild seals	*De-worming* *(Research and enhancement)*	• Currently-permitted studies and treatment (through topical treatment, injections or oral treatment) for intestinal parasites in the Hawaiian Archipelago would continue after 2014. • Capture (by hand or net) and restrain seals to weigh and measure, treat for intestinal parasites, fecal sample, and conduct ultrasound measurements to determine if treatment is effective. • Up to 200 seals (up to age 3 years) can be treated for intestinal parasites.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• If treatment for intestinal parasites is deemed effective, conduct widespread treatment of young seals to reduce overall parasite loads with additional treatments above number permitted in Status Quo. • New treatments could be used as they become available. • Could be done in conjunction with translocation and vaccination. • Captive seals could be treated.	• Same as Alternative 3
	Translocate seals to improve survival or alleviate male aggression *(Enhancement)*	• Currently-permitted translocation to aid abandoned nursing pups, mitigate shark predation or human interaction, or mitigate male aggression would continue after 2014. • Capture (net or hand), restrain, handle, transport, and release seals by various methods. • Up to 20 nursing pups annually that have been abandoned or have been switched between two lactating females may be captured, restrained by hand or net, and relocated to a prospective foster mother or back to their natural mother, respectively. • Up to 35 weaned pups annually may be captured, restrained, sedated, sampled, instrumented, and translocated via boat, vehicle or aircraft from a high risk area (*e.g.,* shark predation or anthropogenic threats) to a low risk area within the same island or atoll in the NWHI or Johnston Atoll, or within the MHI. • Up to 6 weaned pups annually may be translocated (using methods as described above) within the NWHI from areas of poor juvenile survival to areas with higher rates of juvenile survival. • Up to 10 aggressive adult males over a 5-year period may be captured, restrained, sedated, sampled, instrumented and translocated via boat, vehicle or aircraft or placed in permanent captivity to improve survival of immature seals and females.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Same as Status Quo **with following differences:** • Translocate seals with unmanageable human interactions out of the MHI as needed. • Translocate ≥2-year-old seals from the MHI to NWHI to evaluate survival rates. • Additional translocations within the NWHI or within the MHI above number permitted in Status Quo could be authorized. • Translocate up to 20 weaned pups annually from areas with low prospective juvenile survival to areas with higher juvenile survival within the NWHI, within the MHI or from the MHI to NWHI (instead of only within the NWHI as under Status Quo). **This *excludes* moving seals born in the NWHI to MHI**. This could equate to a total of 200 weaned seal pups translocated over a 10-year period though this number is not likely to be reached (see Section 2.9). • For two-stage translocations, NMFS will use a decision framework for determining the source and recipient sites as well as other aspects of translocations, *with a prohibition* on translocation of weaned pups from the NWHI to the MHI. • Option to return previously translocated seals ≥2 years old back to their original site or nearest appropriate alternative site. Note that seals born in the MHI and previously translocated to the NWHI may be returned to the MHI in the second stage of two-stage translocations.	• Same as Alternative 3 **with following differences**: • Translocate up to 20 weaned pups annually from areas with low prospective juvenile survival to areas with higher juvenile survival **anywhere within the Hawaiian Archipelago**, ***including*** **from the NWHI to MHI** (*i.e.,* greater flexibility than under Alternative 3). This could equate to a total of 200 weaned seal pups translocated over a 10-year period with a maximum of 60 translocated seal pups in the MHI during year 3 of the translocation process. While this could be the maximum number permitted, it is not likely this many weaned seal pups would be translocated (see Section 2.10). • NMFS will use a decision framework for determining the source and recipient sites (see Appendix F) as well as other aspects of translocations. • Option to return previously

Classification	Research/Enhancement Activity	Alternative 1 - Status Quo; Currently-permitted activities would continue after 2014 with no increased efforts or new activities allowed.	Alternative 2 - No Action; No Permit after 2014; activities currently permitted would not be authorized after 2014.	Alternative 3 - Limited Translocation (Preferred Alternative)	Alternative 4 - Enhanced Implementation Alternative
					translocated seals ≥2 years old back to their original site or nearest appropriate alternative site.
	Supplemental Feeding	• Not authorized.	• Not authorized.	• Supplemental feeding of monk seals in NWHI locations where seals are released after being cared for in captivity (post-rehabilitation).	• Same as Alternative 3.
	Mitigate Fishery and Human/Domestic Animal Interactions and alter aggressive male behavior *(Research and enhancement)*	• Currently-permitted approach and disentanglement of any seals in the Hawaiian Archipelago or Johnston Atoll from marine debris would continue after 2014. • Fishing hooks embedded in seals may also be removed. • Restraint and sedation may be used as necessary to accomplish these tasks on an unlimited number of seals (*i.e.,* as warranted). • Translocating seals away from high risk areas such as where human/domestic animal interactions or adult male aggression threaten a seal is covered above in Translocations.	• Same as Status Quo except no new permits or authorizations issued after 2014.	• Conduct research to develop tools for modifying undesirable Hawaiian monk seal behavior related to interactions with humans, domestic animals, and fishing gear in the MHI. This includes research on captive and wild and seals. • If research indicates that aversive conditioning or other methods are effective in reducing interactions with humans, domestic animals, and fishing gear, then implement these tools, particularly in the MHI as needed. • Chemically alter aggressive male monk seal behavior using a testosterone agonist. This includes research on captive and wild seals. If research indicates methods are effective, implement in the wild as needed. • Additional disturbances/harassment above number permitted in Status Quo could be authorized as needed.	• Same as Alternative 3
Potential direct and indirect mortality from research and enhancement	*Mortality incidental to research and enhancement activities*	• Currently-permitted incidental mortality during authorized research and enhancement not to exceed two seals any age or sex annually, up to four over five years would be authorized after 2014.	• Same as Status Quo except no new permits issued after 2014.	• Additional mortality incidental to enhancement (but not research) activities may be authorized.	• Same as Alternative 3
	Intentional lethal collection and permanent removal of seals from the wild for research (moribund seals) or enhancement (adult males)	• Currently-permitted euthanasia of aggressive adult males and any moribund seals in the Hawaiian Archipelago or Johnston Atoll could continue after 2014. • Up to 10 aggressive adult males may be euthanized over a 5-year period to improve survival of immature seals and adult females (total includes translocating aggressive males). • Up to 10 moribund seals of any age/sex may be humanely euthanized and sampled for diagnosis over a 5-year period.	• Same as Status Quo except no new permits issued after 2014.	• Same as Status Quo	• Same as Status Quo

2.11 *ELEMENTS COMMON TO ALL ALTERNATIVES*

Some elements of the alternatives, such as the use of new technology, can be applied under any of the alternatives[1] as appropriate. The following methods would be common to all research and enhancement permits:

- Protocols for capture and handling of monk seals;
- Application of new technologies, as appropriate, to improve results or minimize disturbance;
- Optimization of survey techniques including, but not limited to, timing and coordination;
- Research on existing data sets such as population modeling, etc.;
- Research on existing tissue samples including skin, muscle, blubber, blood, swabs, placentae, etc.; and
- Collection of samples from prey species for potential contaminant monitoring.

Additionally, there are statutory and regulatory requirements for MMPA/ESA permits common to all alternatives, such as:

- Regulatory requirements for issuing and amending permits;
- General permit terms and conditions;
- Mitigation measures to minimize impacts and ensure compliance with the MMPA and ESA;
- Monitoring requirements to determine the status of individual animals after they have been handled and the effects of research related disturbance on the island or atoll, especially in relation to the incidence of serious injury and mortality;
- Requirements for timely dissemination of research results and notification of publications;
- Types of information required in annual and final reports; and

[1]Note that under Alternative 2, No Action, the current MMPA/ESA Research and Enhancement Permit would expire in June 2014.

- Duration of permits.

This section presents requirements for permits common to all alternatives.

2.11.1 *GENERAL PERMIT ISSUANCE REQUIREMENTS (50 CFR 216.34)*

- Permit applicants must demonstrate that the proposed activity is:
    - Humane[2] and does not present unnecessary risks to the health and welfare of marine mammals;
    - Consistent with all restrictions in 50 CFR 216.41;
    - Conducted consistent with the purposes and policies in Section 2 of the ESA; and
    - By itself or with other activities, will not likely have a significant adverse impact on the species.
- The applicant's expertise, facilities, and resources must be adequate to successfully accomplish the objectives and activities stated in the application.
- If a live animal will be held captive or transported, the applicant's qualifications, facilities, and resources must be adequate for the proper care and maintenance of the marine mammal.
- Any import or export of marine mammals or parts will not result in the taking of marine mammals or marine mammal parts beyond those authorized by the permit.
- The opinions or views of persons knowledgeable of the marine mammals that are the subject of the application or of other matters germane to the application will be considered.

2.11.2 *SCIENTIFIC RESEARCH AND ENHANCEMENT PERMIT ISSUANCE REQUIREMENTS (50 CFR 216.41)*

- Permit applicants must demonstrate that:

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[2] Humane means the method of taking, import, export or other activity that involves the least possible degree of pain and suffering practicable to the animal involved (50 CFR 216.3).

    - The proposed activity furthers a bona fide scientific or enhancement purpose.
    - If the lethal taking of marine mammals is proposed:
        - Non-lethal methods for the research are not feasible; and
        - For depleted, endangered, or threatened species, the results will directly benefit that species, or will fulfill a critically important research need.
    - Any permanent removal of a marine mammal from the wild is consistent with any applicable quota established by the Director, NMFS OPR.
    - The proposed research will not likely have significant adverse effects on any other component of the marine ecosystem of which the affected species is a part.
- For endangered species:
    - The proposed research cannot be accomplished using a species that is not endangered.
    - The proposed research, by itself or in combination with other activities will not likely have a long term direct or indirect adverse impact on the species.
    - The proposed research will either:
        - Contribute to fulfilling a research need or objective identified in a species recovery or conservation plan;
        - Contribute significantly to understanding the basic biology or ecology of the species, or to identifying, evaluating, or resolving conservation problems for the species; or
        - Contribute significantly to fulfilling a critically important research need.
- For proposed enhancement activities:
    - Only living marine mammals and marine mammal parts necessary for enhancement of the survival, recovery, or propagation of the affected species may be taken, imported, exported, or otherwise affected under an enhancement permit. Marine mammal parts include clinical specimens or other biological samples required for the conduct of breeding programs or the diagnosis or treatment of disease.
    - The activity must likely contribute significantly to maintaining or increasing distribution or abundance, enhancing the health or welfare of the species, or ensuring the survival or recovery of the

species in the wild.

  - The activity must be consistent with an approved recovery plan developed under Section 4(f) of the ESA.

- An enhancement permit may authorize the captive maintenance of an endangered marine mammal only if NMFS determines that:
  - The proposed captive maintenance will likely contribute directly to the survival or recovery of the species by maintaining a viable gene pool, increasing productivity, providing necessary biological information, or establishing animal reserves required to support directly these objectives; and
  - The expected benefit to the species outweighs the expected benefits of alternatives that do not require removal of marine mammals from the wild.
- NMFS may authorize the public display of marine mammals held under the authority of an enhancement permit only if:
  - The public display is incidental to the authorized captive maintenance;
  - The public display will not interfere with the attainment of the survival or recovery objectives;
  - The marine mammals will be held consistent with all requirements and standards that are applicable to marine mammals held under the authority of the Acts and the Animal Welfare Act, unless the Office Director determines that an exception is necessary to implement an essential enhancement activity; and
  - The marine mammals will be excluded from any interactive program and will not be trained for performance.
- NMFS may authorize non-intrusive scientific research to be conducted while a marine mammal is held under the authority of an enhancement permit, only if such scientific research:
  - Is incidental to the permitted enhancement activities; and will not interfere with the attainment of the survival or recovery objectives.

2.11.3 DURATION OF PERMITS (50 CFR 216.35 AND 216.39)

Scientific research and enhancement permits may be valid for a maximum of five years from the date of issuance (50 CFR 216.35[b]). The 5-year period may be extended up to 12 months beyond that established in the original permit via a minor amendment (50 CFR 216.39).

2.11.4 REPORTING REQUIREMENTS (50 CFR 216.38)

Permit Holders must submit annual, final, and special reports. Annual reports must be submitted to the Chief, Permits and Conservation Division (hereinafter "Permits Division"), Office of Protected Resources at the conclusion of each year for which a permit is valid. Annual reports are due 90 days after the end of each reporting period (either a calendar year or a 12-month period determined by field seasons). Each annual report must include the following:

- A table reporting the number of animals taken, by activity and location;
- Non-permitted species taken and observed effects;
- Problems or unforeseen effects encountered and steps to resolve such problems;
- Measures taken to minimize effects on animals and the effectiveness of these measures;
- Circumstances surrounding unintentional injuries or deaths of animals, and a description of how the animals were disposed;
- The physical condition of animals taken;
- The effects permitted activities had on animals;
- Steps taken to coordinate the activities with other permit holders;
- Preliminary findings and whether the goals were accomplished;
- Titles of reports, publications resulting from the reporting period; and
- Any incidental use of photographs, film, or other images.

Special or "incident" reports are required for events such as serious injury, mortality, and exceeding authorized take. Incident reports must be submitted to within two weeks of the incident and describe the events and steps that will be taken to reduce the potential for additional incidents.

Final reports must be submitted within 180 days after conclusion of research or expiration of the permit. Final reports must include the following:

- A description of how project goals were accomplished or an explanation of why they were not accomplished;
- A description of how the research or enhancement benefited the species, promoted recovery, or conserved the target species and fulfilled objectives listed in the Recovery Plan;
- Any problems or unexpected outcomes; and if permitted to use different methods, which worked best and why;
- A qualitative and quantitative description of the types of reactions target and non-target animals had, and whether the activities had any effects on habitat;
- Whether the mitigation measures employed were successful in minimizing or avoiding adverse impacts to target and non-target species, and any additional measures that might further minimize reactions;

- Efforts made to share data or collaborate with other researchers and a description of how the collaborations occurred;
- Publications or reports not listed in annual reports;
- Any new directions for future studies identified as a result of the research or enhancement;
- Any new or emerging technologies that could be used to further the research or enhancement; and
- An explanation of whether any permit conditions were difficult to comply with or were unclear; and whether the take numbers requested in the permit application were accurate and realistic.

2.11.5 MITIGATION AND CONDITIONS OF PERMITS AND AUTHORIZATIONS

Scientific research and enhancement permits issued under the MMPA and ESA require researchers to abide by general terms and conditions based on requirements of the statutes and regulations.

Activities authorized in a permit must occur by the means, in the areas, and for the purposes set forth in the permit application, and are limited by the terms and conditions in a permit. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

MMPA and ESA research and enhancement permits contain the following types of permit terms and conditions:

- Duration of permit;
- Number and kinds of protected species, locations and manner of taking;
- Qualifications, responsibilities, and designation of personnel;
- Possession of permit;
- Reports;
- Notification and coordination;
- Observers and inspections;
- Permit modification, suspension, and revocation; and
- Penalties and permit sanctions; and Acceptance of permit.

Descriptions of how mitigation measures would be incorporated into the research and enhancement programs must be included in the permit applications and are presented in Sections 2.7-2.10 for the various alternatives. Incorporation of terms and conditions in a permit also helps to mitigate possible adverse impacts to animals from the permitted activities.

In addition to general terms and conditions common to all research and enhancement permits, there are a number of special conditions for activities

conducted on pinnipeds, and specifically on Hawaiian monk seals. These are found within the conditions pertaining to the manner of taking. The section below details both the general and special terms and conditions common to permits issued under each alternative.

2.11.5.1 *DURATION OF PERMIT*

As described above, permits may be valid for a 5-year period. The Director, NMFS Office of Protected Resources, may extend the permit by one year via a minor amendment. Each permit has a specified expiration date.

Researchers are required to suspend permitted activities if serious injury or mortality of protected species reaches that allowed in the permit, or if authorized take is exceeded.

2.11.5.2 *NUMBER AND KINDS OF PROTECTED SPECIES, LOCATIONS AND MANNER OF TAKING*

Each permit contains a table outlining the number of animals authorized to be taken (by species and stock), and the locations, manner, and time period in which they may be taken.

Researchers working under a permit may take photographs and video incidental to research or enhancement, provided it does not result in takes. Photos and other media may be used in printed materials (including commercial or scientific publications) and presentations; a statement citing the permit number must accompany the images.

The Chief, Permits Division may authorize non-essential activities (*e.g.*, a documentary film crew). These activities must not influence the research or enhancement or result in takes. The Permit Holder and researchers cannot require compensation in return for allowing non-essential personnel to accompany researchers.

Researchers must comply with the following special conditions related to the manner of taking Hawaiian monk seals (these conditions pertain to the current research and enhancement Permit No. 10137):

- Carry out activities efficiently and use biologists experienced in capture and sampling techniques to minimize handling time and disturbance.
- Whenever feasible, take target animals or collect samples when no other seals are near, particularly mother/pup pairs.
- Immediately stop activities if the actions may be life threatening to a seal; if a seal has an adverse reaction, monitor and treat the animal as

determined by the attending veterinarian, principal investigator (PI) or a co-investigator (CI).

- Minimize disturbance when approaching seals, particularly mother/pup pairs, and stop if there is evidence that the activity is interfering with vital functions of any animal.
- If a pup is orphaned as a result of permitted activities, the pup must be humanely provided for (*i.e.*, placed in a Stranding facility for rehabilitation or humanely euthanized).
- Only experienced, well-trained personnel may perform intrusive procedures. For activities involving the use of sedatives, an experienced marine mammal veterinarian must be present.
- Use sterile disposable needles, biopsy punches, and other sampling tools or clean and disinfect non-disposable equipment.
- Monitor seals after disturbance or capture to ensure they resume normal behavior.
- The Permit Holder must provide updates on how deworming trials proceed and halt treatments if the health and welfare of the seals is compromised.
- An experienced veterinarian must conduct humane euthanasia and after necropsy, all parts not retained must be collected for environmentally safe disposal.
- Hawaiian monk seals used in captive research must be maintained and transported in compliance with the provisions of the Animal Welfare Act (AWA) and AWA implementing regulations.
- Contingency plans must be in place to prevent escape from temporary pens (*e.g.*, during extreme weather events) and to respond to escape (*e.g.*, search surveys).
- Prior to removing adult male seals from the wild into permanent captivity, a facility to permanently house the seal(s) must be identified,, and plans for temporary care of the animals prior to transfer to the permanent facility, if needed, must be submitted.

The above or similar conditions would apply to future permits (including File No. 16632; see Section 2.9), as deemed appropriate by the Director, Office of Protected Resources (50 CFR 216.36[b]).

All research and enhancement permits authorizing sample collection have requirements for the disposition of marine mammal parts/biological samples, outlined in Appendix I.

2.11.5.3 QUALIFICATIONS, RESPONSIBILITIES, AND DESIGNATION OF PERSONNEL

All research and enhancement permits identify by name the researchers (PI and CIs) authorized to participate in the permitted activities. Individuals conducting

permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under a permit are as follows:

- The Permit Holder is ultimately responsible for activities of individuals operating under the permit. Where the Permit Holder is an institution, the Responsible Party is the person at the institution who is responsible for the supervision of the PI.
- The PI is the individual primarily responsible for the taking, import, export and related activities conducted under the permit. The PI must be on site during activities conducted under this permit unless a CI is present to act in place of the PI.
- CIs are individuals who are qualified to conduct activities authorized by the permit without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.
- Research Assistants (RA) work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI and are not named in the permit.

Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to:

- Individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of vessels or aircraft);
- Individuals included as backup for essential personnel; and
- Individuals included for training purposes.

Persons who require state or Federal licenses to conduct activities authorized under a permit (*e.g.*, veterinarians, pilots) must be duly licensed when undertaking such activities.

Permitted activities may be conducted on vessels or aircraft or in cooperation with individuals engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities, except with written approval of the Chief, Permits Division (*e.g.*, for documentary film making).

The Permit Holder cannot require or receive direct or indirect compensation from persons requesting to conduct activities under the permit. The Permit Holder or PI may designate additional CIs and must provide a copy of the letter designating the individual to the Permits Division on the day of designation.

2.11.5.4 POSSESSION OF PERMIT

Permits cannot be transferred or assigned to any other person. The Permit Holder and persons operating under the authority of a permit must possess a

copy of the permit when engaged in a permitted activity. A copy of the permit must be attached to any means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

2.11.5.5 REPORTS

As described in Section 2.11.4 above, Permit Holders must submit annual, final, and incident reports, and papers or publications resulting from the activities authorized by a permit. Incident reports (*e.g.*, for serious injury, mortality, or exceeding authorized take) are due within 2 weeks of the incident. Annual reports are due 90 days after the end of each permit year, and final reports are due 180 days after the expiration of the permit or conclusion of research or enhancement. Section 2.11.4 presents information required in permit reports. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

2.11.5.6 NOTIFICATION AND COORDINATION

Permit Holders must provide written notification of planned fieldwork to the Pacific Islands Assistant Regional Administrator for Protected Resources at least 2 weeks prior to initiation of a field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

Permit Holders must coordinate activities with other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals.

2.11.5.7 OBSERVERS AND INSPECTIONS

At the request of NMFS, the Permit Holder must allow an employee of NOAA or another designated other person to observe permitted activities. The Permit Holder must provide documents or other information relating to the permitted activities upon request.

2.11.5.8 MODIFICATION, SUSPENSION, AND REVOCATION

Permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

The Director, NMFS Office of Protected Resources may modify, suspend, or revoke a permit in whole or in part:

- To make the permit consistent with a change in the regulations prescribed under Section 103 of the MMPA and Section 4 of the ESA;
- In a case in which a violation of the terms and conditions of the permit is found;
- In response to a written request from the Permit Holder;
- If NMFS determines that the application or other information pertaining to the permitted activities includes false information; and
- If NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

Issuance of a permit does not guarantee or imply that NMFS will issue or approve subsequent permits or amendments for the same or similar activities requested by a Permit Holder, including those of a continuing nature.

2.11.5.9 PENALTIES AND PERMIT SANCTIONS

A person who violates a provision of a permit, the MMPA, ESA, or the regulations at 50 CFR 216 and 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA, ESA, and 15 CFR part 904.

NMFS is the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in a permit. The Permit Holder must contact the Permits Division for verification before conducting an activity if they are unsure whether an activity is within the scope of the permit. Failure to verify, where NMFS subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

2.11.5.10 ACCEPTANCE OF PERMIT

When a permit is issued by signature of the Director, Office of Protected Resources, the Permit Holder must date and sign the permit, and return a copy of the original signature to the Office Director. The permit is effective upon the Permit Holder's signing of the permit.

In signing a permit, the Permit Holder:

- Agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 216, and 222-226, and all restrictions and requirements under the MMPA, and the ESA;

- Acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and
- Acknowledges that the permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with other Federal, State, local, or international laws or regulations.

2.11.6 MONITORING

All NMFS permits for research on pinnipeds require permit holders to conduct post-activity monitoring without causing further disturbance. As indicated above, Permit Holders conducting research on Hawaiian monk seals are required to monitor animals after disturbance or capture (*e.g.,* for signs of acute stress or injury, effects of administering drugs). The results of such observations are included in reports submitted to the OPR Permits Division. Monitoring protocols designed for the proposed research and enhancement activities are presented in Sections 2.5, 5.2 – 5.4, and Appendix F.

2.11.7 INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE

Federal mandates, including the United States Department of Agriculture (USDA) AWA of 1966 as amended (1985), and the Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals established the requirements for oversight of animal research by an Institutional Animal Care and Use Committee (IACUC).

NMFS researchers applying for permits must submit with a permit application verification of IACUC approval and the protocols reviewed by the IACUC. The NMFS PIFSC submitted with their application File No. 16632 such verification.

The IACUC must be composed of at minimum three members, one of which must be a veterinarian "with experience in laboratory animal science and medicine who has direct or delegate program responsibility for activities involving animals at the research facility," and another who is not affiliated in any way with the facility other than being a member of the committee (9 CFR 2.31). If the committee consists of more than three members, no more than three members may be of the same administrative unit of the facility (9 CFR 2.31). The purpose and functions of the IACUC are to:

- Review, inspect, and prepare a report on the facility's program for humane care and use of animals and animal facilities at least once every 6 months;
- Review and investigate (if warranted) complaints concerning the care and use of animals at the facility;

- Make recommendations to the institutional office concerning the facility's animal program, facilities, or personnel training;
- Review, approve, require modifications to, or withhold approval of, any components, activities, or significant proposed changes in activities related to the care and use of animals, and;
- Be authorized to suspend any activities related to the care and use of animals (9 CFR 2.31).

While the AWA exempts field studies from full IACUC review and approval by an animal use committee, the field study exemption does not apply to any study that involves "an invasive procedure or that harms or materially alters the behavior of the animal under study" (NMFS 2010a).

To ensure adherence to the AWA and U.S. Government Principals for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training, NMFS established in 2010 three regional IACUC's as well as incorporated the IACUC review and approval process into any field studies not excluded from AWA exemption including any future permit requests for Hawaiian monk seal research and enhancement activities (NMFS 2010a; NFMS 2010b; Personal comm. with NMFS 2011).

NMFS IACUC standards require that any research conducted by a NMFS Principal Investigator be reviewed and approved by the regional NMFS IACUC (NMFS 2010b). NMFS IACUC standards also apply to any research conducted by a CI under a NMFS Principal Investigator, research funded by NMFS, and non-NMFS funded research (NMFS 2010b).

For Hawaiian monk seal research, NMFS uses the IACUC established by the University of Hawai'i (UH) in addition to the NMFS IACUC as a form of independent review and because UH personnel are involved in much of the research as CIs. The use of the UH IACUC by NMFS does not preclude the need for NMFS IACUC oversight (Personal comm. with NMFS 2011).

The UH IACUC is a body composed of volunteers consisting of veterinarians, biological and non-biological scientists, and local community representatives who are responsible for the oversight and evaluation of university activities involving vertebrate animals (UH IACUC 2002). The committee is responsible for:

- Reviewing activities involving vertebrate animals;
- Conducting semiannual inspections and program reviews;
- Investigating, reviewing and addressing concerns brought to the committee; and

- Managing issues concerning humane care, use, and alleged noncompliance (UH IACUC 2002).

The UH IACUC requires that vertebrate animal use be reviewed and approved by the committee prior to use occurring (UH IACUC 2002). The UH IACUC requires all applicants to submit to the committee:

- The species, number, and justification for the use of animals;
- A non-technical description of the project;
- A description of the procedures to be performed including use of anesthetics/analgesics, paralytic agents, surgeries, methods of restraint and euthanasia;
- A list of precautions to ensure humane care;
- A description of animal holding facilities, and;
- The final disposition of the animals (UH IACUC 2002).

2.12 ALTERNATIVES NOT CARRIED FORWARD FOR ANALYSIS

2.12.1 REDUCTION OF COMPETITION AND PREDATION IN THE NORTHWESTERN HAWAIIAN ISLANDS

Comments were submitted during scoping and public comment period requesting that an alternative to reduce populations of large predatory fish in the NWHI (Papahānaumokuākea Marine National Monument [Monument]) as a way to increase survival of Hawaiian monk seals be considered in the PEIS. This proposal is based on the hypothesis that one of the primary factors limiting monk seal recovery in the NWHI is shark predation and direct or indirect competition with other top predators (*e.g.*, sharks and jacks). Mitigation of shark predation on monk seals is an ongoing activity that has been subject to previous NEPA analysis (NMFS 2012). The competition hypothesis is consistent with dietary information for these species that indicates a probable overlap with that of monk seals. Further, observations from Critter Cam deployments have revealed direct competition between monk seals and sharks and jacks (*i.e.*, harvesting prey items flushed by monk seals, also known as kleptoparasitism) (Parrish *et al.* 2008). One possibility is that the abundance of top-level predators in the NWHI may be unnaturally high due in part to supplemental food provided in discarded bait and bycatch from commercial fisheries that operated in the NWHI. However, the latter theory is largely conjectural and has yet to be fully validated by scientific research.

NMFS has considered reduction of competition and predation to benefit monk seals. There is currently a lack of sufficient information on NWHI food web

dynamics to reliably predict whether predator reduction would be an effective method for improving juvenile monk seal survival without unintended consequences. Undesirable changes in predator-prey dynamics could potentially be caused by fishing and therefore a more complete understanding of the system's trophic dynamics is required prior to undertaking any predator reduction experiment, whether locally or system wide. Compared to all other actions proposed in the alternatives carried forward for analysis, the result of large-scale predator management/removal is far more uncertain. It is not the ability to remove fish that is uncertain, but rather whether it would necessarily benefit monk seals without having other unanticipated and undesirable environmental consequences. The time required to gather sufficient data in order to understand the impacts and effectiveness of reducing predatory fish populations would not be timely for the recovery of the monk seal – which makes predator reduction inconsistent with the Purpose and Need of this PEIS.

NMFS is not dismissing this concept indefinitely, and plans to investigate it further with other agency and independent scientists outside the context of the PEIS. If after obtaining sufficient data to determine such action is warranted, we would conduct a separate NEPA analysis to fully address the potential effects of such environmental manipulation. However, given the currently available information, this alternative is not practical or feasible and will not be carried forward for analysis.

2.12.2 BUILD A HAWAIIAN MONK SEAL RESEARCH FACILITY OR AQUARIUM IN THE NORTHWESTERN HAWAIIAN ISLANDS

Comments were submitted during scoping and public comment period requesting that an alternative to build a research facility or aquarium for breeding, rearing and feeding monk seals in the NWHI be considered in the PEIS. The infrastructure necessary for constructing and operating such a facility in the NWHI would be expensive and logistically very challenging due to the remote nature of the NWHI. The NWHI are a U.S. Marine National Monument, as well as a United Nations World Heritage Site. Human impacts in the Monument are minimized and heavily regulated to protect the native ecosystem. The current NMFS researchers in the field live in tents, bring up all food and water (stored in sealed buckets) to survive for several months, have only limited electricity from small solar systems, and no running water. Construction of a facility to hold monk seals in captivity in the NWHI could be possible at a site such as Midway Atoll, which has a working runway and considerable infrastructure. However the costs of constructing a holding facility with appropriate refrigeration for seal diet (and ability to have that diet delivered), adequate water filtration, staff accommodations, cost of transport, etc. would be several orders of magnitude more than the current NMFS research program budget. While a monk seal care facility is under construction by a non-

government entity (The Marine Mammal Center) on Hawaii Island in the MHI, building, operating and maintaining a facility on a scale sufficient for research, breeding, rearing and feeding captive monk seals in the NWHI is not reasonable..

2.13 ONGOING NOAA ACTIVITIES THAT ARE NOT PART OF THE PEIS ALTERNATIVES

Currently, the Pacific Islands Regional Office (PIRO) of NMFS implements activities that indirectly affect Hawaiian monk seals but are not considered elements of the PEIS alternatives evaluated herein either because they have been evaluated under separate NEPA compliance documents or are not considered part of the research and enhancement program (*e.g.*, education and outreach). Table 2.12-1 provides a list of these activities and links where additional information is available. These activities are considered in the analysis of cumulative effects presented in Chapter 4 (see Table 4.5-1).

Table 2.12-1 Ongoing NOAA Activities That Are Not Part of Alternatives

Classification	Activity
Sightings Network	• Opportunistic sightings and volunteer observation programs for Hawaiian monk seals in the MHI
Marine Mammal Health and Stranding Response Program	• Rehabilitation and release of stranded seals; • Health-related research on captive and rehabilitating seals (excluding vaccination research); and • Responding to unusual mortality events
Ecological studies	• Continue demographic and ecosystem modeling • Using LIDAR to collect elevation and bathymetry data for the NWHI • Conduct oceanographic studies to determine effects of oceanographic variability on prey abundance availability and foraging success
Habitat protection, loss mitigation and restoration	• Maintain current habitat protection or ensure that if status or jurisdiction changes protection is not diminished • Investigate rebuilding pupping habitat and evaluate possible colonization of Johnston Atoll • Ensure that monk seal concerns are included in all vessel grounding response plans • Provide rapid response, removal and monitoring of vessel groundings
Education/Outreach programs	• Hawaiian Monk Seal Recovery Team • Main Hawaiian Islands Management Plan • Outreach plan • Partnership grants for Hawaiian monk seal recovery • Incorporating community feedback into research and enhancement activities
Program to Remove Marine Debris	• Removal of hazardous debris from high entanglement risk zones • Develop working groups and education to help reduce the amount of debris

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3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter provides a description of the physical, biological and socioeconomic environment within the project area that may be affected by research and enhancement on Hawaiian monk seals or that may be a factor in the species' decline. The objective of this section is to provide a baseline against which the alternatives may be evaluated and compared (Chapter 4).

The project area for the analysis encompasses the Hawaiian Archipelago and Johnston Atoll as shown in Figure 1.3-1. The time frame for this analysis is defined as 1958 through approximately 2024. As described in more detail in Section 3.3.1, 1958 marks the point in time when the first beach counts of Hawaiian monk seals were conducted in all the primary Northwestern Hawaiian Islands. That year is considered a benchmark for the species' known historic high point of abundance. By the year 2024, National Marine Fisheries Service (NMFS) will have completed two five-year permit cycles authorizing Hawaiian monk seal research and enhancement activities.

3.2 PHYSICAL ENVIRONMENT

The Hawaiian Archipelago is a part of the Hawaiian Ridge-Emperor Seamounts chain in the central North Pacific Ocean. The Hawaiian Ridge-Emperor Seamounts chain is comprised of more than 80 volcanoes and is the result of the Pacific Plate traveling northward then northwestward over the stationary Hawaiian oceanic "hot-spot" (currently located underneath the Island of Hawai`i) over the past 70 million years (United States Coast Guard [USGS] 1999). The Hawaiian Ridge-Emperor Seamounts chain extends approximately 6,000 kilometers from the main Island of Hawai`i (the youngest of the islands) to the Aleutian Trench, which parallels the Aleutian Islands of Alaska. The Hawaiian Ridge section of this chain is approximately 2,600 kilometers in length (the equivalent distance of Washington D.C. to Denver, CO) extending from the Island of Hawai`i to Kure Atoll (USGS 1999).

The Archipelago is comprised of two island groups: The "Main" Hawaiian Islands (MHI) and the "Northwestern" (or "Leeward") Hawaiian Islands (NWHI). The eight Main Islands are grouped at the southeastern end of the Archipelago and occupy about 600 km (approximately 373 miles) of its total length, while the NWHI extend another 1,100 km (approximately 684 miles) to the west-northwest. The capital city of Hawai`i, Honolulu, on the island of O`ahu, is located 3,800 kilometers (km) (approximately 2,361 miles) from the west coast of the Unites States (U.S.) mainland, about 6,000 km (approximately 3,728 miles) east of Japan, and 4,400 km (approximately 2,734 miles) due south of Anchorage, Alaska (Friedlander *et al.* 2009; USGS 1999).

3.2.1 *Main Hawaiian Islands*

The MHI are the youngest of the Hawaiian Island Archipelago. The MHI are comprised of eight large islands (O`ahu, Kaua`i, Maui, Hawai`i, Moloka`i, Lāna`i, Ni`iahu, Kaho`olawe) as well as numerous minor islands, islets and stacks (Hawaii Department of Business, Economic Development and Tourism [DBEDT] 2010). The MHI comprise approximately 12,548 square kilometers of land and 1,431 km of coastline (Coastal Geology Group 2011; DBEDT 2010). Hawaiian monk seals can be found in small numbers throughout MHI (Antonelis *et al.* 2006). Physical attributes of the MHI are presented in Table 3.2-1 below.

Table 3.2-1 Key Physical Attributes of the Main Hawaiian Islands

Island	Land area (miles^2)	Shoreline (miles)	Max Elevation (feet) (location on island)	Lat/Long	Special Features
O`ahu	597	112	4,003 (Mt. Ka`ala)	21°28'North (N) 157°59'West (W)	Most populous island; 3rd largest; Waianae and Koolau, mountain ranges
Kaua`i	562	136	5,243 (Kawaikini)	22°05′N 159°30′W	4th largest island; Waimea Canyon; "Barking Sands" Pacific Missile Range
Maui	727	86	10,238 (Haleakalā)	20°48′N 156°20′W	2nd largest island; wintering area for humpback whales in Au`au Channel
Hawai`i	4028	266	13,796 (Mauna Kea)	19°34′N 155°30′W	Largest island; The Great Crack 9 8 mi long deep fissure; active volcano, Kilauea
Moloka`i	206	88	4961 (Kamakou)	21°08′N 157°02′W	5th largest island
Lāna`i	141	121	3,366 (Lānaihale)	20°50′N 156°56′W	6th largest island
Ni`iahu	70	90	1250 (Mt. Pānī`au)	21°54′N 160°10′W	7th largest island; mostly private with limited public access
Kaho`olawe	45	30	1,438 (Pu`u Moaulanui [Lua Makika])	20°33′N 156°36′W	8th largest island; Kaho`olawe Island Reserve; commercial uses are prohibited

All data approximate
Source: Coastal Geology Group (2011)
Website: http://www.soest.hawaii.edu/coasts/data/

3.2.2 *Northwestern Hawaiian Islands*

The NWHI extend from Nihoa Island (located 249 km [approximately 155 miles] Northwest [NW] of Kaua`i) for 1,931 km (approximately 1,200 miles) to Kure Atoll. The NWHI are a conglomerate of atolls, shoals, and emergent land totaling 13.6 square kilometers (km^2) (approximately 5.2 $miles^2$) with none of the island groups totaling more than 6 km^2 (approximately 4 miles).

The mean elevation of the islands is less than 33 feet (ft) (10 meters [m]) with the highest point on Nihoa Island (275 m) (Juvik and Juvik 1998). The NWHI are surrounded by over 30 submerged ancillary banks and seamounts. The majority of the islands are uninhabited, with the exception of Midway Atoll, Kure Atoll, Laysan Island, and French Frigate Shoals, which have been occupied by various government agencies for extended periods over the last century (Friedlander *et al.* 2009).

Hawaiian monk seals are found predominantly throughout the NWHI with six of the population's reproductive sites being located at Kure Atoll, Midway Atoll, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and the French Frigate Shoals (Antonelis *et al.* 2006; Reeves *et al.* 2002). Key physical attributes of the NWHI are presented in Table 3.2-2.

Table 3.2-2 Key Physical Attributes of the Northwestern Hawaiian Islands

Island / Atoll	Area (mi^2)	Area (mi^2) < 10 fathoms	Max Elevation (feet)	Lat / Long	Special Features
Nihoa Island	<1	2.0	903 (Miller's peak)	23° 03′38″N 161° 55′W	Much of the shoreline is rocky and inaccessible due to turbulent nearshore waters, but there is a small sandy beach with suitable habitat for Hawaiian monk seal (NMFS 2007; United States Fish and Wildlife Service [USFWS] 2008)
Necker Island (Mokumanamana)	<2	4.0	102 (Summit Hill)	23° 34′N 164° 42′W	Rocky inaccessible shoreline; turbulent nearshore waters (NMFS, 2007; USFWS, 2008). Surrounded by 603 $miles^2$ (1,558 km^2) of reef habitat; second largest in NWHI ([PIBHMC] 2009)
French Frigate Shoals	<3	181.0	-	23° 52.134′N 166° 17.16′W	Enclosed by an 18 mile (28.9 kilometers [km]) long crescent-shaped reef. Provides highly important habitat for the largest breeding colony of Hawaiian monk seals (NMFS 2007; USFWS 2008)
Gardner Pinnacles	<4	<1	190	25° 01′N 167° 59′W	Oldest high islands in Hawaiian chain; access limited to calm ocean conditions.
Maro Reef	open atoll; awash	84.0	(Awash)	25° 30.2′N 170° 38.34′W	One of the largest reef habitats in NWHI covering 582 $miles^2$ (1,508 km^2)
Laysan Island	2.0	10.0	40	25° 0.04′N 167° 59.82′W	Partially surrounded by fringing reef (NMFS 2007; USFWS 2008) surrounded by extensive sand beds
Lisianski Island	<1	83.0	40	26° 4.2′N 173° 58.12′W	Surrounded by extensive reef, Neva Shoals; open atoll with surface area of 378 $miles^2$ (979 km^2)

Island / Atoll	Area (mi^2)	Area (mi^2) < 10 fathoms	Max Elevation (feet)	Lat / Long	Special Features
Pearl and Hermes Reef	<1	145.0	10	27° 51.37'N 175° 51.09'W	True atoll fringed with shoals, permanent emergent islands, and ephemeral sandy islets which provide essential dry land for Hawaiian monk seal (NMFS 2007; USFWS 2008)
Midway Atoll	25.0	33.0	12	28° 14.28'N 177° 22.01'W	Consists of three sandy islets: Sand, Eastern and Spit which lie within an elliptical barrier reef measuring approximately 5 miles (8 km)
Kure Atoll	<1	35.0	20	28° 25.28'N 178° 19.55'W	World's northernmost coral atoll; Consists of two islets; atoll is circular with a reef 6 miles (9.6 km) in diameter (NMFS 2007; USFWS 2008) covering approximately 64 $miles^2$ (167 km^2) (PIBHMC 2009)

Source: Friedlander et. al. (2009);
County of Hawai`i Data Book Retrieved from http://www.co.hawaii.hi.us/databook_current/Table%205/5.5.pdf. March 2011

3.2.3 *Meteorology and Air Quality*

The so-called "Trade Winds," which blow from northeast to east-northeast direction, account for about 70 percent (%) of all winds in Hawai`i. Winds blow from each of the other quadrants (Northwest [NW], Southwest [SW], and Southeast [SE]) about 10% of the time. During summer trade winds may prevail as much as 90% of the time, while in winter they may occur only 40-60% of the time, giving way stormy and rainy weather.

Concentrations of pollutants fall well below the state and federal ambient air quality standards and air quality in the Hawaiian Islands is better than most other parts of the nation (Department of Health [DOH] 2007). Hawai`i's clean air can be attributed partially to abundant wind and rain, as well as a relatively low population and lack of heavy industry (Rubin 2009).

3.2.4 *Pacific Ocean Around the Hawaiian Archipelago*

The islands of Hawai`i are set in a dynamic oceanographic and meteorological regime in the northern/central subtropical region of the Pacific Ocean and, as such, are influenced by the transition zone between the nutrient-poor surface waters of the North Pacific Subtropical Gyre and the nutrient–rich surface waters of the North Pacific Subpolar Gyre (Kazmin and Rienecker 1996; Leonard *et al.* 2001; Polovina *et al.* 2001; Friedlander *et al.* 2009). Colder, nutrient-rich waters are brought to the region by seasonal shifts and interannual migrations of this front. These waters are important to the productivity and ecology of the region (Polovina and Haight 1999; Nakamura and Kazmin 2003; Polovina 2005; Friedlander *et al.* 2009).

Low day-to-day and month-to-month variability in climate is characteristic of the Hawaiian Archipelago. The climate features mild year-round temperatures, moderate humidity, persistent northeasterly trade winds and infrequent severe storms (Giambelluca and Schroeder 1998; USFWS 2008a). The climate is

influenced by either marine tropical or marine Pacific air masses, depending on the season. During summer, the Pacific High Pressure System dominates, placing the region under the influence of easterly winds with marine tropical and trade winds prevailing. In winter, the area is influenced by the southward movement of the Aleutian Low over the North Pacific (Grigg *et al.* 2008; USFWS 2008a). The surrounding ocean has a dominant effect on the weather of the entire archipelago.

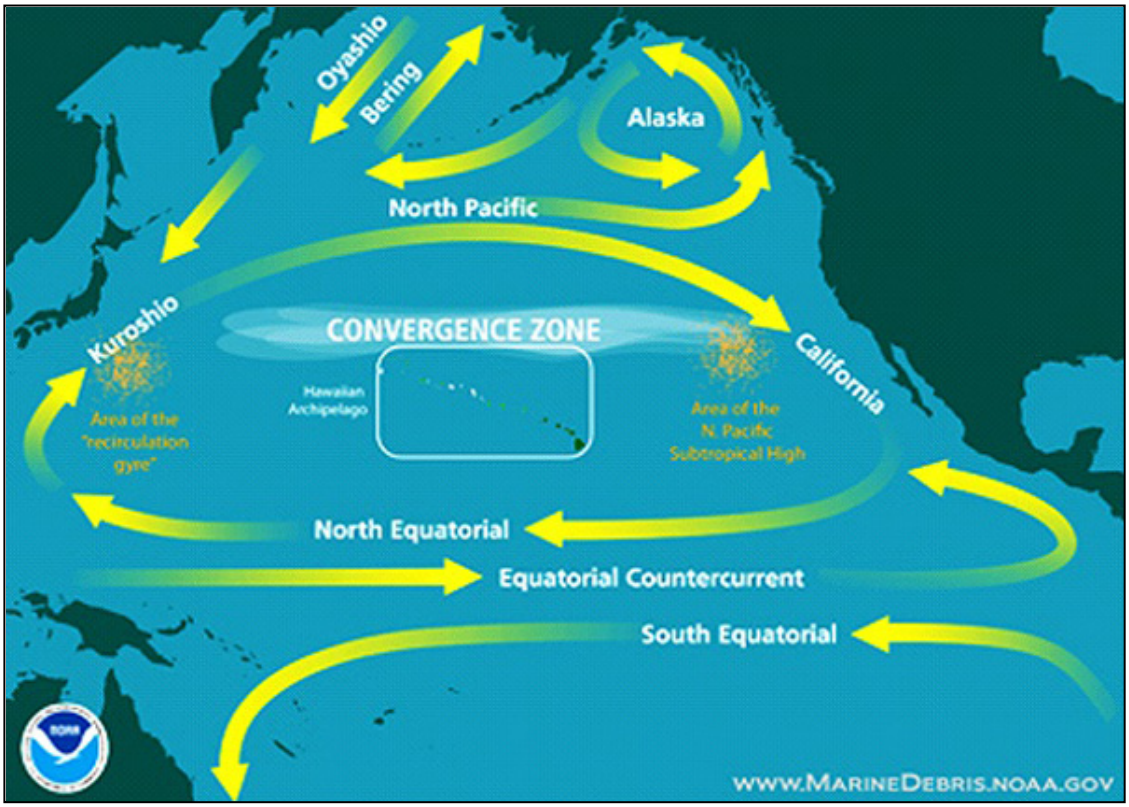
3.2.4.1 *Ocean Circulation and Currents*

Surface currents in the Pacific Ocean are driven by the trade winds and westerlies, such that surface flows are predominantly westward in low latitudes and eastward in high latitudes. When these flows encounter the continents they are diverted both north and south to form coastal currents, which further serve to establish rotating water masses ("gyres") that characterize the overall circulation patterns of the ocean.

The Hawaiian Archipelago is in the central subtropical region of the North Pacific Ocean, near the middle of the North Pacific gyre. In this region the large-scale circulation is generally clockwise (*i.e.*, anti-cyclonic) as depicted in Figure 3.2-1. Near the Hawaiian Islands, oceanic flows are generally from east to west, with vigorous eddies forming on the leeward side of the islands (Flament *et al.* 1998). To the south of Hawai`i, the North Equatorial current flows westward, completing the circuit of the North Pacific gyre.

Eastward-flowing currents carry planktonic larvae from the species-rich western Pacific, and the eastward-spiraling Kuroshio Current facilitates the natural transport of many Japanese organisms to Hawaiian waters (Juvik and Juvik 1998). The archipelago spans such a great distance that its opposite ends often experience different oceanographic and meteorological conditions (Friedlander *et al.* 2009). Surface currents in the NWHI are highly variable in both speed and direction (Firing and Brainard 2006) with the average long-term surface flow being from east to west due to the prevailing northeasterly winds. Eddies created by local island effects on large-scale circulation contribute to the highly variable nature of the surface currents (USFWS 2008a).

Figure 3.2-1 North Pacific Ocean Circulation and Major Currents



Seas offshore of the Hawaiian Islands can be rough, with wave heights of several meters and winter large swell events having waves up to 10 – 12 m in height. The seas are rougher between the islands due to the funneling of wind, and calmer on the leeward side where the surface is shielded from the winds (Flament *et al.* 1998). The Hawaiian Islands are typically not impacted by tropical storms, but do experience annual extratropical storms (storms that originate outside of tropical latitudes) creating high waves during winter. These waves shape the ecosystem by limiting the growth and abundance of coral communities, and lead to species and growth forms that are adapted to these dynamic wave energy environments (Grigg *et al.* 2008).

The transition zone between the nutrient-poor surface waters of the North Pacific Subtropical Gyre and the nutrient-rich surface waters of the North Pacific Subpolar Gyre shifts 15 degrees (°) (between 30° and 45°N) seasonally. This shifts far enough south in winter that it encompasses the three northern most atolls (Kure Atoll, Midway Atoll, and Pearl and Hermes Reef). The front brings colder and nutrient rich waters into the area that are important to the productivity and ecology of the ecosystems (Leonard *et al.* 2001; Polovina *et al.* 2001; Friedlander *et al.* 2009).

3.2.5 *Water Column*

Biological productivity in the pelagic zone is highly dynamic. Physical conditions present in the water column, such as isotherm and isohaline (temperature and salinity) boundaries, often determine what species will be present in the surrounding waters (USFWS 2008a). A mixed layer is present below the surface and ranges in depth from 120 m (400 ft) in winter to less than 30 m (100 ft) in summer. Below this layer there is a thermocline (sharp decrease in temperature) from 25° Celsius (C) at the surface to 5°C at 700 m (2,300 ft), then decreases to 1.5°C at the bottom.

Surface salinities range from 35.2 parts per thousand (ppt) at 26°N to 34.3 ppt at 10°N. Salinity reflects the balance between precipitation and evaporation so the decrease in salinity at the southern end of the Hawaiian Islands reflects the higher amount of precipitation near the Inter-Tropical Convergence Zone. Salinity tends to decrease with depth, indicating the sinking of lower salinity water from the northern ocean. Higher salinity water (35.2 ppt) is present at the surface down to 150 m (500 ft), lower salinity (34.1 ppt) down to 500 m (1670 ft), and then the salinity increases slightly to 34.7 ppt for very deep abyssal waters (Flament *et al.* 1998).

3.2.6 *Temperature and Nutrient Regimes*

The distribution of many species is influenced by the temperature gradient along the Hawaiian Archipelago (DeMartini and Friedlander 2004; Friedlander *et al.* 2009). Water temperatures in the area are several degrees lower than in the tropical western Pacific, leading to a decrease in diversity of aquatic species (Juvik and Juvik 1998). Average water temperatures surrounding the Hawaiian Archipelago vary from 22° C (71.6° Fahrenheit [F]) in March to 27 °C (80.6°F) in September. The northernmost atolls of the islands are occasionally affected by an eastward expansion of the Western Pacific warm pool, which can cause higher ocean temperatures during the summer at Kure Atoll than the more "tropical" waters of the islands further south (USFWS 2008a). Therefore, the temperature variation at French Frigate Shoals (74 to 81.5°F [23.3 to 27.5°C]) is much less than at Kure Atoll, in the northernmost part of the chain (66.2 to 80.6°F [19 to 27°C]).

Nutrient conditions in the Hawaiian Islands are influenced by both local and regional factors. The concentration of nutrients (such as nitrate, nitrite, phosphate, silicate) is small at the surface, but increases with depth (Flament *et al.* 1998). Localized wind and bathymetric features may cause upwelling to occur, bringing the cooler, nutrient-rich deep water closer to the surface. Circulation cells and wake eddies found downstream of oceanic islands may concentrate plankton, enhancing productivity near those islands (Ashmole and Ashmole 1967; Boehlert 1993; USFWS 2008). Regional factors include subtropical fronts and the high chlorophyll content of the associated waters north of the front. A major ecological transition zone in the northern Pacific known as the "Transition Zone Chlorophyll Front" seasonally migrates and influences the primary productivity of the northern portion of the NWHI (Polovina *et al.* 2001; Bograd *et*

al. 2004). This influx of nutrients increases ocean productivity and therefore recruitment of aquatic life, such as Hawaiian monk seals (Polovina *et al.* 1994; USFWS 2008).

3.2.7 *Marine Water Quality*

While water offshore around Hawai`i is remarkably clean, nearshore localized concentrations of pollutants occur near populated areas due to stormwater discharges and permitted sanitary outfalls.

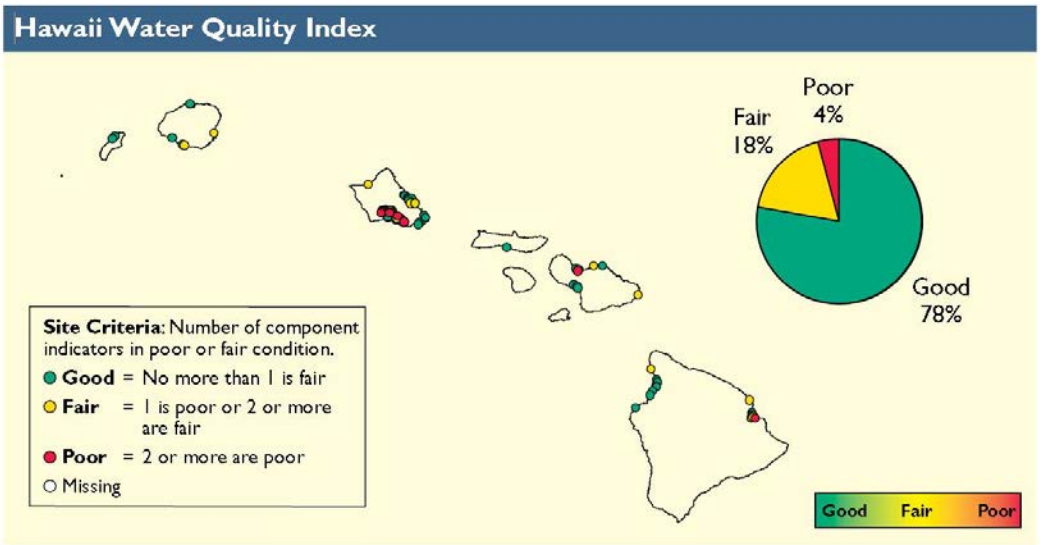
Water quality has been assessed in 99% of Hawaiian estuaries. Of this percentage, 57% are impaired and 43% are fully supporting designated uses. Eighty-three percent of shoreline waters have been assessed. Two percent of shoreline waters are impaired, 1 % is threatened, and 97% is fully supporting designated uses (EPA 2005, National Oceanic and Atmospheric Administration [NOAA] 2009a).

Hawai`i does not monitor all coastal areas. However, the Clean Water Branch (CWB) of the State of Hawai`i's DOH is responsible for monitoring the State's waters, identifying sources of water pollution, and evaluating the data (CWB 2011). The Polluted Runoff Control Program (PRCP) administers grant money it receives from the Environmental Protection Agency (EPA) through Section 319(h) of the federal Clean Water Act to address Hawai`i's polluted runoff (CWB 2011). Key PRCP coastal priority projects monitoring sites include (CWB 2010):

- Kaua`i
    - Port Allen Pier
    - Nawiliwili Harbor
- Island of Hawai`i
    - Wailoa River Mouth
    - Hilo Bay Lighthouse
    - Pelkane Bay
    - Waiulaula Bay

According to the latest available data from EPA's National Coastal Assessment program, the overall quality of Hawai`i 's coastal waters, based on the Water Quality Index, is rated 78% good, 18% fair and 4% poor (EPA 2008) (Figure 3.2-2).

Figure 3.2-2 Hawai'i Water Quality Index



Source: National Coastal Condition Report III. Chapter 8 Part B Alaska, Hawaiian Island Territories (EPA 2008).

3.2.8 *Climatic Variability and Change*

3.2.8.1 *Atmosphere-Ocean Time Scales and Forcing Mechanisms*

Atmospheric and oceanic parameters in the North Pacific vary on several time scales and are due to many different forcing mechanisms (Table 3.2-3). Short-term (daily to annual) fluctuations in atmospheric and oceanic conditions are familiar and generally well-understood, to the extent that cause-and-effect relationships are generally well-established. Fluctuations having longer (interannual) time scales are becoming better documented, thanks to extensive environmental monitoring activities, but definition of causal relationships for most remains an elusive challenge. The focus of this section is on atmosphere-ocean interactions that occur on time scales of several months to several years, or even decades. No attempt is made to catalogue all possible sources of variability. Rather, only the few that are well-known are identified and their possible influences are described.

Table 3.2-3 Atmosphere-Ocean Variability – Time Scales and Forcing Mechanisms

Period	Forcing Mechanism
Diurnal/Semidiurnal	Lunar & solar tides
3-10 days	Atmospheric storms
Seasonal	Solar declination
Interannual (years) 0.5 – 1+ 3-7 6-7 10+ 11 18.6 22	 Mesoscale ocean eddies El Niño – Southern Oscillation (ENSO) events Mid-latitude atmospheric events "Regime shift" Sunspots Lunar Declination Sunspots

*After National Research Council 1996. The Bering Sea Ecosystem

3.2.9 *Interannual Variability*

The phenomenon known as El Niño – Southern Oscillation (ENSO) has long been recognized as a significant factor in the interannual variability of atmospheric-oceanic response. ENSO events radiate from the equatorial regions at irregular intervals, which range most commonly from three to seven years between events. The two distinct forms of ENSO in the Pacific Ocean are known as El Niño and La Niña. During El Niño events, the Aleutian Low pressure system tends to be more intense and is positioned further to the south (closer to the NWHI), thereby producing stronger winds, larger waves and cooler water temperatures in the NWHI (Bromirski *et al.* 2005). Large-scale oceanographic events such as El Niño change the characteristics of water temperature and productivity across the Pacific, and these events have a significant effect on the habitat range and movements of pelagic species (USFWS 2008). During La Niña, sea surface temperatures in the eastern tropical Pacific are below average, and temperatures in the western tropical Pacific are above average (Friedlander *et al.* 2009).

3.2.9.1 *Interdecadal Variability*

A chronology of interdecadal climatic changes affecting the North Pacific Ocean was compiled from available measured atmospheric pressure data by Minobe (1997) for the period 1899-1997. A climatic regime shift was defined as a transition from one climatic state to another within a period substantially shorter than the lengths of the individual epochs of each of the (two) climatic states. Data used by Minobe included the North Pacific index, the area- and time-averaged sea level pressure anomalies in the region of 160°E to 140°W by 30° to 60°N for winter to spring (December to May), which provided examples of rapid strength changes in the Aleutian Low in the winter and spring seasons. Bidecadal pressure averages during 1899-1924 showed that the Aleutian Low was about 1 millibar (mb) weaker than average, then strengthened to 1 mb below normal during 1925-1947. Similar behavior occurred in the latter part of the 20th century

as the Aleutian Low shifted back to 1 mb above normal from 1948 to 1976, then strengthened back to 1 mb below normal during 1977-1997.

Using late-nineteenth century data for spring air temperature in western North America, Minobe (1997) then identified 1890 to be the first regime shift. This extended the length of the first period to 34 years in comparison to the 22-, 26-, and 20+ year regimes to follow. The 50- to 70-year interdecadal variability (a two-regime cycle) has been prevalent from the nineteenth century to the present in North America. Minobe (1997) speculated that the likely cause of this variability is an internal oscillation in the coupled atmosphere-ocean system.

Long-term changes in fish populations around the North Pacific have apparently been influenced by climatic change of the same 50- to 70-year variability. Alaska salmon catches decreased in the 1940s and increased in the 1970s. Larger Japanese sardine catch amounts occurred in the regimes with the deepened Aleutian Low. Baumgartner *et al.* (1992) found evidence of an approximately 60-year variability in sardine and anchovy populations in eastern North Pacific from sediments in the Santa Barbara basin dating back to A.D. 270.

Dubbed the Pacific Decadal Oscillation (PDO), this cyclical behavior is an El Niño-like pattern of Pacific climate variability. PDO differs from ENSO in that it persists for much longer (20 to 30 years versus 6 to 8 months) and is most visible in the North Pacific with secondary signatures in the tropics, while the opposite happens during ENSO (Friedlander *et al.* 2009).

3.2.9.2 *Regime Shifts*

In the late 1970s a step change in climate, referred to as a "regime shift," occurred in the North Pacific Ocean. While there is evidence to suggest that there have been previous regime shifts, as noted above, it was the 1970s regime shift that stimulated extensive research on the topic and, especially, how oceanic ecosystems were responding to these phenomena. Although more than a decade was required to recognize the pattern, the regime shift of 1976/1977 is now widely acknowledged, as well as its associated far-reaching consequences for the large marine ecosystems of the North Pacific Ocean.

The most recent regime shift (1989) has been studied extensively by Hare and Mantua (2000), who assembled and examined 100 environmental time series of indices (31 climatic and 69 biological) to obtain evidence of regime shift signals. Although their focus was on the Gulf of Alaska and Bering Sea, there is no reason to preclude the applicability of their findings as far south as the Hawaiian Archipelago.

Abundant evidence suggests that the coupled atmospheric-oceanic system of the North Pacific is subject to multiple forcing factors, each having characteristic behaviors and different frequencies of occurrence. The evidence also indicates that, rather than there being a single average or "normal" condition, the overall system appears to stabilize periodically around two or more "normal" states, changing from one to another abruptly in what has been termed a "regime shift."

These are the characteristics of systems whose dynamics are addressed by "chaos" theory, which is a body of mathematical theory that focuses on systems that have multiple states of equilibrium. Chaos theory attempts to define the mechanisms that cause the systems to change from one equilibrium state to another and to predict all such equilibrium conditions.

Use of the word "chaos" in this context is not to imply the more common definition of great confusion or disorder. Rather, its use invokes the mathematical implication that there is order behind the irregularity of the system. A chaotic model may lead to a better understanding of the low-frequency relationship between the physical and biological systems in the North Pacific. One characteristic of a chaotic system is that, near the time of major interdecadal transition, there could be several years of extreme and perhaps opposite, anomalies in the physical system. These extremes provide opportunities for change in the biological system. Recent experience with North Pacific fisheries and marine mammal populations may provide examples of such transition periods.

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Hawaiian Monk Seals

3.3.1.1 Hawaiian Monk Seal Distribution

Hawaiian monk seals occur on lands (islands, atolls, emergent reefs) throughout the Hawaiian Archipelago, from Kure Atoll to Hawai'i Island, a distance of over 2,500 km (approximately 1,553 miles). Seals forage (search for food) in and transit the waters surrounding and between all land areas. Additionally, intermittent sightings of Hawaiian monk seals have occurred at remote Johnston Atoll approximately 800 km (about 500 miles) south of the Hawaiian Archipelago. Although seals are perhaps not continuously present at this site, they do occur there naturally so Johnston Atoll is considered part of the species range. Historically, most Hawaiian monk seals have been located in the remote NWHI, with subpopulations at Kure Atoll, Midway Atoll, Pearl and Hermes Reef, Lisianski Island, Laysan Island, French Frigate Shoals, Necker Island and Nihoa Island. Seals are also seen at Gardner Pinnacles and Maro Reef in the NWHI; however, these sites have limited areas where seals can haul out. A historically small, but currently growing portion of the seals occur in the MHI, including the islands of Ni'ihau, Kaua'i, O'ahu, Molokai'i, Lāna'i, Kaho'olawe, Maui, and Hawai'i. Seals also land on smaller islands (for example, Kaula Rock, Lehua Rock) and offshore islets that occur throughout the MHI. A research report released at the time this Draft PEIS was being prepared for printing offers additional information on the historical distribution and occurrence of Hawaiian monk seals in the NWHI and MHI. The 2011 report, Historical and Contemporary Significance of the Endangered Hawaiian Monk Seal in Native Hawaiian Culture, is included as Appendix J.

The species is structured in a metapopulation consisting of multiple subpopulations, which display varying degrees of demographic independence but are linked through regional environmental correlation as well as migration (Baker *et al.* 2007; Baker and Thompson 2007; Schultz *et al.* in press).

Hawaiian monk seal population monitoring is based upon long-term marking and resighting of individuals. This is a powerful approach, which facilitates tracking abundance, age and sex structures (because age and gender of most individuals are known), survival rates, reproductive rates and movement between subpopulations.

3.3.1.2 *Hawaiian Monk Seal Physical Description and Life Cycle*

Male and female Hawaiian monk seals are similar in size. Sex is determined by observing the ventral side of a seal (Kenyon and Rice 1959). Females have two pairs of teats, often appear larger and fatter than adult males (Kenyon and Rice 1959), and may have dorsal mating scars (Hiruki *et al.* 1993a, b). Males have a penile opening, often have scars along their necks inflicted by other males (Hiruki *et al.* 1993a, b), and may be darker than females (Kenyon and Rice 1959). Adults weigh up to 270 kilograms (kg) and may be more than 7 ft long (Kenyon and Rice 1959).

Hawaiian monk seals do not form dense breeding colonies (Kenyon and Rice 1959; Johanos *et al.* 1994); rather, they tend to haul out alone or in sparse clusters on the beach. Mating, which occurs in the water and is rarely observed, is inferred from male-female association patterns and from mounting injuries (Johanos *et al.* 1994). Hawaiian monk seal births may occur any time of year, but there is a broad peak in pupping from March to August (Johanos *et al.* 1994). The mean interval for births in consecutive years is 381 days, which results in the prolonged pupping season (Johanos *et al.* 1994). When females give birth in consecutive years they do so later each season. When they skip a year or more their subsequent birth occurs earlier in the year. Birth rates vary depending on breeding location and year, with approximately 30-70% of all adult females giving birth in any given year (Johanos *et al.* 1994; Harting *et al.* 2007). Hawaiian monk seals tend to give birth on secluded beaches adjacent to shallow, protected waters, apparently to afford protection to the pup (Westlake and Gilmartin 1990).

Newborn pups weigh 15-17 kg and measure 95-100 centimeters (cm) long (Kenyon and Rice 1959). Pups are black at birth and undergo a post-natal molt (shedding) late in the nursing period. Nursing lasts, on average, 39 days (Johanos *et al.* 1994), during which time the mother remains constantly near her pup in and out of the water (Kenyon and Rice 1959). The mother apparently fasts and rapidly loses weight through lactation. At the end of lactation, she leaves her pup and swims offshore to feed (Kenyon and Rice 1959; Wirtz 1968; Johnson and Johnson 1984). At weaning, pups normally weigh between 59-90 kg (Kenyon and Rice 1959).

3.3.1.3 *Hawaiian Monk Seal Population Status and Trends*

The Hawaiian monk seal was listed as endangered throughout its range under the Endangered Species Act (ESA) in 1976 (41 Federal Register [FR] 51611; November 23, 1976). The Hawaiian monk seal is the most endangered pinniped species in U.S. waters and the second most endangered pinniped in the world; only the Mediterranean monk seal, also critically endangered, is rarer. Their cousin, the Caribbean monk seal, is extinct.

Hawaiian monk seals probably occurred throughout the Hawaiian Archipelago when Polynesian colonizers arrived 1500–1600 years ago, after which the seals were likely extirpated from the MHI (Bellwood 1978; Baker and Johanos 2004). The NWHI provided a refuge for the species until European sailors arrived in the 19th century and hunted subpopulations to near extinction (Ragen 1999).

Although historical counts of total population size are not available, records indicate an abundance of seals up to the year 1857 (Hiruki and Ragen 1992), no or few seals at most islands by 1893 (Ragen 1999), and a ''large number'' at Kure Atoll and Pearl and Hermes Reef by 1915 (Hiruki and Ragen 1992). In 1958, mean counts of seals on the beach at the six main NWHI subpopulations (French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll and Kure Atoll) had recovered to 916 individuals, age 1 year or older (non-pups; Rice 1960). A "beach count" is an index of abundance, rather than total abundance as it represents the average number of seals counted on the beach at any given time, thereby it doesn't include seals in the water. Because total abundance was not estimable until the past decade or so at most sites, the beach count index provides the best indicator of abundance trends over time.

The counts conducted in 1958 are a benchmark for the species' known historic high point of abundance. Certainly it is likely that the species was far more abundant prior to human contact, but there is no reliable figure for abundance or even an abundance index prior to 1958. Though 1958 was unique in that counts were conducted at all six main subpopulations in that year, counts at individual subpopulations within a few years of 1958 substantiate the relatively high abundance in that period. The mean of comparable counts summed for the same six locations in 2010 was 268 non-pups, representing a decline of over 70% in just over five decades. The most recent published best estimate of total abundance is 1,212 seals (Carretta *et al.* 2013) in 2010, and the number was estimated to be declining at approximately 4.0% per year.

The general decline in total abundance since the late 1950s masks complex spatial dynamics in population trends. Regional trends are described separately in the following sections.

<u>NWHI Abundance and Trends</u>

The six NWHI subpopulations listed above have been the subject of consistent, thorough long-term monitoring. Beach counts have been conducted in most years at these sites since 1958 and since the early to mid-1980s more thorough population studies have been conducted annually. Necker and Nihoa Islands

have historically hosted a relatively small portion of the total species abundance and are especially logistically difficult places to work, therefore the data from these sites is mostly limited to zero to a few opportunistic counts per year.

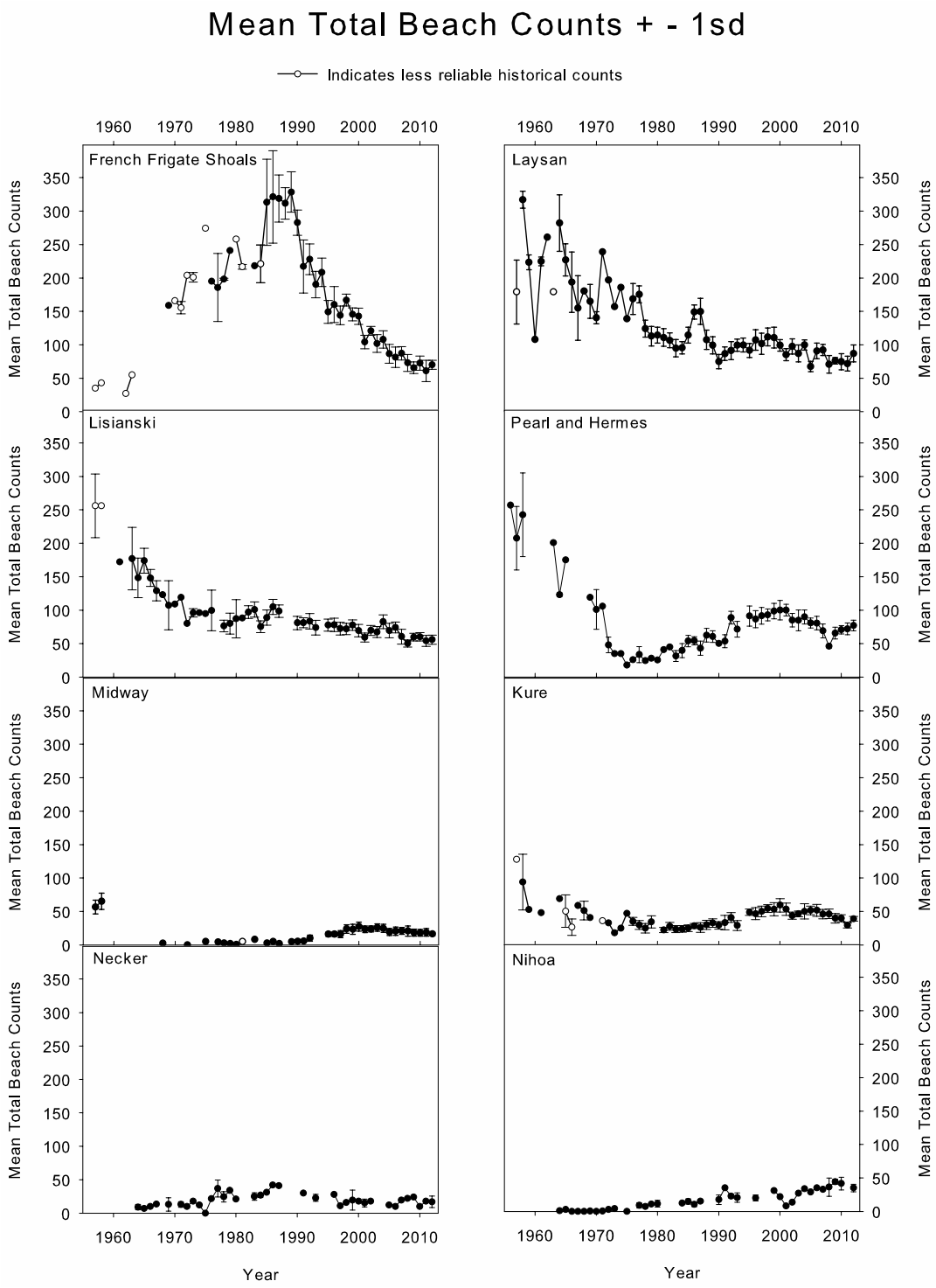
Figure 3.3-1 shows the trend in mean non-pup beach counts at the various sites in the NWHI, updated with preliminary (unpublished) data through 2012. While the other main subpopulations had their documented high counts in the late 1950s, French Frigate Shoals was highly reduced at that time, likely due to human impacts and harassment. However, after human disturbance was curtailed that population grew rapidly and reached a peak in the late 1980s, followed by a dramatic crash which continues to the present. Laysan and Lisianski Islands have demonstrated an overall declining trend since the late 1950s, though the rate of decline was most rapid in the early part of the time series. The three western subpopulations (Pearl and Hermes Reef, Midway Atoll and Kure Atoll) all declined precipitously after the late 1950s and then at different time points ranging from the 1970s to the 1990s, each subpopulation began to recover, but then each experienced renewed decline over approximately the past decade. Finally, Necker and Nihoa Islands counts remained very low into the 1970s, and thereafter have been fairly stable at Necker Island, whereas Nihoa Island has demonstrated increasing trends over the past decade.

Total population abundance is estimated in a variety of ways; each year, the most appropriate method for each site is determined according to the available data for that site. For example, at some sites and years, total enumeration is achieved (Baker *et al.* 2006). If all seals are not demonstrably identified, then capture-recapture methods are used as an alternate method (Baker 2004). If no capture-recapture estimator is appropriate for the data available, minimum abundance estimates are used. Finally, at Necker and Nihoa Islands, where at most a few beach counts are available each year, a correction factor is applied to counts to estimate abundance (Carretta *et al.* 2013). Table 3.3-1 presents abundance estimates in the NWHI in 2010, the most recent year for which a published stock assessment report is available (Carretta et al. 2013). The abundance of the six thoroughly monitored NWHI subpopulations has been falling 4.0% per year during recent years (Carretta *et al.* 2013).

Table 3.3-1 Abundance Estimates of Hawaiian Monk Seals in the NWHI in 2010 and Method Used to Estimate Abundance At Each Site As Indicated

Location	Abundance	Method
Kure Atoll	100	Capture-recapture
Midway Atoll	52	Total Enumeration
Pearl and Hermes Reef	179	Capture-recapture
Lisianski Island	174	Capture-recapture
Laysan Island	207	Total enumeration
French Frigate Shoals	195	Minimum
Necker Island	49	Corrected counts
Nihoa Island	102	Corrected counts

Figure 3.3-1 Hawaiian Monk Seal Mean Total Beach Counts 1958 - 2012



MHI Abundance and Trends

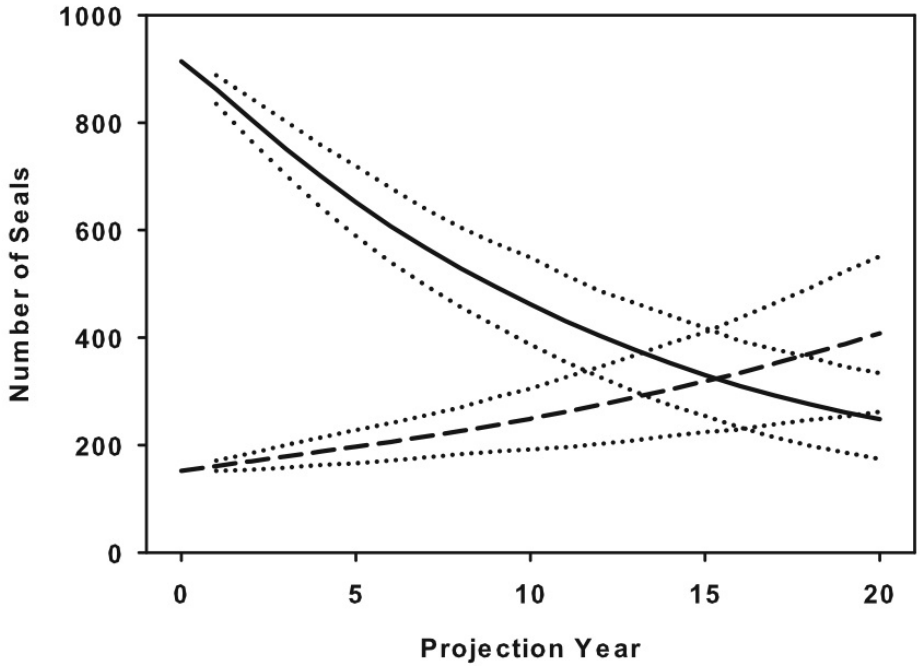
While most of the existing Hawaiian monk seals still live in the NWHI where abundance is falling, a smaller portion lives in the in MHI, and numbers in this region are on the rise. Prior to 2000, no systematic surveys of seals had been conducted in the MHI owing to the rarity of seals in the region. Kenyon and Rice

(1959) present a handful of MHI seal sightings from the first half of the 20th century. A seal was reportedly killed in 1900 in Hilo Bay on the island of Hawai`i, and subsequently eaten (H.W. Henshaw in Dill and Bryan 1912). Earlier reports of monk seal sightings in the MHI documented by Westerners have not been found. However, Rosendahl (1994) reported finding monk seal remains dating to between 1400 and 1760 on the island of Hawai`i, and there have been at least two other archeological findings indicating the presence of monk seals in the MHI. See Section 3.4.7.2 and Appendix K for more information on the significance of Hawaiian monk seals in Hawaiian archeology and Hawaiian culture.

Reports of seal sightings and births were increasing by the mid-1990s, which motivated the first systematic surveys in 2000 and 2001, when 45 and 52 seals, respectively, were counted from aircraft in the MHI (Baker and Johanos 2004). These counts were considered well below total abundance because like the beach counts described above, they did not account for animals in the water, and not every seal on land could be detected.

More recently, MHI monk seal population data have been collected by a network of individual volunteers, volunteer groups, partner agencies, and directed efforts by NMFS. Total seal abundance in the MHI is still not reliably estimated; however, the most recent published estimate was 152 seals in 2008 (Baker *et al.* 2011a). A population model estimates that the MHI population may be growing at 7% per year (Baker *et al.* 2011a). While the MHI monk seals still comprise a relatively small portion of the total species, their numbers are on the rise, whereas NWHI abundance is falling. Projections using a stochastic simulation model indicate that if current demographic trends continue, abundance in the NWHI and MHI will equalize in approximately 15 years (see Figure 3.3-2).

Figure 3.3-2 Stochastic Projection Simulation - Dotted lines indicate 95% confidence intervals for projections



Key: NWHI Projection
MHI Projection

Survival Rates

Survival rates of Hawaiian monk seals in the NWHI are very well-characterized because for well over two decades, most of the seals born have been tagged in their year of birth and resighted throughout their lives. Baker and Thompson (2007) characterize temporal and spatial variation in survival rates at six NWHI subpopulations. Because Necker and Nihoa Islands have been rarely visited, minimal marking and resighting of seals means that no survival rate information is available for these sites. Recently, sufficient numbers of seals have been studied in the MHI to obtain reliable estimates of survival in this region (Baker *et al.* 2011a).

The general lifetime pattern of survival for Hawaiian monk seals is as follows. After they are born, pups spend 5-7 weeks being nursed and cared for by their mothers. Pups are weaned abruptly when the mother leaves the pup on the birth island. From weaning on, the pups are entirely independent. Thus, the first interval for which survival is measured is from birth to weaning. Throughout most of the species range, pup survival during the nursing period is quite high—over 90% of pups born survive to weaning. The exception is at French Frigate Shoals, where for over a decade, typically a quarter to a third of pups has died each year prior to weaning. This anomalously high mortality is largely attributed to Galapagos shark predation (Gobush 2010).

In order to survive the first year after weaning, monk seal pups must learn to forage successfully, while avoiding predators and other risks. The first few years

post-weaning is when survival rates are lowest, and in fact juvenile survival rates exert the most influence on overall population trends in the long term (Harting 2002).

First year cohort survival (the survival of a group of seals born all in the same year) in Hawaiian monk seals are highly variable, with observed rates spanning from only a few percent to 100 percent at given sites and year. Survival tends to rise as seals mature until they reach a peak "adult" survival rate at approximately age 3 years or older (this varies over space and time). Thereafter, seals enjoy high survival rate (typically over 90%) for most of the rest of their lives. After approximately age 17 years, a drop in survival rates, or senescence, occurs. Unlike in many other species, male and female monk seals tend to have equal survival. The one exception is that historically, survival rates of female seals at French Frigate Shoals tend to be slightly higher than that of males.

The foregoing describes the general pattern for the species; however, there has been a great deal of variability observed in survival rates over time and between subpopulations. At present, of utmost importance is that while juvenile survival rates are variable, they have been chronically low at all of the six best-studied NWHI subpopulations, which comprise the majority of the species. The low juvenile survival in the NWHI has indirectly contributed to further declines in abundance through a degradation of the age structure -- because few seals are maturing to reproductive age, the number of pups born has also been falling. Further, because low juvenile survival has prevailed sufficiently long to winnow the age structures, these declining trends will continue for years into the future even if juvenile survival improves.

In contrast to the low juvenile survival rates in the NWHI, young seals in the MHI are doing much better. For example, in recent years, survival from weaning to age 1 year in the MHI has averaged 77%, compared to only 42-57% in the NWHI (Baker *et al.* 2011a). It is important to note that, while this discrepancy in juvenile survival exists, adult survival rates are comparable and relatively high throughout the species range.

Reproductive Rate

As noted above, Hawaiian monk seals, like all pinnipeds, give birth at most annually to a single pup. Seals do have twins on rare occasions, though one or both twins typically do not survive (Schultz *et al.* 2011). Gross reproductive rates (the ratio of number of pups to number of adult females) vary from about 30% to 70%, and there is considerable variability between years and subpopulations (Harting *et al.* 2007). Age-specific reproductive (or fecundity) curves have been estimated for three NWHI subpopulations. Females in the NWHI typically have their first pup when they are 5 to 9 years old. Pupping rates rise to a plateau after about age 10 years, and then begin to decline in the late teens or later (Harting *et al.* 2007). Some variability in the age-specific curves amongst subpopulations appears to correlate with growth rates. That is, at sites where female seals grow to adult size more slowly, the onset of reproduction is also delayed. Consistent

with this pattern, in the MHI where body condition and growth tends to be superior to the NWHI, sparse data suggest that females begin reproducing at a younger age and may achieve higher reproductive rates (Baker *et al.* 2011a).

Genetics, stock structure, site fidelity and movement among subpopulations

Hawaiian monk seals exhibit extremely low genetic diversity according to a variety of measures (Schultz *et al.* 2008). This is probably due in part to a population bottleneck associated with overexploitation in the 19th Century, but genetic diversity appears to have been low even prior to that time (Schultz *et al.* 2008). There is little indication of contemporary inbreeding, and Hawaiian monk seal subpopulations have exhibited robust growth at various times despite their low genetic diversity. Further, although the species is distributed in a metapopulation, there is no evidence of genetic population structure. That is, the species is comprised of a single, panmictic (unstructured) population (or "stock") (Schultz *et al.* 2011).

The lack of genetic population structure is consistent with movement patterns of seals amongst subpopulations. While the majority of seals prefer to stay in the subpopulation where they were born, some 4% to 18% of seals born in the NWHI have been observed at more than one subpopulation (Schultz *et al.* 2011). Seals tend to move more between relatively nearby subpopulations than between distant ones. Also, juveniles appear to range less widely compared to adults (Schultz *et al.* 2011). Though data are limited, there have been several observations of individual seals moving between the NWHI and MHI, and also the NWHI to Johnston Atoll (NMFS unpublished data). This mixing of seals from different subpopulations has resulted in sufficient gene flow to maintain panmixia (in other words, the species genes are fully mixed throughout its range) (Schultz *et al.* 2011).

3.3.1.4 Hawaiian Monk Seal Habitat Requirements

The Hawaiian monk seal requires both marine and terrestrial environments. While Hawaiian monk seals spend a majority of their time in the water, the terrestrial component of their habitat plays a vital role throughout all life stages. Monk seals use terrestrial habitat to haul-out for resting, molting, parturition (birthing), nursing and avoiding predators. Since monk seals may remain at sea for several days or more at a time, resting on land is essential to conserve energy. Resting commonly occurs on sandy beaches, but may also occur on rocky shores, rock ledges, emergent reefs, and even shipwrecks (Antonelis *et al.* 2006). While on shore, monk seals may take shelter from wind and rain under shoreline vegetation. Resting on land may last from a few hours to several days at a time (Antonelis *et al.* 2006).

Terrestrial habitat is essential for parturition (pupping) and nursing of pups. Pupping and nursing areas are usually sandy beaches adjacent to shallow protected water (Westlake and Gilmartin 1990). Individual females appear to favor certain pupping locations, returning to them year after year. Although the

pup is able to swim at birth, nursing occurs on land and the mother-pup pair usually remains on land for the first few days after the pup is born. The mother gradually begins swimming with her pup in the shallows, returning to the general area around the pupping site. As weaning approaches, the mother-pup pair spends more time in the water, venturing further away from the pupping site. After weaning, pups typically remain in the shallows near their nursing areas for several weeks before venturing into deeper foraging areas (Kenyon and Rice 1959; Henderson 1988). During the annual one- to two-week molt period, seals spend most of their time on land shedding their skin and fur (Kenyon and Rice 1959).

Hawaiian monk seals use the marine environment for foraging, resting, thermoregulation, and social interaction, including mating. Observation of seals with animal-borne video cameras showed that nearly one-half of the time spent underwater was spent resting or interacting with other seals (Parrish *et al.* 2000). Resting may occur at sea or in shallow, submerged caves. Satellite-linked and other tracking technology indicate that monk seals are primarily, though not exclusively, benthic (bottom) foragers. They forage in marine habitats anywhere from 1-500 m depth and seem to prefer low-relief substrates such as sand and talus in areas of habitat uniformity. The seals appear to use all submerged habitat at least up to 500 m depth, including sea mounts, banks, marine terraces and a variety of reef habitats.

Critical Habitat

In 1986, critical habitat for the Hawaiian monk seal was 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 Atoll (except Sand Island), Pearl & 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).

In 2008, NMFS received a petition to revise the Hawaiian monk seal critical habitat designation under the ESA. The petitioners sought to revise critical habitat by adding the following area types in the MHI: key 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 200 m. In addition, the petitioners requested that designated critical habitat in the NWHI be extended to include Sand Island at Midway Atoll, as well as ocean waters out to a depth of 500 m (Center for Biological Diversity 2008).

In accordance with procedures outlined in the ESA (16 U.S.C. 1533), NMFS found that a revision was warranted and announced its intent to revise Hawaiian monk seal critical habitat on June 12, 2009 (74 FR 27988). Critical Habitat is defined under the ESA (16 U.S.C. 1532) and may include the following:

- Specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features essential to conservation, and which may require special management considerations or protection; and
- Specific areas outside the geographical area occupied by the species if the areas are determined essential for conservation.

On June 2, 2011 (76 FR 32026) NMFS proposed to revise critical habitat for the Hawaiian monk seal by extending the current designation in the NWHI and by designating new areas in the MHI. Specific areas proposed for designation in the NWHI includes 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 the 500 meter (m) bathymetry line around the following: Kure Atoll, Midway Islands (not including Midway Harbor), Pearl and Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island. Specific areas proposed for designation in the MHI includes marine habitat from 500 m depth bathymetry line (relative to mean lower low water), through the water's edge into the terrestrial environment where the inland boundary extends 5 m inland from the vegetation line.

3.3.1.5 *Hawaiian Monk Seal Foraging Ecology*

Foraging Behavior

Hawaiian monk seals feed on the sea floor from the shallows to over 500 m depths. Seal-mounted video camera ("Crittercam") images reveal that adult seals move large, loose talus fragments to capture prey underneath (Parrish *et al.* 2000). Seals appear to prefer this type of uniform habitat because of the prey available in those areas (Parrish *et al.* 2000). Studies in the NWHI (Parrish *et al.* 2002; Stewart 2006) have also shown that adult monk seals may forage at 300 – 500 m, sometimes visiting patches of deep corals (Parrish *et al.* 2002). The use of these deeper habitats may reflect monk seals taking advantage of readily available prey in a habitat with decreased interspecific competition (Parrish *et al* 2008).

Juvenile monk seals (1 – 3 years old) in the NWHI exhibit foraging behavior similar to that of adult monk seals. Feeding occurs both within shallow atoll lagoons (10 – 30 m) and on deep reef slopes (50 – 100 m), usually over sand rather than talus (Parrish *et al.* 2005). Video footage of juvenile seal foraging showed seals moving along the bottom flushing prey with a variety of techniques including probing the bottom with their nose, using their mouth to squirt streams of water at the substrate, and flipping small rocks with their heads and shoulders (Parrish *et al.* 2005). While juvenile seals are able to dive to depths similar to adults, the smaller seals likely do not yet have the size or experience to engage in the successful large talus-foraging behavior exhibited by adults (Parrish *et al.* 2005).

Use of satellite-linked telemetry and time-depth recorders has shown that Hawaiian monk seals primarily forage in areas of high bathymetric relief within 40 km (approximately 25 miles) of the atoll or island center and there is substantial overlap in the habitat use of monk seals at each site (DeLong *et al*. 1984; Abernathy and Siniff 1998; Parrish *et al*. 2000; 2002; Stewart *et al*. 2006). Submerged banks and reefs 24-322 km away from the breeding sites also are used by monk seals (Stewart *et al*. 2006). Foraging monk seals typically have dive durations of less than 8 minutes but some dives exceeding 20 minutes also have been observed (Abernathy and Siniff 1998; Littnan *et al*. 2004; Stewart and Yochem 2004a, b; Stewart *et al*. 2006). Foraging trip durations are highly variable with ranges from 13 hours to around 3 wks (Abernathy and Siniff 1998; Littnan *et al*. 2004).

Telemetry studies have revealed that seals in the MHI exhibit similar foraging behavior and habitat selection as seals in the NWHI (Littnan *et al*. 2006). However, MHI seals appear to have smaller home ranges, travel shorter distances to feed and spend less time foraging on average compared to NWHI seals.

Prey Species and Size

Hawaiian monk seals are foraging generalists, with a wide variety of prey taxa identified from fecal (scat) and regurgitate analysis. Some 31 families of teleost (bony) fishes and 13 families of cephalopods (octopus, squids and related species) were identified by Goodman-Lowe (1998) in monk seal scat. The prey families Congridae, Muraenidae, Holocentridae, Labridae, Scaridae, Acanthuridae, Balistidae, and Tetraodontidae are the most frequently occurring in monk seal scat and regurgitate samples (Goodman-Lowe 1998; Longenecker 2010). Monk seals consume a variety of crustaceans including multiple species of crab and lobster. A recent study found similar diets were consumed by monk seals in the NWHI and MHI (Cahoon *et al.* in press).

Fatty acid analysis of the monk seal diet has begun to identify an even broader number of prey species consumed by the Hawaiian monk seal (Iverson 2006). Fatty acid analysis studies have also demonstrated substantial variation in diet among individuals, demographic groups (between juveniles and adults/sub adults) and locations (Iverson 2006); indicating that individual monk seal foraging preferences and capabilities play a role in selection of foraging habitat. Scat and regurgitate analysis from the MHI indicate that the prey taxa selected by seals is similar throughout the archipelago (Cahoon *et al.* in press).

Studies of monk seal prey selection based upon scat/spew analysis and seal-mounted video revealed some evidence that monk seals fed on families of bottomfish which include commercial species (many prey items recovered from scats and spews were identified only to the level of family; Goodman-Lowe 1998; Longenecker *et al*. 2006; Parrish *et al*. 2000). Recent quantitative fatty acid signature analysis results support previous studies illustrating that monk seals consume a wide range of species (Iverson 2006). However, deepwater-slope

species, including two commercially targeted bottomfishes and other species not caught in the fishery, were estimated to comprise a large portion of the diet for some individuals. Similar species were estimated to be consumed by seals regardless of location, age or gender, but the relative importance of each species varied. Diets differed considerably between individuals.

3.3.1.6 *Hawaiian Monk Seal Carrying Capacity*

The concept of carrying capacity (also known as K), refers to the stable number of individuals that a habitat or area is capable of supporting on a relatively long-term basis. In the classical sense, a population will begin to decline in abundance when it exceeds K and will grow when it is below K, thereby maintaining an average abundance of approximately K. A related concept, "density dependence," refers to changes in survival or reproductive rates that cause the population to grow or decline, respectively, when it is below or above K.

The ability of an area to support a population is a function of all of the resources and environmental attributes that characterize the habitat. For the Hawaiian monk seal, this would include terrestrial and marine foraging habitats, predator abundance, competition from other species, and all other factors that jointly influence the ability of an area to support seals.

There is a considerable body of scientific theory and literature pertaining to the concepts of carrying capacity and density dependence. However, with most species, including the monk seal, it can be exceedingly difficult to determine K with confidence. One approach is to observe how the population has historically grown or declined at various population sizes and infer where carrying capacity lies based on those observations. Alternatively, if much is known about the habitat requirements of a species, it may be possible to quantify habitat resources in terms of their ability to support that species (for example, the prey biomass required to sustain each seal) and estimate how many individuals can be supported by the available resources in a given area. This approach requires a very complete knowledge about the resource requirements of the species. Much is known about monk seal resource use from observation, at-sea tracking and dietary studies. Yet, there is insufficient knowledge to reliably predict how many seals can be supported in either the NWHI or the MHI.

Another factor which can confound estimation of carrying capacity is that it can change over time due to environmental fluctuations, human manipulation or other factors. Historically, we have seen a number of phases of growth and decline at all of the NWHI breeding sites. It is normal to expect some variation in how well a population performs due to random chance or normal environmental events. This is often referred as stochastic variation. However, extended periods of population growth or decline may reflect a long-term, persistent change in habitat capability or carrying capacity. This may be what has happened in the NWHI, where demographic rates, especially juvenile survival, have declined and remained low on average over the last decade. The environmental drivers

responsible for these trends appear to be expressed most strongly through effects on juvenile survival.

Although carrying capacity of monk seals cannot be reliably estimated, observing certain indicators can suggest whether a population's size is above or below K. Eberhardt (1977) suggested a pattern in how long-lived species, such as the monk seal, regulate their abundance in accordance with habitat capability:

- The first demographic to change as a population approaches the size where it is limited by available resources is newborn or juvenile survival.
- This is followed by changes in the age of first birth, changes in the reproductive rates of mature animals, and finally changes in adult survival rates.

Whether monk seal populations fully adhere to this pattern is uncertain, but several observations do seem consistent with it. Survival of young animals has been the most volatile feature of the species' demographics. Age of first birth and reproductive rates have also varied among sites. Finally, adult survival is the one demographic measure that does not seem to have varied markedly; it is fairly good system-wide and it has historically been relatively stable. Consistent monitoring of all of these variables can suggest whether a population is above or below K and thereby help determine what interventions are most appropriate. Gradual changes in any of these population measures may suggest that population abundance is nearing K, but it can be difficult to distinguish normal annual variability from density dependent regulation of population size.

3.3.1.7 *Crucial and Serious Environmental and Anthropogenic Stressors/Threats*

<u>Prey Limitation</u>

Numerous lines of evidence indicate that prey limitation is the primary cause of poor juvenile survival in the NWHI, which is driving the current population decline. Phocid pup condition at weaning reflects how much mass and energy mothers are able to impart to their offspring both *in utero* and during the nursing period. Hawaiian monk seal girth at weaning indicates body condition at this key life stage. Larger girth (fatter) pups have a higher probability of surviving their first year of life post-weaning (Craig and Ragen 1999; Baker 2008). The monk seal population on French Frigate Shoals began to exhibit declining and then chronic poor juvenile survival by the early 1990s. Craig and Ragen (1999) found that pups weaned at French Frigate Shoals were smaller in girth and mass than those at Laysan Island, indicating that perhaps their mothers were not able to forage as efficiently. Weaned pups in the MHI, where food limitation is not thought to be a problem for seals, tend to be very much larger than those weaned in the NWHI (Baker and Johanos 2001).

Thin and emaciated juvenile seals are commonly observed in the NWHI indicating that these seals are unable to forage successfully. Most seal carcasses are not recovered; however when juvenile seals are found dead, they are often in poor body condition indicating food stress. Baker (2008) presented evidence that

in years with poor survival of NWHI subpopulations, size-selective mortality was intensified, also suggesting that poor juvenile survival is related to food limitation of juveniles.

It is counterintuitive that seals should starve in this large no-take marine protected area known for its abundant and diverse marine life. There are a number of hypotheses regarding why juvenile monk seals struggle to find sufficient prey in the NWHI. Climate-ocean conditions appear to lead to variable primary productivity and, consequently, variable prey for top predators such as monk seals (Polovina *et al*. 1994; Antonelis *et al*. 2003; Baker *et al*. 2007; Polovina *et al*. 2008a; Baker *et al*. 2012).

In addition to the possibility that less total prey is available, it has been hypothesized that juvenile monk seals may be disadvantaged by competition with other species of top predators. Large sharks and jacks (*Caranx sp.*) are extremely abundant in the NWHI compared to the MHI (Friedlander and DeMartini 2002). There is a dietary overlap between these apex predator fishes and monk seals, and direct competition of seals and these fishes has been documented on video (Parrish *et al*. 2008). Baker and Johanos (2004) hypothesized that both low intra- and inter-specific competition might explain why monk seals in the MHI seem to enjoy higher juvenile survival and better body condition.

Food limitation may limit monk seal populations not only through its effects on survival, but also through reproductive effects. It is thought that when food is more limited, animals grow more slowly and reach maturity at a later age. They may also continue to reproduce at a lower frequency when food is limited. Observed monk seal reproductive patterns are consistent with food limitation in the NWHI. Harting *et al*. (2007) found that patterns in age-specific reproductive curves amongst NWHI subpopulations were coherent with overall population trends. For example, at French Frigate Shoals (rapidly declining population), female seals start having pups later and achieve lower reproductive rates than at Laysan Island (until recently a more stable population). More recent evidence suggests that seals in the MHI mature earlier and may have higher reproductive rates than in the NWHI (Baker *et al*. 2011a). Consistent with this, seals in the MHI tend to grow to adult size at a younger age than those in the NWHI (Baker *et al*. 2011a).

Entanglement

Most of the derelict fishing gear and marine debris collected and documented in the NWHI is from fishing or other maritime industries, and most net debris appears to be trawl webbing. Because no trawl or gillnet (other than reef lay gillnet) fishing occurs in the NWHI, it is assumed that virtually all derelict fishing debris has been transported by ocean currents from distant fisheries around the North Pacific Ocean. The Hawaiian Archipelago is situated in the convergence zone of the North Pacific subtropical gyre, and debris is carried towards the islands by wind-driven currents and circulation of water from the

eastward flowing North Pacific Current to the westward flowing North Equatorial Current (Donohue *et al*. 2001). More debris is deposited by a strengthening of the convergence zone in Hawaiian waters during ENSO events (Donohue and Foley 2007).

Marine debris and derelict fishing gear have been well documented to entangle monk seals, and monk seals have one of the highest documented entanglement rates of any pinniped species (Henderson 2001). Entangled seals may drown, strangle, sustain severe wounds, or be immobilized by debris anchored to substrate. Entangled seals also experience increased hydrodynamic drag when traveling and foraging, thus increasing their energy use and reducing foraging efficiency. They may also be more vulnerable to shark attack. Some seals free themselves or are disentangled by human responders. Estimates of entanglement rates are based almost exclusively on observations of animals encountered on shore. However, interactions between monk seals and marine debris occur at sea and at times of the year when researchers are not in the field. Therefore, observed entanglement rates underestimate the actual rate.

Proportionally, pups and juveniles, probably because of their inquisitive nature, are more likely than older seals to become entangled (Henderson 2001). From 1982 to 2010, a total of 311 cases of seals entangled in fishing gear or other debris have been observed, many of which involved injuries and eight of which resulted in confirmed mortalities (Carretta *et al.* 2013). Most of the entangled seals were either released by researchers or escaped on their own. As there is no basis for estimating the frequency of undetected entanglements, it is not possible to estimate total mortality attributable to entanglement.

Despite ongoing efforts to remove entanglement hazards from the beaches and waters of Hawai`i, entanglement rates remain variable but show no signs of declining. Of the six main NWHI subpopulations, Lisianski Island tends to suffer the highest rates of entanglement, whereas debris entanglement in the MHI appears to be rarer. Though over 500 metric tons of marine debris has been removed from the reefs and beaches in the NWHI, accumulation of incoming debris poses a persistent hazard for monk seals and other NWHI biota (Dameron *et al*. 2007).

Shark Predation

Sharks are the only known predators of Hawaiian monk seals. Shark injuries and scars from old injuries can be seen on many monk seals, and shark predation has been observed occasionally (Bertilisson-Friedman 2006; Wirtz 1968; Balazs and Whittow 1979; Alcorn and Kam 1986; Hiruki *et al*. 1993a). These incidents of predation or wounding of monk seals of all ages have been attributed to tiger sharks. Because tiger shark predation on monk seals occurs at sea, where the prey is also consumed, it is not possible to quantify the amount of mortality attributable to tiger sharks. Seals that survive attacks and are wounded and observed on shore constitute the only observable evidence of tiger shark predation.

However, beginning in 1997 a marked increase in shark predation on nursing and recently weaned monk seal pups at French Frigate Shoals has been noted. At Trig and Whaleskate Islands (small islets within French Frigate Shoals), the number of predation mortalities from sharks (including both confirmed and inferred losses) peaked between 1997 and 1999 (Gobush 2010). Additional pups were permanently maimed by severe shark bites that likely reduced the seals' ability to dive, forage and reproduce. After 1999, pre-weaned pup mortalities from sharks declined but pups were still being killed at an unsustainable level. Between 2000 and 2009, the number of pup losses (confirmed and inferred) at French Frigate Shoals atoll-wide was at 6–11 pups per year. As fewer pups have been born each year for the last several years, the numbers of pups lost to predation has exacted an increasingly heavy toll. Since 2000, 15–28% of the incoming French Frigate Shoals cohort has been lost each year to shark predation. From 1997 through 2009, 205 of 835 pups born at French Frigate Shoals (24.6%) were involved in shark incidents (Gobush 2010). Periods of intensive observation over more than a decade have confirmed that the Galapagos shark is the primary species predating nursing monk seal pups at French Frigate Shoals although some pups may also be taken by tiger sharks (Gobush 2010).

Observations at other subpopulations in the NWHI indicate that shark related injury and mortality of nursing and recently weaned pups occurs primarily at French Frigate Shoals. As was noted, the degree of threat posed by tiger shark predation is unknown, but prevailing levels of Galapagos shark predation are a severe threat to the French Frigate Shoals subpopulations. The number of seals at this atoll has been declining for more than 20 years due to poor juvenile survival, largely attributable to food limitation. As recruitment of new adults has been chronically low, the number of pups born at French Frigate Shoals has fallen from nearly 120 per year to less than 40 per year. NMFS has pursued a variety of means of reducing Galapagos shark predation at this atoll, including deterrence, harassment, targeted removals of sharks preying on seals, and within-atoll translocation of weaned pups to areas where predation is rare (Gobush 2010). Nevertheless, unsustainable levels of predation continue.

Climate Change

Sea-level rise poses the most compelling threat to Hawaiian monk seals that is associated with climate change. Terrestrial habitats in the NWHI consist largely of low-lying oceanic sand islands (cays) and atolls, which are required for monk seal pupping, nursing, resting and molting.

The low-lying land areas of the NWHI are highly vulnerable to sand erosion due to storms and sea-level rise. Global sea-level rise reduces cays by passive flooding, active coastal erosion, and in concert with seasonal high swell. As a result, the subaqueous land area supporting these important littoral and coastal ecologies is at risk. Demonstrating this, islands at one NWHI atoll, French Frigate Shoals, have been greatly reduced in size during roughly the past 40 years for reasons not well understood, as this occurred during a period when sea level

rose relatively little (Antonelis *et al*. 2006). An example of this is the effective disappearance of Whaleskate Island, which had been important habitat for turtles and seals.

Concerns about sea level rise in the NWHI motivated a study to project what might happen as global sea level increases in the future. Baker *et al*. (2006b) produced the first NWHI topographic maps in three locations (Lisianski Island, Pearl and Hermes Reef, and French Frigate Shoals). They then used passive flooding scenarios to estimate the area that would be lost if islands maintained their current topography and the sea were to rise by various amounts predicted by the Intergovernmental Panel on Climate Change (IPCC) (Church *et al*. 2001). The projected effects of sea level rise on surface area varied considerably among the islands examined and depending upon the sea level rise scenario. For example, Lisianski Island is projected to be the least affected of the islands surveyed, losing only 5% of its area even under the maximum rise scenario examined. In contrast, the islets at French Frigate Shoals and Pearl and Hermes Reef are projected to lose between 15 and 65% of their area under the median sea level rise scenario.

The uncertainty of predictions increases over time, but the expectation is that sea level will continue to rise beyond 2100 (Church *et al*. 2001). Moreover, recent evidence suggests that sea level may rise more rapidly than previous models have predicted, due in part to an accelerated rate of ice loss from the Greenland Ice Sheet (Rignot and Kanagaratnam 2006). The loss of key terrestrial habitats could lead to declines and shifts in distribution of monk seals in the NWHI.

A new set of high-resolution topographic maps and estimation of potential sea level rise impacts was recently published by Reynolds *et al.* (2012).

Other aspects of climate change could impact Hawaiian monk seals either positively or negatively, and the balance of future such effects cannot be predicted at this time. However, some effects of climate-ocean variability on monk seals have been documented. Antonelis *et al*. (2003) found evidence that El Niño events may enhance foraging conditions for monk seals as reflected in weaned pup condition. However, Donohue and Foley (2007) found that monk seal entanglement rates tended to increase in El Niño years. Baker *et al*. (2007) found that juvenile monk seal survival in the northern portion of the NWHI was related to variability in the southern extent of the Transition Zone Chlorophyll Front, a large-scale seasonal oceanographic feature that brings relatively productive waters into the region in winter. Baker et al. (2012) also found that trends in abundance of several NWHI subpopulations were associated with Pacific Decadal Oscillation regimes. Polovina *et al*. (2008b) present evidence that low productivity areas of the worlds oceans, including a region encompassing the NWHI, appear to have expanded in recent years.

Male Aggression

During the 1980s and early 1990s, injuries and deaths of female monk seals caused by multiple-male aggression (or "mobbing") attacks inhibited population

recovery at Laysan Island (Banish and Gilmartin 1992). These attacks occur when several adult males aggregate and attempt to mount and mate with a single seal. The frequency of multiple-male aggression appears to be related to an imbalance in adult sex ratios, with males outnumbering females. Prior to 1994, the sex ratio at Laysan Island was skewed to males at a time when Hiruki *et al*. (1993a) showed females at Laysan Island were injured by males at three to four times the frequency of that observed at French Frigate Shoals. Hiruki *et al*. (1993b) reported that adult male inflicted injuries on females resulted in increased mortality. Additionally, a wounded female's reproductive success in the year of injury appeared to be influenced by the severity of her injuries.

To mitigate multiple-male aggression, two groups of adult male seals were translocated from Laysan Island (Johanos *et al*. 2010). During 1984-1994, a total of 37 adult males were selectively removed and either translocated to Johnston Atoll, taken into permanent captivity or translocated to the MHI (two of the males died either in the capture or holding process at Laysan Island). Mitigation of male aggression may also involve researchers intervening to drive a male off if an attack is observed and judged to pose sufficient risk to the pup. Three males known to have killed one or more pups at French Frigate Shoals have been removed (one male lethally removed in 1991, two males translocated to Johnston Atoll in 1998). None of the translocated males have returned to their original locations (Baker *et al*. 2011b). Following the 1998 translocations, a marked drop in pup losses to male aggression occurred (Baker *et al.* 2011b). Again at Kure Atoll in 2011, a high degree of male aggression against pups was observed. A known Kure male aggressor was captured and brought into captivity in early 2012; subsequently no pups were observed injured in 2012 beyond normal scratches weaned pups often exhibit.

Another mitigation approach for multiple male aggression using a drug to reduce testosterone levels in males was investigated in both captive and field settings (Atkinson and Gilmartin 1992; Atkinson *et al*. 1993; 1998). Captive trials demonstrated effective testosterone suppression and a pilot field trial was subsequently performed (Atkinson *et al*. 1998). However, translocation was chosen as the preferred mitigation measure for a number of reasons. Each male had to be captured and injected a number of times over the course of the breeding season in order to maintain low testosterone levels, which would have resulted in an unacceptable level of disturbance to the general seal population. Also, it was not determined whether the reduction in testosterone led to the desired reduction in aggression. This approach may be pursued further, perhaps with more long-acting drugs in the future.

Prior to 1984, there were more than two adult males for each adult female at Laysan Island. Male removals and natural processes reduced the sex ratio to just under one male per female after 1994. Before the removals, an average of 4.1% (range 0 to 12.9%) of adult females died from male aggression annually. Up to eight females were being killed per year. Both the proportion and the absolute number of injuries and deaths declined after this date. Although some adult

females continue to sustain severe mounting injuries, the proportion of females that were lost decreased to 0.3% per year (range 0 to 2.6%), and only three females are believed to have been killed through 2005. From 2008 to 2010 one or two adult females per year apparently died due to male aggression at Laysan Island. The loss of any adult females is considered a serious threat to population recovery and death due to male aggression are still occurring at Laysan Island. Even though the sex ratio is approximately even at this time, multiple male aggression remains a concern.

Attacks by single adult males have resulted in several monk seal mortalities. This form of single male aggression occurs at most or all locations and appears to involve behavior which ranges from normal pinniped male harassment of younger animals, to an aberrant level of focused aggression, especially directed toward weaned pups. This was most notable at French Frigate Shoals in 1997, where at least eight pups died as a result of adult male aggression (Carretta *et al*. 2013). Many more pups were likely killed in the same way, but the cause of their deaths could not be confirmed. When single male aggression results in deaths, it is typically due to drowning when pups are mounted in the water, or from infection of bite wounds.

Infectious Disease and Parasites

Infectious Disease

Historically, infectious diseases have not been recognized as a major mortality factor for Hawaiian monk seals. NWHI baseline epidemiological surveys were conducted between 1997 and 2001 at all six major sub-populations (Aguirre *et al*. 1999; Aguirre 2000; NMFS unpublished data). Biomedical sampling and epidemiological investigations through 2001 have demonstrated evidence of exposure to some potential pathogens. Annual monitoring of seal survival, as well as evaluation of pathology through necropsies and histology, have not identified evidence of significant infectious disease related mortality.

To date, there has been limited investigation of the health and disease of monk seals in the MHI (Littnan *et al*. 2006). Relative to the NWHI, Hawaiian monk seals in the MHI may be at risk of increased exposure to several infectious disease agents associated with terrestrial animals that are known to cause disease in other marine mammals and to contaminate marine habitats via runoff. Infectious diseases considered to pose the highest risk to the MHI monk seal population are toxoplasmosis, *Leptospira sp*., marine *Brucella spp*. and possibly canine distemper virus (morbillivirus). The emergent threat of West Nile Virus (WNV) is a serious concern: although this disease has yet to be detected in Hawai`i. There remains a high risk for exposure and there is a case report of WNV killing a captive monk seal in Texas. Other phocids are also susceptible to WNV morbidity and mortality. *Salmonella* and several potentially pathogenic agents found in domestic animals also could have the capacity to infect monk seals in the MHI. Further, seals overlap substantially in their use of coastal habitats and are seen on beaches near each other. For example, adult male seals cruise shorelines in search of

potential female mates. This suggests that diseased seals could infect healthy seals throughout the MHI.

Monk seals at any location in the archipelago could be exposed to diseases such as morbilliviruses via contact with infected marine mammals. Migrating cetaceans are known to travel from areas of endemic morbillivirus to monk seal habitat, and one recently stranded cetacean in Hawai'i tested positive for morbillivirus (NMFS unpublished data). There are two confirmed records of juvenile northern elephant seals in the MHI, one in the NWHI (Midway Atoll) and other reported sightings (Tomich 1986; NMFS unpublished data). Elephant seals are known to carry lungworm and other parasites and pathogens that could result in disease in monk seals. In 2012, a northern fur seal was found in the MHI. NMFS captured the animal and it was flown to a rehabilitation facility in California and released there. The seal tested negative for morbillivirus (NMFS unpublished data).

In summary, infectious diseases do not appear to be currently limiting recovery of the monk seal. However, the threat they pose has high potential for causing devastating impacts should a disease outbreak occur. Monk seals and Hawaiian hoary bats are the only native mammals that occur on the islands. Until humans and the mammals they brought with them arrived, monk seals had likely been isolated from many terrestrial mammalian diseases. This fact, plus the lack of genetic variation in the monk seal (Schultz *et al*. 2009), may make the species highly vulnerable to new disease outbreaks (Yochem *et al*. 2004). Coupled with this, the mobility of seals could facilitate the spread of any outbreak of a disease or pathogen transmissible from seal to seal throughout the archipelago.

To prepare for an infectious disease outbreak or other contingencies, an Unusual Mortality Event (UME) plan has been prepared (Yochem *et al*. 2004). Protocols have been developed for a variety of procedures including anesthesia, sample collection and banking, and necropsy examinations, and training has been instituted for field staff. Archives of tissues and samples have been developed by sampling all animals sedated for research purposes and by performing complete necropsies on all dead animals found. Cell cultures of skin, brain, lung, kidney and spleen have been established in laboratories for potential future analysis and isolation of pathogens.

Parasites

The predominant parasites identified in monk seals are gastrointestinal: tapeworms (*Diphyllobothrium spp.*), nematodes (*Contracaecum spp.*), and an acanthocephalan species (Rausch 1969; Dailey *et al*. 1988). Gastrointestinal parasites are very common in wildlife, including pinnipeds, and their presence is not necessarily indicative of poor health. However, Reif *et al*. (2004) reported that young seals infected with *Diphyllobothrium spp*. (tape worms) tended to be in poorer body condition than those uninfected, and proposed that "intervention strategies to reduce the gastrointestinal parasitic worm (helminth) burdens in immature animals should be considered as a conservation measure." Ulceration

of the stomach associated with nematode infection has been reported (Whittow *et al*. 1980) and is a common finding (Braun, NMFS, personal communication). Even though internal parasites are not identified as a cause of death, they have been shown to be significant stressors in many other species, and survival rates as well as body condition are known to improve in most domestic species with anthelminic treatment. In 2009, field studies to test the effectiveness of deworming medications to reduce parasite burden, improve body condition and ultimately improve survival of juvenile seals were initiated (Gobush *et al.* 2011). These studies are ongoing.

Contaminants

Persistent organic pollutants (POP) originate from anthropogenic substances such as pesticides, industrial chemicals, and flame retardants, or occur as chemical byproducts (Bard 1999). Although many POPs have been banned from use in North America and Western Europe, some nations still use these substances. POPs are persistent in the environment due to their long half-lives and resistance to degradation. POPs are lipophilic and tend to accumulate in the blubber and other fatty tissues of animals. Contaminants are often measured in blubber, liver, and blood of animals because these are tissues in which the contaminants concentrate or which are relatively easy to obtain from live animals. Hawaiian monk seals, like other mammals, accumulate POPs such as polychlorinated biphenyls (PCB), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDE) in their tissues through nursing when young and through their diet later in life.

Three studies have quantified POPs in Hawaiian monk seal tissue but none have yet assessed effects of these compounds on the seals. The first study investigated PCB and DDT levels in the serum and blubber of 46 individual seals from French Frigate Shoals (Wilcox *et al*. 2004). The presence and levels of 14 PCB congeners, DDT and DDT metabolites was examined. This study found patterns in contaminant level associated with the sex and age-class of the seals. Adult males had significantly higher PCB levels than reproductive adult females and immature seals of both sexes. Only one DDT metabolite (p,p'-DDE) was detected in the blubber, and none in any serum samples. Age, sex, reproductive history, and minimum number of pups were not significantly correlated with PCB levels in the blood or blubber (Wilcox *et al*., 2004). The second study investigated contaminant levels in whole blood and blubber of 158 individual seals from four NWHI populations (French Frigate Shoals, Laysan Island, Pearl and Hermes Reef, and Midway Atoll). This study also found patterns in contaminant levels relating to life history traits of the seals. Adult males and juveniles from Midway Atoll were found to have higher total PCB levels compared to individuals of the same age and sex from the three other NWHI sites tested (Ylitalo *et al*. 2008). The most recent study measured persistent organochlorine pollutants in MHI monk seals (Lopez *et al.* 2012).

Multiple studies have shown links between contaminant exposure and detrimental health effects such as reproductive impairment, immune

dysfunction, and cancer in several pinniped species (northern fur seals: Beckmen *et al*. 2003, harbor seals: De Swart *et al*. 1994, California sea lions: Ylitalo *et al*. 2005 and DeLong *et al*. 1973). Although contaminant exposure is often discussed as a correlate to these sub-lethal effects, a causative relationship can be difficult to determine without experimental data. Of the studies above in which contaminant effects (or correlations with contaminant levels) were detected, only the Ylitalo *et al.* (2005) study was comparable (in terms of tissue, age class, and units measured) to the monk seal studies. Summed PCB and DDT levels were approximately one or two orders of magnitude higher in the California sea lions Ylitalo *et al.* (2005) analyzed compared to the contaminant levels measured in the two NWHI monk seals studies.

Human –Caused Mortality and Serious Injury

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 variably oceanic productivity (represented by the Pacific Decadal Oscillation, or PDO) and by human disturbance (Baker *et al.* 2012; Ragen 1999; Kenyon 1972; Gerrodette and Gilmartin 1990).

Currently, human activities in the NWHI are limited and human disturbance is relatively rare, but human-seal interactions, have become an important issue in the MHI. Intentional killing of seals in the MHI is a relatively new and alarming trend. In 2009, three seals (including a pregnant female) were shot and killed in the MHI (Baker *et al.* 2011a). In 2010, a juvenile female seal died on Kauai 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 on the same general area of Molokai dead with skull fractures from blunt force trauma. Recently a new law was passed imposing strict penalties of up to $100,000 fine and 40-year imprisonment term for conviction of intentionally killing or harming monk seals, now a Class C Felony (Hawaiʻi Senate Bill 2441, sponsored by Kauaʻi Senator Gary Hooser).

In contrast to directed killing, repeated disturbance of seals on MHI beaches might cause individuals to avoid habitats they might otherwise use. Seals have also been attacked by pet dogs, posing a risk of trauma to both animals as well as a risk of disease transmission. Finally, at least three young Hawaiian monk seals in the MHI became socialized to humans to the point where they sought out people in the water and on land for social interaction, including play. Seals have also been fed by people. When these situations became unmanageable risks to public safety, two of the seals were translocated away from the MHI, and a third was placed in captivity (Baker *et al*. 2011b). In each case, the seals involved were lost from the MHI population. Many other stories of these and other types of

human-seal interactions in the MHI have been reported, though the frequency and nature of these events is essentially unknown.

Fishery interactions with monk seals can include direct interaction with gear (hooking or entanglement), seal consumption of discarded catch, seals being fed by divers, and seals taking fishers' catch from lines, nets and spears. Entanglement of monk seals in derelict fishing gear, which is believed to originate outside the Hawaiian Archipelago, was already described above. Fishery interactions are a serious concern in the MHI, especially involving State of Hawaii managed nearshore fisheries. Nearshore gillnets have become a more common source of mortality in recent years. Three seals have been confirmed dead in these gillnets in recent years (2006, 2007, and 2010), and one additional seal in 2010 may have also died in similar circumstances but the carcass was not recovered. Several cases of seals with embedded hooks are observed each year in the MHI, many of which involve hooks used to catch ulua (jacks, *Caranx* spp.). Most reported hookings and gillnet entanglements have occurred since 2000 (NMFS unpubl. data). NMFS received public comments during the scoping period for this Programmatic Environmental Impact Statement (PEIS) stating that monk seal interactions with fisheries or fishing gear are on the rise in the MHI (see Appendix B, Scoping Report of the Draft PEIS). Consistent with this, in 2011, 9 seals were observed hooked, and in 2012, 14 seals were observed hooked (3 of which died as a result), and 1 was entangled in gillnet. In 2013, by 20 March, 5 seals were already observed hooked (1 of which died) and another had a fishing spear embedded in its head.

No mortality or serious injuries have been attributed to the MHI bottomfish handline fishery. Yet total fishery mortality and serious injury cannot be considered to be insignificant and approaching a rate of zero. Monk seals are being hooked and entangled in the MHI at a rate which has not been reliably assessed. The information above represents only reported direct interactions, without purpose-designed observation effort the true interaction rate cannot be estimated.

There are currently no fisheries operating in or near the NWHI. In the past, interactions between the Hawai'i -based domestic pelagic longline fishery and monk seals were documented (NMFS 2002). This fishery targets swordfish and tuna and does not compete with Hawaiian monk seals for prey. In October 1991, in response to 13 unusual seal wounds thought to have resulted from interactions with this fishery, NMFS established a Protected Species Zone extending 50 nautical miles around the NWHI and the corridors between the islands. Subsequently, no additional monk seal interactions with either the swordfish or tuna components of the longline fishery have been observed. Possible reduction of monk seal prey by the NWHI lobster fishery has also been raised as a concern, though whether the fishery indirectly affected monk seals remains unresolved. However, the NWHI lobster fishery closed in 2000. In 2006, the NWHI (later renamed Papahānaumokuākea) Marine National Monument was established. Subsequent regulations prohibited commercial fishing in the

Monument, except for the bottomfish fishery (and associated pelagic species catch), which is authorized until June 2011 but has been voluntarily closed since 2009.

Hawaiian monk seal research and enhancement efforts have also resulted in mortalities. From 1982 to 1994, 23 seals died during rehabilitation efforts. Most of these involved seals brought into captivity for rehabilitation when they were already in exceedingly poor health. Thus, some portion of these seals would have certainly also died if they had not been brought into captivity. Additionally, two other seals have died in captivity, two adult males died when captured for translocation to mitigate male aggression, one was euthanized (an aggressive male known to cause mortality), four died during captive research and four died during field research (Baker and Johanos 2002; Carretta *et al.* 2013).

3.3.1.8 Hawaiian Monk Seal Recovery Plan

In 1976, the Hawaiian monk seal was listed depleted under the MMPA of 1972 and as endangered under the ESA of 1973. Section 4(f) of the ESA directs the responsible agency to develop and implement a Recovery Plan, unless such a plan would not promote the conservation of a species. NMFS determined that a recovery plan would promote the conservation of the Hawaiian monk seal. The first recovery plan was completed in March 1983 (Gilmartin 1983) by the Hawaiian Monk Seal Recovery Team (HMSRT), which included experts on marine mammals from the private sector, academia, and government, as well as experts on endangered species conservation and other stakeholders such as fisheries managers. In 1989, the HMSRT was reconstituted and reconvened, and it met nearly every year through spring 2001, with its primary function to review management and research activities aimed at recovery and to make recommendations to NMFS. A new HMSRT was appointed in fall 2001 and charged with preparing a revised recovery plan (NMFS 2007).

1983 Hawaiian Monk Seal Recovery Plan

The 1983 Hawaiian Monk Seal Recovery Plan (Gilmartin 1983) outlined five objectives: 1) identification and mitigation of factors causing decreased survival and productivity; 2) characterization of habitat, including foraging areas; 3) assessment and monitoring of population trends; 4) documentation and mitigation of negative effects from human activities; 5) implementation of conservation oriented management actions; and 6) development of educational programs to enhance public conservation efforts. The plan also assessed the threats and set research priorities.

Despite these efforts, the population continued to decline and the plan was revised in 2007.

2007 Revised Hawaiian Monk Seal Recovery Plan

The 2007 Recovery Plan contains: 1) a comprehensive review of Hawaiian monk seals status and ecology; 2) a review of previous conservation actions; 3) a threats assessment; 4) biological and recovery criteria for downlisting and delisting; 4)

actions necessary for the recovery of the species; and 5) estimates of time and cost to recovery.

The threats impacting Hawaiian monk seals were assessed based on severity and magnitude, as well as the scope and geographic range and have been described in more detail in Section 3.3.1.7. Determining which threat had higher concern regarding its current and potential impact to Hawaiian monk seals was intended to improve the ability to implement effective management actions and increase the probability for a successful recovery. Threats were classified into the following categories:

Crucial threats are ongoing sources of mortality that are apparent at most sites in the NWHI, and include:

- Food limitation;
- Entanglement; and
- Shark predation.

Serious threats are ongoing impacts with the potential for a range-wide concern, and include:

- Infectious diseases;
- Habitat loss;
- Fishery interaction;
- Male aggression; and
- Human interaction.

Moderate threats have possible, localized impacts, but are not considered to be a serious or immediate cause of concern.

- Biotoxins;
- Vessel groundings; and
- Contaminants.

The Recovery Program identified over 100 actions required to alter the trajectory of the Hawaiian monk seal population, grouped into 14 categories (Table 3.3-2). Please see the executive summary of the 2007 Hawaiian Monk Seal Revised Recovery Plan, as well as the document itself, for further details.

Priorities were assigned to each action in the implementation schedule. In compliance with NMFS' Endangered and Threatened Species Listing and Recovery Priority Guidelines (55 FR 24296), all recovery actions were assigned priorities based on three categories: (P) actions necessary for protection; (I) interventions, and; (R) research needs.

Priority 1 actions are, by definition, those actions "that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future." Priority 2 actions are defined as "an action that must be taken to prevent a significant decline in species population/habitat quality or some other significant impact short of extinction." Priority 3 actions are defined as "all other actions necessary to provide for full recovery of the species."

The implementation schedule identified 57 Priority 1 actions: 28 research, 23 intervention, and 14 protection. (Some actions are assigned to more than 1 or more categories). For a complete list of the actions and priorities, please see the table in Section V of the 2007 Hawaiian Monk Seal Revised Recovery Plan.

Current Research and Enhancement Priorities

Table 3.3-2 lists the 14 major recommended action categories identified in the 2007 Recovery Program. Each recommended action has a number of sub-actions that detail specific research programs, intervention actions and/or protection measures for that action. Actions 1-11 are short-term actions; Actions 12 and 13 are recommended essential long-term actions. The 2007 Revised Hawaiian Monk Seal Recovery Plan provides a narrative description of each action/sub-action and a discussion of the issues for each.

Table 3.3-2 All Recovery Action Categories for Hawaiian Monk Seals

Action Number	Action Description
1)	**Investigate and Mitigate Factors Affecting Food Limitation**
2)	Prevent entanglements of monk seals
3)	**Reduce shark predation**
4)	**Prevent introduction and spread of infectious decrease**
5)	**Conserve Hawaiian monk seal habitat**
6)	**Reduce Hawaiian monk seal interactions with fisheries**
7)	**Reduce male aggression toward pups/immature seals and adult females**
8)	Reduce the likelihood and impact of human disturbance
9)	Investigate and develop response to biotoxin impacts
10)	Reduce impacts from compromised and grounded vessels
11)	Reduce the impact of contaminants
12)	**Continue population monitoring and research**
13)	**Create a Main Hawaiian Islands Hawaiian Monk Seal Management Plan**
14)	Implement the Hawaiian Monk Seal Recovery Program

Note: Actions in **BOLD** type have sub-actions with Research Priority 1. See text for description of priority level.
Source: NMFS 2007

3.3.1.9 Field Camps Associated with Hawaiian Monk Seal Research and Enhancement Activities

NMFS conducts Hawaiian monk seal research and enhancement activities at remote field stations in the NWHI (Papahāunamokuākea Marine National Monument [Monument]), typically between April and August each year, though timing varies depending on program funding, logistics and program goals. There are a total of six field stations located at Kure Atoll (Green Island), Midway Atoll (Sand Island), French Frigate Shoals (Tern Island), Pearl and Hermes Reef (Southeast Island), Lisianski Island and Laysan Island (see Figure 3.3-4). The field camps located at Pearl and Hermes Reef, French Frigate Shoals, and Laysan and

Lisianski Islands are operated out of temporary seasonal tents while camps at the other locations are operated out of permanent buildings that were previously used for other purposes. The number of people at each location varies from project to project and year to year but the total number in all camps averages approximately 15 – 17 people total.

Figure 3.3-3 Seasonal Field Camp of South East Island Pearl & Hermes Reef

Source: Jessica Lopez, NMFS 2010

Transportation of personnel, equipment, and supplies to and from the field camps is usually provided by one of two vessels (based on availability), NOAA ship Oscar Elton Sette or the M.V. Kahana. Visits by these large (approximately 200 ft) ships to the NWHI field camps are typically limited to twice per year, deployment (April or May) and demobilization (August), except for special projects and emergencies. In case of an emergency, vessels or a charter plane may be used. There are air strips located on Midway Atoll, and Tern Island (French Frigate Shoals).

Access to the Monument requires a permit issued by the Monument's Co-trustees. NMFS conducts research and enhancement in the Monument under Permit PMNM-2011-001 (see Appendix L). The Monument permit General Terms and Conditions sets out protocols and procedures to ensure protection of the Monument and specified Best Management Practices (BMP) are employed by NMFS staff according to directives provided by the Monument. Copies of the BMPs relevant to Hawaiian monk seal research are also included in Appendix L. NAO 217-103 (Management of NOAA Small Boats) sets the policy and requirements for NOAA programs that utilize small boats (less than 300 gross tons) such as those used in monk seal research.

3.3.2 *Sea Turtles*

There are five species of sea turtles that occur in the waters of the Hawaiian islands (see Table 3.3-3), all of which are listed under the ESA including green, hawksbill, loggerhead, olive ridley, and leatherback turtles. Critical habitat has not yet been designated for any of these species in the U.S. Pacific. Most of the sea turtle species do not often occur where Hawaiian monk seals are found and would not be affected by the proposed action.

Hawksbill, loggerhead, olive ridley, and leatherback turtles would not be affected by the proposed activities because appropriate mitigation would be implemented to avoid activities co-occurring in locations with these turtles and/or to avoid disturbance. Loggerhead, olive ridley, and leatherback turtles are typically found offshore and would not likely be encountered. Hawksbill turtles occur in nearshore waters in the MHI and are known to nest in the MHI. Researchers do not work at night so no nesting animals would be disturbed. If these species are sighted during the day, research activities would not occur in that area. Boat drivers would watch for turtles to avoid disturbance or collision.

Green sea turtles are found in similar habitat as Hawaiian monk seals in the NWHI and MHI and are known to be present on beaches where monk seal researchers conduct their work; therefore, additional detail on green sea turtles is provided below.

Table 3.3-3 Sea Turtle Species of Hawai'i

Common Name	Scientific Name
Green Sea Turtle	*Chelonia mydas*
Hawksbill Turtle	*Eretmochelys imbricate*
Leatherback Turtle	*Dermochelys coriacea*
Loggerhead Turtle	*Caretta caretta*
Olive Ridley Turtle	*Lepidochelys olivacea*

Source: Hawaii Department of Land and Natural Resources (HDLNR) 2011

Green Turtle (Chelonia mydas)

Green turtles are listed as threatened under the ESA, except for breeding populations found in Florida and the Pacific coast of Mexico, which are both listed as endangered. Green turtle populations are in serious decline throughout most of the rest of the Pacific Ocean, except for the Hawaiian population. The Hawaiian green sea turtle population is generally comprised of one genetic stock (Balazs and Chaloupka 2006).

Green turtles occur in the coastal waters surrounding the MHI throughout the year and also migrate seasonally to the NWHI to reproduce (Thompson 2003). The largest nesting colony in the central Pacific Ocean occurs at French Frigate Shoals in the NWHI, where about 200 to 700 females nest each year (Balazs 1976,

as cited in Balazs and Chaloupka 2006). On occasion, green turtles also nest in the MHI; and, they haul out on shore during the day to rest. Nesting in the MHI has occurred along the north shore of Molokaiʻi, the northwest shore of Lānaʻi, and the south, northeast, and southwest shores of Kauaʻi.

The Hawaiian green turtles' nearshore benthic foraging pastures and associated underwater habitats are among the best known in the Pacific. Important resident areas have been identified and are under study along the coastlines of Oʻahu, Molokaiʻi, Maui, Lānaʻi, Hawaiʻi, as well as at Lisianski Island and Pearl and Hermes Reef (Balazs *et al.* 1987; Balazs 1979, 1980, and 1982b). The available evidence indicates that the range of adult green turtles using French Frigate Shoals is confined to the 2,400 km expanse of the Hawaiian Archipelago (Balazs 1976, as cited in Balazs and Chaloupka 2006) and to Johnston Atoll immediately to the south, where algal foraging pastures occur (Balazs 1985).

In the NWHI, and especially at French Frigate Shoals, adult male and female green turtles regularly haul out during the daytime to bask along the shoreline, a behavior not common in other Pacific green sea turtle populations (Balazs 1980; Whittow and Balazs 1982).

Following harvest restrictions in 1978 (50 Code of Federal Register [CFR] 17.11), the population of green sea turtles endemic to the Hawaiian Archipelago has increased in abundance (Balazs and Chaloupka 2006). The population has also shown a distinct 3-4 year periodicity in nesting abundance, which may indicate synchronized breeding behavior throughout the Archipelago.

In terms of health, green sea turtles residing in certain benthic habitats of the Hawaiian Islands are afflicted by tumors (*fibropapillomas*) on their skin, scales, scutes, eyes, oral cavities, and viscera (Balazs and Pooley 1991). The tumors begin as small, localized lesions that rapidly grow to exceed 30 cm in diameter, greatly interfering with or even prohibiting swimming, feeding, breathing, or seeing. The lesions have been classified as fibropapillomas, based on established histologic criteria for tumor classification. The cause of this disease is unknown, but a herpes virus is thought to be responsible (Herbst 1994). The disease has increased to epidemic proportions in Hawaiʻi since the mid-1980s. The Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*) (NMFS and USFWS 1998) identifies the fibropappilloma disease as one of the highest priorities for ongoing research and conservation of the species.

The 1998 Recovery Plan (NMFS and USFWS) also outlines key recovery strategy priorities for green turtles, including measures to protect turtles in their nesting environment on beaches and in the marine environment.

3.3.3 Cetaceans

There are 23 species of cetaceans that occur in the vicinity of the Hawaiian Archipelago (Table 3.3-4). Many of these species do not occur close enough to the shoreline to be affected by the proposed action. Additionally, because the

proposed alternatives include measures to avoid marine mammals during aerial and boat surveys, most cetaceans would not be affected by the project.

Table 3.3-4 Cetaceans Occurring in Hawaiian Archipelago

Cetaceans		
Common Name	**Scientific Name**	**Status[a]**
North Pacific right whale	*Eubalaena japonica*	E
Humpback whale	*Megaptera novaeangliae*	
Minke whale	*Balaenoptera acutorostrata*	
Sei whale	*Balaenoptera borealis*	E
Fin whale	*Balaenoptera physalus*	E
Blue whale	*Balaenoptera musculus*	E
Bryde's whale	*Balaenoptera edeni/brydei*	
Sperm whale	*Physeter macrocephalus*	E
Pygmy sperm whale	*Kogia breviceps*	
Dwarf sperm whale	*Kogia sima*	
Cuvier's beaked whale	*Ziphius cavirostris*	
Blainville's beaked whale	*Mesoplodon densirostris*	
Longman's beaked whale	*Indopacetus pacificus*	
Rough-toothed dolphin	*Steno bredanensis*	
Pantropical spotted dolphin	*Stenella attenuata*	
Spinner dolphin	*Stenella longirostris*	
Striped dolphin	*Stenella coeruleoalba*	
Risso's dolphin	*Grampus griseus*	
Melon-headed whale	*Peponocephala electra*	
Fraser's dolphin	*Lagenodelphis hosei*	
Pygmy killer whale	*Feresa attenuata*	
False killer whale	*Pseudorca crassidens*	
False killer whale (Main Hawaiian Islands Insular)	*Pseudorca crassidens*	E
Killer whale	*Orcinus orca*	

[a] E = Endangered under the ESA

In 1992, the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) was established to protect humpback whales (*Megaptera novaeangliae*) and their habitat (see Section 3.4.11.1). Given that monk seals also inhabit this area and some research and enhancement activities may occur within the HIHWNMS where humpback whales occur, humpback whales are discussed in more detail in this section. The MHI insular stock of false killer whales (*Pseudorca crassidens*) also may occur in the nearshore environment in the MHI and could be affected by the proposed activities. In addition, spinner dolphins (*Stenella longirostris*) and bottlenose dolphins (*Tursiops truncatus*) may occur in

close enough proximity to monk seals to be affected by certain proposed actions; thus, additional detail on these species is provided below.

Humpback Whale (Megaptera novaeangliae)

The humpback whale is listed as endangered under the ESA. There is no designated critical habitat for this species in the North Pacific. Humpback whales and other marine mammals are of interest from a cultural perspective to some Native Hawaiians and other people.

Abundance of humpback whales for the entire North Pacific Ocean is estimated to be 18,302 individuals, with over 50% of the population (approximately 10,000) estimated to winter in Hawaiian waters (Calambokidis *et al.* 2008). Humpback whales use Hawaiian waters as a major breeding ground during winter and spring (November through April). Peak abundance around the Hawaiian Islands is from late February through early April (Mobley *et al.* 2001). During the fall–winter period, primary occurrence is expected from the coast to 50 nm offshore, which takes into consideration both the available sighting data and the preferred breeding habitat (shallow waters) (Mobley *et al.* 1999; 2000; 2001). The greatest densities of humpback whales (including calves) are in the four-island region consisting of Maui, Molokaiʻi, Kahoʻolawe, and Lānaʻi, as well as Penguin Bank (Baker and Herman 1981; Mobley *et al.* 1999; Maldini 2003) and around Kauaʻi (Mobley 2005).

Humpback whales return to the feeding grounds of near northern California to the Aleutian Islands as determined by comparing songs (McSweeney *et al.* 1989) and recording the migration path of animals with satellite tags (Mate *et al.* 1998). Many of the Central North Pacific stock of humpback whales migrate south to Hawaiʻi in winter for breeding and calving from December through April (Clapham and Mead 1999; Mobley *et al.* 2001). Recent studies (Lambert *et al.* 2011) have found wintering activity in the Northwestern Hawaiian Islands. Monitoring of song activity indicates that humpback whales are common in the NWHI from late December until mid-May. A comparison of song activity with the main Hawaiian Islands found that song length and volume was comparable between Oʻahu locations (known to provide wintering habitat) and the NWHI locations at Maro Reef, Lisianski Island, and French Frigate Shoals.

False Killer Whale (Pseudorca crassidens) Main Hawaiian Islands Insular Stock

The Hawaiian Islands Stock Complex of false killer whales includes (1) the MHI insular stock, which includes animals inhabiting waters within 140 km (approx. 75 nmi) of the MHI, (2) the MWHI stock, which includes animals inhabiting waters within 93 km (50 nmi) of the NWHI and Kauai, and (3) the Hawaii pelagic stock, which includes false killer whales inhabiting waters greater than 40 km (22 nmi) from the MHI (Carretta *et al.* 2013).

The MHI insular stock of false killer whales was listed as endangered in 2012 (77 FR 70915). The minimum population estimate for the MHI insular stock of false killer whales is 129 false killer whales (Carretta *et al.* 2013). The population is

thought to have been in decline over the past two decades (Reeves *et al.* 2009 and Baird 2009).

The MHI insular stock of false killer whales may occur in include a wide range of depths (<50 to >4,000 m) and can move widely and rapidly among the MHI (Baird *et al.* 2010). Anthropogenic threats to this stock include competition with fisheries for prey, bioaccumulation of contaminants, and injury from fisheries interactions (Carretta *et al*. 2013).

Spinner Dolphin (Stenella longirostris)

The spinner dolphin is found in tropical and subtropical waters worldwide. In the Hawaiian Islands, spinner dolphins occur along the leeward coasts of the MHI and at several NWHI. Long-term site fidelity has been noted for spinner dolphins along the Kona coast of Hawai`i, along O`ahu, and off the island of Moorea in the Society Islands (Norris *et al.* 1994; Östman 1994; Poole 1995; Marten and Psarakos 1999). Spinners spend their daylight hours in coastal waters, generally in calm bays. They use these areas to rest, care for their young and to avoid predators, before traveling to deeper water at night to hunt for food. Spinner dolphins form large schools of hundreds of animals when feeding at night and split off into much smaller groups, sometimes of only a dozen individuals, when socializing and resting during the day (NMFS 2011).

Spinner dolphins (subspecies *S. longirostris longirostris*) that may be affected by the proposed action are part of the Hawaiian Islands stock complex, which is comprised of 6 stocks (Carretta *et al.* 2013). The most current population estimate for the overall abundance in Hawaiian waters is 2,805 based on a 2002 ship survey (Barlow 2006). However, this estimate is out of date and may have been an underestimate because limited effort was expended in nearshore areas where spinners are common (Barlow 2006). Individual Hawaiian spinner dolphin stock abundance estimates are either unavailable or considered unreliable due their age or suspected biases (Carretta *et al.* 2013).

In recent years, the increase in human-spinner dolphin interactions in the MHI including from "swim with wild dolphin" tours, and individuals that swim or kayak from shore to seek out dolphins, has resulted in disturbance of this species during times of rest. Under a separate project, NMFS is drafting an EIS on the potential rulemaking under the MMPA to provide more protection to Hawaiian spinner dolphins. Additional information can be found at: http://www.fpir.noaa.gov/PRD/prd_spinner_EIS.html.

Bottlenose Dolphin (Tursiops truncatus)

Bottlenose dolphins occur in the Hawaiian Archipelago and may be affected by the proposed activities. The Hawaiian Islands stock complex of bottlenose dolphin includes Kauai/Niiahu, Oahu, 4-island, Hawaii Island, and the Hawaii Pelagic stock. This stock complex is not listed as threatened or endangered under the ESA nor depleted under the MMPA. They are listed on Appendix I under

Convention on International Trade in Endangered Species of Wild Flora and Fauna and as low risk under the IUCN.

Bottlenose dolphins occur throughout the Hawaiian Archipelago in the MHI and NWHI. The abundance estimates are as follows: Kauai-Niihau – 147; Oahu – 594; 4-islands region – 153; Hawaii Island - 102; and Hawaii Pelagic (deep water and NWHI) - 3, 178 (Carretta *et al.* 2013).

3.3.4 *Sharks*

Approximately 40 species of sharks occur in Hawaiian waters (HDLNR 2011) (see Table 3.3-5). Inshore species of sharks include the Galapagos shark, blacktip reef shark, gray reef shark, bignose shark, blacktip shark, sandbar shark, tiger shark, scalloped hammerhead shark, smooth hammerhead shark, and whitetip reef shark.

The four most common shark species in the coastal waters surrounding the Hawaiian Islands are sandbar sharks, tiger sharks, Galapagos sharks, and gray reef sharks (Wetherbee *et al.* 1994).Tiger sharks and Galapagos sharks have been found to be more abundant in the northern Hawaiian islands (Papastamatiou *et al.* 2006), consistent with diver-based surveys that have found increasing abundance of large, predatory sharks from south to north in the Hawaiian islands (Friedlander and DeMartini 2002).

Table 3.3-5 Inshore Shark Species of Hawai'i

Common Name	Scientific Name
Galapagos shark	*Carcharhinus galapagensis*
Blacktip reef shark	*Carcharhinus melanopterus*
Gray reef shark	*Carcharhinus amblyrhynchos*
Bignose shark	*Carcharhinus altimus*
Blacktip shark	*Carcharhinus limbatus*
Sandbar shark	*Carcharhinus plumbeus*
Tiger shark	*Galeorcerdo cuvier*
Scalloped hammerhead shark	*Sphyrna lewini*
Smooth hammerhead shark	*Sphyrna zygaena*
Whitetip reef shark	*Triaenodon obesus*

Source: HDLNR 2011

Acoustic monitoring conducted at French Frigate Shoals in the NWHI was used to assess movement patterns of tagged tiger and Galapagos sharks within the atoll, particularly at locations where monk seal pups had been preyed upon (Lowe *et al*. 2006). Tiger sharks were detected at French Frigate Shoals throughout the year, but there was a strong seasonal trend in area use through the atoll, with tiger sharks spending more time around East Island in the summer months, but more time around the northern islands (Tern, Trig, and Shark

Islands) in winter months (Lowe *et al*. 2006). A smaller number of Galapagos sharks was tagged at French Frigate Shoals (four adults), but available data indicate that the presence of the sharks at Trig Island varied within the diel cycle, within annual cycles, and among individual sharks. The Galapagos sharks were most common at islands close to the outer reef of French Frigate Shoals (Tern, Trig, and Shark), and were not frequently found within the interior of the atoll (Lowe *et al*. 2006).

Additionally, information regarding confirmed shark attacks is provided in Table 3.3-6 below. As illustrated the number of shark attacks in Hawaii has been quite variable over the 2000 – 2012 period with no apparent trends in the shark attack data. The average number of shark attacks in Hawaii over the 2000 – 2012 period has been 4.2 attacks annually.

Table 3.3-6 Number of Confirmed Shark Attacks in Hawaii (2000-2012)

Year	Total Attacks	Fatal	Non-fatal
2000	2	0	2
2001	3	0	3
2002	6	0	6
2003	5	0	5
2004	3	1	2
2005	4	0	4
2006	3	0	3
2007	7	0	7
2008	1	0	1
2009	3	0	3
2010	4	0	4
2011	3	0	3
2012	10	0	10

Source: International Shark Attack File, ISAF Statistics for the USA Locations with the Highest Shark Attack Activity Since 2000,
Website: (http://www.flmnh.ufl.edu/fish/sharks/statistics/statsus.htm) accessed April 5, 2012.

3.3.5 Other Fish Species

The Hawaiian Archipelago distinguishes itself as a subprovince of the spacious tropical and subtropical Indo-Pacific region, which extends from the Red Sea and coast of East Africa to the easternmost islands of Oceania (Hawai'i and Easter Island). The composition of the Hawaiian marine life varies enough from the rest of the Indo-Pacific to be treated as a distinct faunal subregion. Hawai'i's unique fish fauna can be explained by its geographical and hydrographical isolation (Randall 1998). Pelagic fishes such as the larger tunas, the billfishes, and some sharks are able to traverse the great distance that separates the Hawaiian Islands from other islands or continents in the Pacific Ocean; however, shore fishes are dependent on passive transport as larvae in ocean currents for distribution. As

would be expected, the fish families that have a high percentage of species in the Hawaiian Islands compared to elsewhere tend to be those with a long larval life stage, such as the moray eels and surgeonfishes (*Acanthurus spp*.). Families that contain mainly species with short larval life stages, such as the gobies, blennies, and cardinal fishes, are not as well represented in Hawai`i as in the rest of the Indo-Pacific region (Randall 1995).

3.3.5.1 *Essential Fish Habitat*

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) defines Essential Fish Habitat (EFH) as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity (16 United States Code [U.S.C.]§ 1802). These waters include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include areas historically used by fish. Substrate types include sediment, hard bottom, structures underlying the waters, and associated biological communities. EFH can consist of both the water column and the underlying surface (for example, seafloor) of a particular area. Certain properties of the water column such as temperature, nutrients, or salinity are essential to various species. Some species may require certain bottom types such as sandy or rocky bottoms, vegetation such as sea grasses or kelp, or structurally complex coral or oyster reefs. EFH also includes those habitats that support the different life stages of each managed species, as a single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions.

Fisheries managed by the Western Pacific Regional Fishery Management Council (WPRFMC) and the state of Hawai`i units include 22 bottom fish species, 32 pelagic species, 5 crustacean species, and 13 precious corals and coral reef ecosystem species. Currently, no data are available to determine potential overfishing of pelagic species except for the bigeye tuna (*Thunnus obesus*) (NMFS 2004), which is declining throughout its range.

In 2009, the WPRFMC published a Fishery Ecosystem Plan (FEP) for the Hawaiian Archipelago, which establishes the framework under which the Council will manage fishery resources, and begin the integration and implementation of ecosystem approaches to management in the Hawaiian Archipelago. The Hawaiian Archipelago FEP is intended to consolidate, rather than replace existing fishery regulations for demersal species. Pelagic fisheries will continue to be managed by NMFS based on recommendations from the WPRFMC under a separate FEP (WPRFMC 2009).

3.3.5.2 *Commercially Harvested Species*

Among the various categories of fisheries, the pelagic fishing industry is the largest and most valuable one, accounting for almost 96% of commercial landings with 25.7 million pounds of pelagic fish caught commercially in 2009 (WPacFin 2010). Key fishery categories include the pelagic, coral reef fishery, bottomfish, precious corals, and crustacean fisheries. Tunas (especially bigeye

tuna) and billfish (especially blue marlin, striped marlin, swordfish) are the main target species for pelagic fishing, but other species, such as mahimahi, ono (wahoo), and moonfish, are also important (NMFS 2005). Popular commercial coral reef fish species include akule (which dominates nearshore commercial landings), soldierfishes, surgeonfishes, goatfishes, squirrelfishes, unicornfishes, and parrotfishes (WPRFMC 2010b).

The most commonly harvested species of coral reef-associated organisms include the following: surgeonfishes (*Acanthuridae*), triggerfishes (*Balistidae*), jacks (*Carangidae*), parrotfishes (*Scaridae*), soldierfishes/squirrelfishes (*Holocentridae*), wrasses (*Labridae*), octopus (*Octopus cyanea, O. ornatus*), and goatfishes (*Mullidae*). A small-scale harvest of crustaceans occurs throughout the inhabited islands of the Western Pacific Region. The most common harvests include lobster species of the taxonomic groups Palinuridae (spiny lobsters) and Scyllaridae (slipper lobsters) (WPRFMC 2009).

The families of bottomfish and seamount fish that are often targeted by fishermen include snappers (*Lutjanidae*), groupers (*Serranidae*), and jacks (*Carangidae*). Distinct depth associations are reported for certain species of snappers and groupers (WPRFMC 2009).

Currently, there are minimal harvests of precious corals in the Western Pacific Region. However, in the 1970s to early 1990s, both deep- and shallow-water precious corals were targeted in waters around Hawai`i. The commonly harvested precious corals include pink coral (*Corallium secundum, Corallium regale, Corallium laauense*), gold coral (*Narella spp., Gerardia spp., Calyptrophora spp.*), bamboo coral (*Lepidisis olapa, Acanella spp.*), and black coral (*Antipathes dichotoma, Antipathes grandis, Antipathes ulex*) (WPRFMC 2009).

Additional information about commercial fisheries is provided in Section 3.4.3 Commercial Fishing.

3.3.5.3 Nearshore Species

The diversity of fish species in shallow marine habitat in Hawai`i is considered relatively low compared to other tropical areas of the Pacific, due to the isolation and northerly geographic setting. There are about 450 species of inshore fishes (Gosline and Brock 1960; Randall 1980). Common species of fish include moray eels (*Muraenidae*), squirrelfishes (*Holocentridae*), aholehole (*Kuhlia sandvicensis*), aweoweo (*Priacanthus cruentus*), upapalus (*Agoponidae*), nenue (*Kyphosus bigibius*), omilu (*Caranx melampygus*), papios (*Carangidae*), lai (*Scombroides lysan*), amaama (*Mugil cephalus*), nehu (*Stolephorus purpureus*), and needlefishes and halfbeaks (*Belonidae* and *Hemiramphidae*)(Gosline and Brock 1960).

3.3.6 Birds

The Project area includes the waters and shorezone (beaches and rocky shores) of the NWHI, MHI, and Johnston Atoll (see Section 1.3). Seabirds and shorebirds dominate the coastal bird life within the Project area. Millions of resident and

migratory seabirds and overwintering shorebirds depend on the roosting, breeding, migratory, and overwintering habitats found here (USFWS 2005). In addition to the terrestrial environment, the waters surrounding the Hawaiian Archipelago and Johnston Atoll are essential habitat for pelagic seabirds since most rely on fish to feed their young (National Audubon Society 2008).

As described in Chapter 1, under the Migratory Bird Treaty Act (MBTA) (16 USC 703–712; 40 Stat. 755 as amended) and Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, NMFS is required to analyze the potential impacts its actions may have on migratory birds. The MBTA prohibits the take of any migratory bird without authorization from USFWS.

The NWHI Important Bird Area (IBA) coincides with the Monument and provides critical foraging grounds for seabirds (National Audubon Society 2008). Because most seabirds breeding there are pelagic feeders that also rely on the waters surrounding the islands for fish to feed their young, both the terrestrial and the aquatic habitats in the NWHI are integral components of the IBA.

3.3.6.1 Seabirds

Surveys around the Hawaiian Islands in 2002 documented 40 resident and migrant seabird species (USFWS 2005). Most migratory seabirds arrive to breed in February and March, and leave by the late summer or fall. The exceptions are the albatross, which breed in winter and spring (USFWS 2005). All seabird species that regularly breed within the Hawaiian Archipelago have been identified as Hawai'i's Species of Greatest Conservation Need (SGCN) and are listed in Table 3.3-7 (Mitchell *et al.* 2005).

Table 3.3-7 Hawaiian Coastal Bird Species of Conservation Need

Common Name	Scientific Name	MHI	NWHI	State of Hawai`i	USFWS	IUCN
SEABIRDS						
Laysan albatross	*Phoebastria immutabilis*	X	X	SGCN	BCC	NT
Black-footed albatross	*Phoebastria nigripes*	X	X	SGCN	BCC	E
Short-tailed albatross	*Phoebastria albatrus*		X	E	E	VU
Hawaiian petrel	*Pterodroma sandwichensis*	X		E	E	VU
Bonin petrel	*Pterodroma hypoleuca*		X	SGCN		LC
Bulwer's petrel	*Bulweria bulwerii*	X	X	SGCN		LC
Wedge-tailed shearwater	*Puffinus pacificus*	X	X	SGCN		LC
Christmas shearwater	*Puffinus nativitatis*	X	X	SGCN	BCC	LC
Newell's shearwater	*Puffinus auricularis newelli*	X		T	T	E
Band-rumped storm petrel	*Oceanodroma castro*	X		SGCN	C/BCC	LC
Tristram's storm petrel	*Oceanodroma tristrami*		X	SGCN	BCC	NT
White-tailed tropicbird	*Phaethon lepturus*	X	X	SGCN		LC
Red-tailed tropicbird	*Phaethon rubricauda*	X	X	SGCN		LC
Masked (blue-faced) booby	*Sula dactylatra*	X	X	SGCN		LC
Brown booby	*Sula leucogaster*	X	X	SGCN		LC
Red-footed booby	*Sula sula*	X	X	SGCN		LC
Great frigatebird	*Fregata minor*	X	X	SGCN		LC
Gray-backed tern	*Sterna lunata*	X	X	SGCN		LC
Sooty tern	*Sterna fuscata*	X	X	SGCN		LC
Brown noddy	*Anous stolidus*	X	X	SGCN		LC
Black noddy	*Anous minutus*	X	X			LC
Blue-gray noddy	*Procelsterna cerulea*		X	SGCN		LC
White (Fairy) tern	*Gygis alba*	X	X			LC
SHOREBIRDS						
Hawaiian Stilt	*Himantopus mexicanus knudseni*	X		E	E	LC
Pacific golden plover	*Pluvialis fulva*	X	X	SGCN		LC
Wandering tattler	*Heteroscelus incanus*	X	X	SGCN		LC
Bristle-thighed curlew	*Numenius tahitiensis*	X	X	SGCN	BCC	VU
Ruddy turnstone	*Arenaria interpres*	X	X	SGCN		LC
Sanderling	*Calidris alba*	X	X	SGCN		LC
ADDITIONAL NWHI ESA LISTED SPECIES						
Laysan Duck	*Anas laysanensis*		X	E	E	CR
Nihoa millerbird	*Acrocephalus familiaris kingi*		X	E	E	CR
Laysan finch	*Telespiza cantans*		X	E	E	VU
Nihoa finch	*Telespiza ultima*		X	E	E	CR

Sources: Mitchell *et al*. 2005, USFWS 2010a, USFWS 2008, International Union for the Conservation of Nature and Natural Resources (IUCN) 2010

Legend: E = endangered, T = threatened, C = Candidate, BCC = Bird of Conservation Concern, NT = Near Threatened, VU = Vulnerable, CR = Critically Endangered, LC = Least Concern

Seabird species typically nest in colonies either directly on the ground or underground in burrows and crevices or on vegetation (USFWS 2005). Nesting and/or brood-rearing seabirds that occur on or adjacent to beaches will primarily be the seabird species found within the Project area. These species include: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*Phoebastria nigripes*), wedge-tailed shearwater (*Puffinus pacificus*), masked (blue-faced) booby (*Sula dactylatra*), brown booby (*Sula leucogaster*), gray-backed tern (*Sterna lunata*), sooty tern (*Sterna fuscata*), black noddy (*Anous minutes*), brown noddy (*Anous stolidus*), and white (Fairy) tern (*Gygis alba*) (USFWS 2005). The distribution of seabird species that depend on beach habitats where monk seal research and enhancement activities may occur are identified in Table 3.3-7.

Seabird colonies in the NWHI constitute one of the largest and most important assemblages of tropical seabirds in the world, with over 14 million birds and 5.5 million birds of 24 species breeding annually (USFWS 2005). Many species of seabirds that breed on or near beaches depend on the NWHI. Sooty terns are the most numerous breeding species in the NWHI with annual breeding populations estimated at more than 2.5 million birds. The largest populations of Laysan albatross and black-footed albatross in the world nest at Midway Atoll and Laysan Islands. Populations of gray-backed tern in the NWHI are of global significance (NWHI USFWS 2005). Although nesting seabird species are often found throughout the NWHI, the most important islands for breeding seabirds are Laysan, Lisianski, Nihoa, and Necker Islands (Mitchell *et al.* 2005).

The larger islands within the MHI that have higher elevations historically supported large and diverse populations of nesting seabirds. However, human habitation has greatly altered these islands. Today, many of the seabirds nest on the smaller rocks and islets off the MHI where they are free from predators and human disturbance (USFWS 2005). The MHI are still the primary nesting habitat for cliff-nesting species such as petrels and shearwaters that do not nest on islands of low elevation. Many of these species, (*i.e.,* Hawaiian Petrel [*Pterodroma sandwichensis*] and Newell's shearwater [*Puffinus auricularis newelli*]), are threatened by predators and habitat degradation and are listed under the ESA. Some of the most important seabird habitats in the MHI occur on Lehua and Kaula islets off of Ni`iahu, as well as on Mokumanu and Manana islets off of O`ahu (OIRC 2011). The seabird species that depend on beach habitats within the MHI are listed in Table 3.3-8.

Table 3.3-8 Distribution of Breeding or Brood-Rearing Seabird Species That Occur on or Near Beaches in the Hawaiian Archipelago

Common Name	Scientific Name	Nesting Habitat	Kaua`i	O`ahu	Moloka`i	Lāna`i	Maui	Kaho`olawe	Hawai`i	NWHI (throughout)
Laysan albatross	*Phoebastria immutabilis*	Surface, with vegetation	X	X						X
Black-footed albatross	*Phoebastria nigripes*	Surface, with and without vegetation		X						X
Wedge-tailed shearwater	*Puffinus pacificus*	Below surface, burrows	X	X	X	X	X	X	X	X
Masked (blue-faced) booby	*Sula dactylatra*	On surface, no vegetation		X			X			X
Brown booby	*Sula leucogaster*	On surface, with vegetation	X	X						X
Gray-backed tern	*Sterna lunata*	On surface, no vegetation		X						X
Sooty tern	*Sterna fuscata*	On surface, with vegetation		X						X
Black noddy	*Anous minutus*	Above ground, on vegetation; on surface, no vegetation	X	X	X	X	X	X	X	X
Brown noddy	*Anous stolidus*	Above ground, on vegetation; on surface, with and without vegetation		X			X			X
White (Fairy) tern	*Gygis alba*	Above ground, on vegetation; on surface, no vegetation		X						X

Source: USFWS 2010a, USFWS 2005, Mitchell *et al*. 2005

3.3.6.2 *Shorebirds*

Forty-seven species of shorebirds have been recorded in the Hawaiian Islands (National Audubon Society 2008). Most shorebirds are migratory birds that winter throughout the Hawaiian Archipelago, arriving in July and August then returning to the Arctic to breed in May. Younger birds may skip breeding their first summer and remain in the Pacific Islands (National Audubon Society 2008). The only breeding shorebird species in the MHI is the endangered endemic Hawaiian Stilt; no breeding shorebirds occur in the NWHI.

Most shorebird species overwintering in Hawai`i are infrequent visitors or vagrants, but the Hawaiian Islands are of primary importance for four species: Hawaiian stilt (*Himantopus mexicanus knudseni*), Pacific golden-plover (*Pluvialis fulva*), bristle-thighed curlew (*Numenius tahitiensis*), and wandering tattler

(*Heteroscelus incanus*) (Engilis and Naughton 2004). Other common winter visitors include ruddy turnstone (*Arenaria interpres*) and sanderling (*Calidris alba*) (Engilis and Naughton 2004). All of these shorebird species have been identified as Hawaii's SGCN and are listed in Table 3.3-6 (Mitchell *et al.* 2005).

Shorebirds utilize a variety of habitats throughout the Hawaiian Islands, many of which differ from those habitats used by continental wintering populations. Tidal flats, estuaries, exposed reefs, freshwater and salt marshes, ephemeral wetlands, ephemeral playas, and aquaculture wetlands (taro, shrimp, and rice) support the highest diversity of shorebirds (Engilis and Naughton 2004). Beaches, including coral and volcanic sands, and associated dune systems, provide important habitat for curlews, turnstones, sanderlings, and to a lesser degree, Pacific golden-plovers (Engilis and Naughton 2004).

Protected Bird Species

The Hawaiian Islands display a rich biodiversity arising from a variety of factors, including the remoteness of the islands, millions of years of isolation, varying climates, diverse topography, and the pattern of volcanic activity. This biodiversity includes a high percentage of endemic plants and animals.

Unfortunately, roughly ten percent of the endemic bird species to Hawai`i are identified as birds of conservation concern (BCC) (Mitchell *et al.* 2005). The Hawaiian Islands also have a disproportionately large number of bird species listed as either endangered or threatened under the ESA; combining BCC with endangered or threatened species, about 25 percent of the native Hawaiian avifauna is at risk (USFWS 2008a).

There are varying levels of protection for bird species found within the project area, including at the state, federal and international level. Therefore, several lists exist that provide information on the conservation status of these bird species, many of which include the same species. The conservation status of seabird and shorebird species that occur within the Project area are summarized below relative to their applicable state, federal and international protection.

State Listed Species

Hawai`i's Comprehensive Wildlife Conservation Strategy (CWCS) identifies Hawai`i's Bird SGCN (Mitchell *et al.* 2005). The Hawaiian Islands are biologically diverse, with fauna characterized by high levels of endemism. In addition, many migratory species spend key parts of their life cycles (for example, breeding or wintering) in Hawai`i. To recognize the global rarity of these species or the importance of Hawai`i to these species, 77 species of birds were identified as SGCN. Migratory species with irregular or insignificant presence in Hawai`i were not included on the list.

Hawai`i's CWCS identified 77 species of birds as SGCN, including 23 species of breeding seabirds and 6 species of shorebirds (Mitchell *et al.* 2005). All seabird and shorebird species listed as SGCN that occur in either the NWHI or MHI, as well as any ESA listed bird species in the NWHI, are listed in Table 3.3-5.

Birds of Conservation Concern

The primary statutory authority for BCC is the Fish and Wildlife Conservation Act of 1980 (FWCA), as amended; the 1988 amendment to FWCA mandates the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973." The objective of the BCC is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions. These lists should be consulted in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

Seabird and shorebird species in the Project area listed as BCC include Laysan albatross and black-footed albatross (USFWS 2008a). Laysan albatross breed throughout the NWHI and on the MHI of Kauai and O`ahu and Lehua Islet off of Ni`ihau. Outside of Hawai`i, Laysan albatross breed on islands off of Japan and Mexico. In the Hawaiian Archipelago, the population is estimated at greater than 590,000 pairs, with the largest colonies occurring on Midway Atoll (441,000 pairs) and Laysan (145,000 pairs) (Mitchell *et al.* 2005). Total population of all MHI colonies is less than 100 pairs. Worldwide population is estimated at 630,000 breeding pairs. Threats include introduced predators, invasive species, contaminants, marine pollution, collisions, and fisheries (Mitchell *et al*. 2005).

The breeding distribution of black-footed albatross is almost entirely restricted to the Hawaiian Islands except of small breeding populations off Japan (USFWS 2005). In Hawai`i, breeding colonies occur on the NWHI and Kaula and Lehau islets off Ni`iahu. The largest colonies occur at Laysan and Midway Atoll. Black-footed albatross nest close to the shoreline on open sandy beaches or dunes. Longline fisheries, ingestion of plastics, and sea level rise are major threats to this species.

ESA Listed Species

This section addresses ESA-listed seabird and shorebird species in the Hawaiian Archipelago. ESA-listed species identified include: Laysan duck, Nihoa millerbird, Laysan finch, short-tailed albatross, Nihoa finch, Hawaiian petrel, Newell's shearwater, band-rumped storm petrel (candidate species) and Hawaiian stilt (USFWS 2010a). No critical habitat has been designated for any of these species (USFWS 2010a).

Several of the ESA-listed birds identified do not occur within the Project area. These include Hawaiian stilt, Hawaiian petrel, Newell's shearwater, band-rumped petrel and the Nihoa finch. Hawaiian stilt are shorebirds that depend on large coastal wetlands and ephemeral playas in the MHI. Hawaiian petrel, Newell's shearwater, and band-rumped storm petrels are seabirds that nest in upper elevation sea cliffs outside the Project area. The Nihoa finch is an endemic bird species that lives only on the island of Nihoa. It prefers open but vegetated habitat throughout the island and build their nests in small holes in rock outcrops 100 to 800 feet above sea level (USFWS 2010d).

Short-tailed Albatross

The world population of short-tailed albatross is estimated at 2,200 birds (USFWS 2011b). Unfortunately, about 85% of the global short-tailed albatross currently breed on an active volcano at Torishima Island, Japan (USFWS 2009d). The first confirmed successful nesting of short-tailed albatross outside of Japan in modern history occurred on Eastern Island, Midway Atoll in June, 2011 (USFWS personal communication 2012a).

Previously, short-tailed albatross have been observed rarely in the NWHI at Midway Atoll (Sand and Eastern Islets), Laysan Island, French Frigate Shoals (Tern Islet), Pearl and Hermes Reef (Southeast Islet), and Kure Atoll (Green Islet) Short-tailed albatross are primarily seen in the NWHI between November and April but can remain onshore until mid-June if nesting is successful. Short-tailed albatross typically nest on sloping grassy terraces further inland than the Project area.

In recent years, short-tailed albatross have been seen at Midway Atoll, Kure Atoll, and Laysan Island (USFWS personal communication 2011 a, b; DLNR personal communication 2011). The first confirmed successful nesting of short-tailed albatross outside of Japan in modern history occurred on Eastern Island, Midway Atoll in June, 2011(USFWS personal communication 2012a). The same pair nested again within meters of their previous nest and raised a chick estimated to fledge in June 2012 (USFWS personal communication 2012a). Short-tailed albatross have also been sighted on Kure Atoll from October to April in 1994, 2 008, 2010, and 2011 (DLNR personal communication 2011). A female-female pair was observed nesting on Kure Atoll in 2010, but the egg was not fertilized. Short-tailed albatross land on Kure Atoll in camp, at the border of the west landfill and runway, and at the nesting site at the southern edge of the west end of the runway (DLNR personal communication 2011). On Laysan Island, a short-tailed albatross arrived in December of 2009 and 2010 (USFWS personal communication 2011b). It was most often observed in the interior of the island in the northern East Desert (USFWS personal communication 2011b).

Laysan Duck

The Laysan duck has the most restricted range of any duck in the world. A single naturally occurring population estimated at 611 (95% CI 538-714) adult birds exists on Laysan Island (Reynolds *et al.* 2006a cited in USFWS 2009e), and a newly established population estimated in 2007 at nearly 200 birds exists at Midway Atoll (Reynolds *et al.* 2007a cited in USFWS 2009e). Although this species primarily occurs in vegetated upland and lake/wetland habitats during the breeding season, a few ducks on Laysan Island selectively use the camp area to obtain freshwater, insects, and shade (Reynolds 2004 cited in USFWS 2009e). Coastal habitats appear to be used more frequently during the post-breeding season (September through February) when flocks of up to 70 Laysan ducks have been recorded (Reynolds 2004 cited in USFWS 2009e).

Nihoa Millerbird

The Nihoa millerbird is an endangered song bird that has only existed on remote Nihoa Island during the past century. Although previously found at Laysan Island, Nihoa millerbirds were extirpated from Laysan as a result of overbrowsing of the island's vegetation by rabbits and other introduced grazing mammals (USFWS 2012). This species is considered to be at a high risk of extinction from biological and catastrophic factors (BirdLife International 2010). In September of 2011, 24 Nihoa millerbirds were successfully translocated to Laysan Island to help reduce their risk of extinction (USFWS 2012). Millerbirds currently have an estimated global population of 775 birds that are distributed patchily in the vegetated area of Nihoa and Laysan islands (BirdLife International 2010).

Laysan Finch

Laysan finches are endemic to Laysan Island and were introduced to Southeast Island and Grass Island (respectively) at Pearl and Hermes Reef in 1967. This species is restricted to the vegetated area of Laysan Island (NMFS 2003). Laysan finches are a single species and population numbers fluctuate widely, with current estimates to be 17,780 ± 2819 individuals at Laysan Island and approximately 329 at Pearl and Hermes Reef (USFWS 2008d). The Laysan finch is threatened by degradation of habitat from invasive species and both Laysan and Pearl and Hermes Reef are highly susceptible to rising sea levels (Baker *et al.* 2006).

IUCN Listed Species

The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species (IUCN 2010). It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The IUCN Red List is recognized as the most authoritative guide to the status of biological diversity (IUCN 2010).

According to the IUCN Red list, the Laysan duck, Nihoa millerbird and Nihoa finch are listed as critically endangered; the black-footed albatross is listed as endangered; Laysan finches are listed as vulnerable; and the Laysan albatross is listed as near-threatened.

The Laysan duck, Nihoa millerbird, Nihoa finch, and Laysan finch are listed under the ESA and discussed under the ESA section above. Laysan albatross and black-footed albatross are considered birds of conservation concern (BCC) and are discussed under the BCC section above.

3.3.7 Coral

The Hawaiian Islands contain 6,764.5 square miles of coral reefs, representing 84% of the coral reefs in the United States (NMFS 2008a). Hawai'i, because of its isolated location in the central pacific, contains relatively few coral species (about

50 species in 17 genera) (WPRFMC 2005). These reefs consist of both shallow water, waters less than 98 feet (30 m) and deep water, waters greater than 98 feet (30 m). In the NWHI, 57 species of coral have been identified, with 30 percent of them being endemic (NMFS 2008a).

Precious corals of the genus *Corallium* (pink), *Gerardia* (gold), *Narella* (gold), *Lepidisis* (bamboo), and *Antipathes* (black) are regulated by the State of Hawai`i and the U.S. Federal government (NMFS 2008a). Precious corals that are commonly harvested include pink coral, gold coral, bamboo coral, and black coral (WPRFMC 2009).The State of Hawai`i regulates all coral out to 3 nm and also claims jurisdictional authority over the Makapuu Coral Beds, 6 miles off Makapuu (NMFS 2008a). The U.S. Federal government, represented by WPRFMC, regulates all precious coral within the U.S. Exclusive Economic Zone (EEZ), which extends from 3 to 200 nm off the coast of Hawai`i (NMFS 2008a).

3.3.7.1 *Shallow Water Corals*

Shallow water ecosystems are the best understood of the reef ecosystems as most assessment and monitoring of reefs are done at waters shallower than 98 feet (30 m) (NMFS 2008b). Corals are defined by the Coral Reef Conservation Act of 2000 (16 USC 6401 *et. seq.*) as any of the 6000 species of the phylum Cnidaria including:

A. All species of the orders black corals (*Antipatharia*), stony corals (*Scleractinia*), horny corals (*Gorgonacea)*, organpipe corals and others (*Stolonifera)*, soft corals (*Alcyanacea)*, and blue coral (*Coenothecalia)*, of the class *Anthozoa*; and
B. All species of the order fire corals and hydrocorals (*Hydrocorallina)* of the class Hydrozoa.

Coral reef ecosystems are rock like structures that consist of both reef-building and non-reef-building corals, sand and unconsolidated sediments, colonized hardbottom, and microalgae (NMFS 2008b; WPRFMC 2005; NOAA 2005). With the exception of a few outliers and deep water reefs, most coral are confined to warm tropical and subtropical waters located between 30º North and 30º South (WPRFMC 2005; NOAA 2005).

In the NWHI shallow water reef ecosystem, cover ranges from 4.4% to 64.1% and less than 1% to nearly 100% within various island habitats (NMFS 2008b).

Currently, NOAA has proposed listing three species of shallow water reef building corals in Hawaii as threatened under the Endangered Species Act: *Montipora patula/verrilli*, *Montipora dilitata/flabellata/turgescens*, and *Acroproa paniculata*. All three of these species occur in the Northwestern Hawaiian Islands, and *Montipora patula/verrilli* and *Montipora dilitata/flabellata/turgescens* occur in the Main Hawaiian Islands. These species are proposed as threatened due to a number of threats, with the most significant identified as ocean warming, coral disease, and ocean acidification as a result of climate change.

3.3.7.2 *Deep Water Corals*

Deep water corals are found at depths of greater than 98 ft (30 m) (NMFS 2008b) in temperatures as low as 39 °F (NMFS 2008a). Few data are available on the deepwater banks, seamounts and the abyssal plain in the NWHI. In some areas where depths approach 1,000 fathoms (6,000 ft), dense communities of corals (*ahermatypic* [non reef building]) and sponges obscured the underlying substratum (NMFS 2008a). At this depth, light penetration is not sufficient enough for photosynthesis to occur. Deep water ecosystems provide essential habitat, feeding grounds, recruitment and nursery grounds for a variety of deep water epibenthic invertebrates, fishes, and marine mammals (for example monk seals) (NMFS 2008a). Deep water ecosystems are prevalent throughout the Hawaiian Archipelago (NMFS 2008a) extending from the big island of Hawai‘i in the south (NMFS 2008a) to the NWHI (NMFS 2008b).

3.3.8 *ESA-Listed Plant Species*

There are approximately 343 endangered and 11 threatened plant species in the Hawaiian Islands (USFWS 2010). While consultation with USFWS for NMFS Permit No. 10137 concluded that any proposed activities would not affect any ESA-listed plant species (USFWS 2009c), those species found in or near the coastal zone in the Hawaiian Archipelago will be evaluated in Chapter 4 for potential impacts associated with the proposed alternatives.

3.3.9 *Invasive Species*

The introduction of alien species to the Hawaiian Islands is considered to be the main culprit for the decline of the native Hawaiian species (USFWS 2009a). Invasive or alien species are defined as an organism (plant, animal, or microbe) that is introduced into a non-native ecosystem and which cause, or are likely to cause, harm to the economy, environment, or human health (USFWS 2009a; HISC 2008a).

The Hawai‘i Invasive Species Council (HISC) was formed in 2002 for the "purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and local and international initiatives for the control and eradication of harmful invasive species infestations through the State of Hawai‘i (HISC 2008a). The body of the HISC is collaboration between the Department of Land and Natural Resources (DLNR), Department of Agriculture, University of Hawai‘i, Hawai‘i Department of Business, Economics, Development, and Tourism, Hawai‘i DOH, and the Hawai‘i Department of Transportation (HISC 2008b).

The HISC recognizes 46 high-profile invasive species/categories of concern within the Hawaiian Islands (http://www.hawaiiinvasivespecies.org/pests/index.html). Additionally, in the NWHI, there is special concern over the introduction and proliferation of non-

native seeds, insects or other alien species such as snakes, amphibians, rodents, dogs, cats and others.

The islands and atolls of the NWHI provide habitat for a number of rare endemic plants and animals. While some islands are considered to be "relatively pristine" (NOAA 2009e), several others have already been impacted to lesser or greater extent by several introduced alien species. Historically, three notable examples of alien species introduction to Laysan Island included rabbits, rats, and the common sandbur (*Cenchrus echinatus*) a mat-forming weed that inhibits regeneration of the primary nest substrate (*Eragrostis variabilis*) for Laysan finches (Morin and Conant 1998).

Throughout the Archipelago there are concerns that a variety of insect and arachnids species (*e.g.*, beetles, weevils, grasshoppers, bees, wasps, spiders and ants), reptiles (*e.g.*, snakes, lizards) and mammals (*e.g.*, mice, rats, dogs, cats), could be translocated from the MHI to the NWHI and between islands and atolls within the NWHI. Any of these animals may be accidently introduced to a new location.

Invasive plant species include golden crown beard (*Verbesina encelioides*) on Pearl and Hermes Reef, Laysan Island, Kure Atoll, and Midway Atoll and sandbur (*Cenchrus echinatus*) on Laysan Island.

The Monument permit General Terms and Conditions sets out protocols and procedures to reduce the risk of the spread of non-native (invasive) species including the assurance that "…all vessels are inspected for potential introduced species prior to departing the last port before entering the Monument". In addition, NOAA Administrative Order (NAO) 216-6, Section 7.03 addresses the integration of EO 13112, Invasive Species, in the NOAA Decision making process, requiring the agency to "…use authorities to prevent introduction of invasive species, respond to and control invasions in a cost effective and environmentally sound manner."

3.3.10 Other Permitted Activities on Protected Species within the Project Area

Information about other scientific research and other activities within the project area was gathered from two sources: 1) NMFS Authorizations and Permits for Protected Species (APPS) for activities involving marine mammals and other marine endangered and threatened species, and 2) the Papahānaumokuākea Marine National Monument Permitted Activities 2011 Report.

Under the ESA and MMPA, NMFS issues the following types of permits and authorizations:

- Scientific research permits;
- Enhancement permits;
- 4(d) research authorizations;
- Incidental take authorizations;
- Photography permits (excludes ESA species);
- General Authorizations (excludes ESA species);

- Permits to import/export parts for scientific research;
- Authorization to import/export pre-Act parts;
- Authorization to receive U.S. stranded marine mammal parts for scientific research or education; and
- Permits related to public display (excludes ESA species).

Table 3.3-9 presents a list of activities (scientific research and photography permits and incidental take authorizations) currently permitted by NMFS within the project area.

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Table 3.3-9 Current NMFS Permits and Authorizations for Federally Protected Species under the ESA and MMPA

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
727-1915	PR1 Permit #727-1915 scientific research	Scripps Institution Of Oceanography	2/6/2008	2/1/2014	Hawaiʻi / Palmyra Atoll	Bottlenose Dolphin, Hawaiian Stock (Adult/ Juvenile; All); Bryde's Whale, Hawaiian Stock (Adult/ Juvenile; All); Fin Whale, Hawaiian Stock (Adult/ Juvenile; All); Fraser's Dolphin, Hawaiʻi Stock (Adult/ Juvenile; All); Melon-headed Whale, Hawaiian Stock (Adult/ Juvenile; All); Minke Whale, Hawaiian stock (Adult/ Juvenile; All); Risso's Dolphin, Hawaiian Stock (Adult/ Juvenile; All); Rough-toothed Dolphin, Hawaiian Stock (Adult/ Juvenile; All); Sei Whale, Hawaiian stock (Adult/ Juvenile; All); Sperm Whale, Hawaiian stock (Adult/ Juvenile; All); Spinner Dolphin, Hawaiian Stock (Adult/ Juvenile; All); Striped Dolphin, Hawaiian Stock (Adult/ Juvenile; All); Beaked Blainville's beaked Whale, Hawaiian Stock (Adult/ Juvenile; All); Beaked Cuvier's beaked Whale, Hawaiian Stock (Adult/ Juvenile; All); Beaked Longman's beaked Whale, Hawaiian Stock (Adult/ Juvenile; All); Beaked Unidentified beaked Whale (Adult/ Juvenile; All); Killer False killer Whale, Hawaiian Stock (Adult/ Juvenile; All); Killer Pygmy killer Whale, Hawaiian Stock (Adult/ Juvenile; All); Short-finned Pilot Whale, Hawaiian stock (Adult/ Juvenile; All); Sperm Dwarf sperm Whale, Hawaiian Stock (Adult/ Juvenile; All); Sperm Pygmy sperm Whale, Hawaiian stock (Adult/ Juvenile; All); Spotted Pantropical spotted Dolphin, Hawaiian Stock (Adult/ Juvenile; All)	Harass; Harass/Sampling	Survey, vessel
932-1905	PR1 Permit #932-1905 research/ enhancement	NMFS Office of Protected Resources, Marine Mammal Health and Stranding Response Program	6/30/2009	6/30/2014	Beaches, coastal waters of the US, waters within the US EEZ, and international waters; world-wide import/export; U.S. rehabilitation and captive facilities	Pinniped (unidentified; All); Cetacean (unidentified; All)	Capture/Handle/ Release; Harass; Harass/Sampling	Net; Survey, aerial; Survey, vessel; captive
10018	Level B Harassment of Humpback Whales in the Near Shore Waters Around Maui, Hawaiʻi	Keiki Kohola Project	6/18/2008	6/30/2014	Waters of the Au-Au Channel and in the near shore waters off the Four Island region of Maui, Hawaiʻi. All research activities would be conducted within the 200 fathom contour encompassing the islands of Maui, Molokaiʻi, Lānaʻi, and Kahoʻolawe.	Bottlenose Dolphin, Hawaiian Stock (All); Humpback Whale (Adult/ Juvenile; Calf); Spinner Dolphin, Hawaiian Stock (All); Killer False killer Whale, Hawaiian Stock (All); Short-finned Pilot Whale, Hawaiian stock (All); Spotted Pantropical spotted Dolphin, Hawaiian Stock (All)	Harass	Survey, vessel
10137	PIFSC Hawaiian monk seal field research and enhancement activities.	NMFS Pacific Islands Fisheries Science Center, Marine Mammal Research Program	6/30/2009	6/30/2014	Activities may occur in the Hawaiian Archipelago, which includes the NWHI and MHI, and at Johnston Atoll.	Hawaiian Monk Seal, Hawaiian Islands (Adult; All; pup; Pup/ Juvenile)	Capture/Handle/Release; Harass; Harass/Sampling; Unintentional mortality	Hand and/or Dip Net; Other
13427	Vessel surveys and photo-id of non-listed cetaceans in Hawaiian waters	Pacific Whale Foundation	6/4/2008	6/15/2014	Pacific Ocean / Deeper waters (>100 fathoms) outside of the inshore Maui County area, primary South and West of the islands of Lanai and Kahoolawe. Also, research may be conducted within the waters of Maui County, including the Auau, Kealaikahiki and Alalakeiki Channels.	Blainville's beaked Whale, Hawaiian Stock (All);Bottlenose Dolphin, Hawaiian Islands Stock Complex (All);Cuvier's beaked Whale, Hawaiian Stock (All);Killer False killer Whale, Hawaiian Stock (All);Killer Pygmy killer Whale, Hawaiian Stock (All);Killer Whale (All);Melon-headed Whale (All);Risso's Dolphin, Hawaiian Stock (All);Rough-toothed Dolphin, Hawaiian Stock (All);Short-finned Pilot Whale, Hawaiian stock (All);Sperm Dwarf sperm Whale, Hawaiian Stock (All);Sperm Pygmy sperm Whale, Hawaiian stock (All);Spinner Dolphin, Hawaiian Islands Stock Complex (All);Spotted Pantropical spotted Dolphin (All);Striped Dolphin, Hawaiian Stock (All)	Harass	Survey, vessel

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
13545	Global ecology and toxicology of cetaceans	Ocean Alliance	2/16/2010	2/15/2015	Atlantic Ocean, Indian Ocean, Pacific Ocean, High seas / U.S. EEZs and high seas	Blue Whale (Adult/ Juvenile);Bryde's Whale (Adult/ Juvenile);Fin Whale (Adult/ Juvenile);Gray Whale, Eastern North Pacific (Adult/ Juvenile);Humpback Whale (Adult/ Juvenile);Killer False killer Whale (Adult/ Juvenile);Killer Whale (Adult/ Juvenile);Long-beaked Common Dolphin (Adult/ Juvenile);Long-finned Pilot Whale (Adult/ Juvenile);Minke Whale (Adult/ Juvenile);North Atlantic Right Whale, Western Atlantic Stock (Adult/ Juvenile);Sei Whale (Adult/ Juvenile);Short-finned Pilot Whale (Adult/ Juvenile);Sperm Dwarf sperm Whale (Adult/ Juvenile);Sperm Pygmy sperm Whale (Adult/ Juvenile);Sperm Whale (Adult/ Juvenile);Sperm Whale, North Atlantic Stock (Adult/ Juvenile);Sperm Whale, North Pacific (Adult/ Juvenile);Unidentified Mesoplodon Whale (Adult/ Juvenile)	Harass/Sampling	Survey, vessel
13846	Behavior, social organization and communication in humpback and gray whales in Hawai'i, Alaska and Washington	Whale Trust	7/14/2010	7/31/2015	Coastal waters of S.E. Alaska and Hawai'i / Coastal waters of the main Hawaiian Islands (N21 W157); coastal waters throughout S.E. Alaska (N58 W134). Primary study area in AK within the Frederick Sound, Chatham Strait, Stephens Passage, Lynn Canal and Icy Strait areas.	Humpback Whale, Central North Pacific Stock (Adult; Adult/ Juvenile; All); Killer Whale (All)	Harass; Harass/Sampling	Survey, vessel
14097	NMFS Southwest Fisheries Science Center (SWFSC) pinniped, cetacean and sea turtle studies	NMFS SWFSC	7/7/2010	6/30/2015	North Pacific Ocean	Sea Green sea Turtle (Adult/ Subadult/ Juvenile); Sea Hawksbill sea Turtle (Adult/ Subadult/ Juvenile); Sea Leatherback sea Turtle (Adult/ Subadult/ Juvenile); Sea Loggerhead sea Turtle (Adult/ Subadult/ Juvenile); Sea Olive ridley sea Turtle (Adult/ Subadult/ Juvenile)	Capture/Handle/ Release	Hand and/or Dip Net
14118	Medium to long-term satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans via a novel, noninvasive peduncle belt attachment mechanism	Woods Hole Oceanographic Institution	5/1/2012	4/30/2017	North Pacific Ocean / Tagging will occur in N. Pacific waters out to the US EEZ along the coasts of CA,OR,WA,AK, HI, including NMS protected areas: Channel Isl., Monterey Bay, Gulf of Farallones, Cordell Bank, Olympic Coast, Hawaiian Isl. Humpback Whale, Papahanaumokuakea	Fin Whale (Adult/ Juvenile);Gray Whale, Eastern North Pacific (Adult/ Juvenile);Humpback Whale, Central North Pacific Stock (Adult/ Juvenile);Long-finned Pilot Whale (Adult/ Juvenile);Minke Whale (Adult/ Juvenile);Sei Whale (Adult/ Juvenile);Short-finned Pilot Whale (Adult/ Juvenile)	Harass	Survey, vessel

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
14245	Cetacean Research at the National Marine Mammal Laboratory	NMFS National Marine Mammal Laboratory (NMML)	4/25/2011	5/1/2016	Alaska and US West Coast (CA, HI, OR, WA)	Baird's beaked Whale (Adult/ Juvenile;All;Non-neonate);Bearded Seal (All);Beluga Whale, Beaufort Sea Stock (All;Non-neonate);Beluga Whale, Bristol Bay Stock (All;Non-neonate);Beluga Whale, Cook Inlet Stock (Adult/ Juvenile;All);Beluga Whale, Eastern Bering Sea Stock (All;Non-neonate);Beluga Whale, Eastern Chukchi Sea Stock (All;Non-neonate);Blue Whale (Adult/ Juvenile;All;Calf);Blue Whale, Eastern North Pacific Stock (Adult/ Juvenile;All;Calf);Bottlenose Dolphin (Adult/ Juvenile;All;Non-neonate);Bowhead Whale (Adult/ Juvenile;All;Calf);California Sea lion (All);Cuvier's beaked Whale (Adult/ Juvenile;All;Non-neonate);Dall's Porpoise (All;Non-neonate);Fin Whale (Adult/ Juvenile;All;Calf);Fin Whale, California/Oregon/Washington Stock (Adult/ Juvenile;All;Calf);Gray Whale, Eastern North Pacific (Adult/ Juvenile;All;Non-neonate);Harbor Porpoise (All;Non-neonate);Harbor Seal (All);Harbor Seal, Bering Sea Stock (All);Harbor Seal, California Stock (All);Harbor Seal, Gulf of Alaska Stock (All);Harbor Seal, Oregon & Washington Coastal Waters Stocks (All);Harbor Seal, Southeast Alaska Stock (All);Harbor Seal, Washington Inland Waters Stock (All);Humpback Whale, Central North Pacific Stock (Adult/ Juvenile;All;Calf);Humpback Whale, Eastern North Pacific Stock (Adult/ Juvenile;All;Calf);Humpback Whale, Western North Pacific Stock (Adult/ Juvenile;All;Calf);Killer False killer Whale (Adult/ Juvenile;All;Non-neonate);Killer False killer Whale, Hawaiian Stock (Adult/ Juvenile;All;Non-neonate);Killer Whale (Adult/ Juvenile;All;Non-neonate);Killer Whale, Eastern North Pacific Southern Resident Stock (Adult/ Juvenile;All);Long-beaked Common Dolphin (Adult/ Juvenile;All;Non-neonate);Melon-headed Whale (Adult/ Juvenile;All;Non-neonate);Mesoplodon beaked Whale, California/ Oregon/ Washington Stocks (Adult/ Juvenile;All;Non-neonate);Minke Whale (Adult/ Juvenile;All;Non-neonate);Narwhal (All);North Pacific Right Whale (Adult/ Juvenile;All;Calf);Northern fur Seal, Eastern Pacific Stock (All)	Harass	Survey, aerial; Survey vessel
14353	Humpback whale research around Maui, Hawai'i	Cetos Research Organization	7/14/2010	7/31/2015	Humpback research: Au-au Channel; minke research: main HI islands / For humpbacks: the Au'au Channel, < 108' deep. The Channel is surrounded by four-islands: Moloka'i, Maui, Kaho'olawe, and Lāna'i to the west, resulting in calm, protected waters. For minkes: primarily around Kaua'i and the other main HI islands.	Bottlenose Dolphin, Hawaiian Stock (All); Humpback Whale, Western North Pacific Stock (Adult; All; Calf); Melon-headed Whale, Hawaiian Stock (All); Minke Whale, Hawaiian stock (All); Risso's Dolphin, Hawaiian Stock (All); Rough-toothed Dolphin, Hawaiian Stock (All); Spinner Dolphin, Hawaiian Stock (All); Beaked Cuvier's beaked Whale, Hawaiian Stock (All); Killer False killer Whale, Hawaiian Stock (All); Killer Pygmy killer Whale, Hawaiian Stock (All); Short-finned Pilot Whale, Hawaiian stock (All); Sperm Dwarf sperm Whale, Hawaiian Stock (All); Sperm Pygmy sperm Whale, Hawaiian stock (All); Spotted Pantropical spotted Dolphin, Hawaiian Stock (All)	Harass; Harass/Sampling	Survey, vessel
14381	Sampling sea turtle bycatch in Hawaiian Longline Fisheries	NMFS PIRO	2/12/2010	3/1/2015	Hawai'i Shallow-Set Longline Fishery	Sea Green sea Turtle (Subadult/ Adult); Sea Leatherback sea Turtle (Subadult/ Adult); Sea Loggerhead sea Turtle (Subadult/ Adult); Sea Olive ridley sea Turtle, Mexican Breeding Population (Subadult/ Adult)	Handle/Release	Capture under other authority
14451	Assessing distribution and abundance of marine mammals on Navy operational area, instrumented ranges and adjacent waters using surface vessel surveys, photo identification, videography, and acoustic recording	University of Hawai'i at Manoa	7/14/2010	7/31/2015	North Pacific Ocean Offshore Hawaiian Islands/ Federal and state waters around the main Hawaiian Islands and Northwest Hawaiian Islands, including the Hawaiian Islands Humpback Whale National Marine Sanctuary and Papahānaumokuākea Marine National Monument, and waters of and adjacent to US Navy PMRF	Blue Whale, Western North Pacific Stock (All); Bottlenose Dolphin, Hawaiian Stock (All); Bryde's Whale (All); Fin Whale (All); Fraser's Dolphin (All); Humpback Whale (All); Killer Whale (All); Melon-headed Whale (All); Minke Whale (All); Risso's Dolphin (All); Rough-toothed Dolphin (All); Sei Whale (All); Sperm Whale (All); Spinner Dolphin, Hawaiian Stock (All); Striped Dolphin (All); Unidentified baleen Whale (All); Unidentified Dolphin (All); Unidentified Mesoplodon Whale (All); Unidentified toothed Whale (All); Beaked Baird's beaked Whale (All); Beaked Blainville's beaked Whale (All); Beaked Cuvier's beaked Whale (All); Beaked Longman's beaked Whale, Hawaiian Stock (All); Beaked Unidentified beaked Whale (All); Killer False killer Whale (All); Killer Pygmy killer Whale (All); Short-beaked Common Dolphin (All); Short-finned Pilot Whale (All); Sperm Dwarf sperm Whale (All); Sperm Pygmy sperm Whale (All); Spotted Pantropical spotted Dolphin (All)	Harass	Survey, aerial; Survey, aerial / vessel

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
14585	Behavior and biology of humpback whales in the Pacific Ocean, primarily off Hawai'i and Alaska	University of Hawai'i at Hilo	7/14/2010	7/31/2015	Eastern, Central, and Western North Pacific Ocean / Includes waters off Hawai'i (main study area) and along the North Pacific rim from California northward to Southeast Alaska and then westward through the Gulf of Alaska, Aleutian Islands, and regions of the upper western Pacific.	Humpback Whale (Adult/ Juvenile; All; Non-neonate); Sperm Whale (All); North Pacific Right Whale, Eastern North Pacific Stock (All)	Harass; Harass/Sampling	Survey, vessel
					Hawaiian Islands Exclusive Economic Zone / Waters of the Hawaiian EEZ only	Blue Whale, Western North Pacific Stock (All); Bottlenose Dolphin, Hawaiian Stock (All); Bryde's Whale, Hawaiian Stock (All); Fin Whale, Hawaiian Stock (All); Fraser's Dolphin, Hawai'i Stock (All); Killer Whale (All); Melon-headed Whale, Hawaiian Stock (All); Minke Whale, Hawaiian stock (All); Rough-toothed Dolphin, Hawaiian Stock (All); Sei Whale, Hawaiian stock (All); Spinner Dolphin, Hawaiian Stock (All); Striped Dolphin, Hawaiian Stock (All); Beaked Blainville's beaked Whale, Hawaiian Stock (All); Beaked Cuvier's beaked Whale, Hawaiian Stock (All); Killer False killer Whale, Hawaiian Stock (All); Killer Pygmy killer Whale, Hawaiian Stock (All); Kogia (dwarf/pygmy sperm) Unidentified Kogia (dwarf/pygmy sperm) Whale (All); Short-finned Pilot Whale, Hawaiian stock (All); Spotted Pantropical spotted Dolphin, Hawaiian Stock (All)	Harass	Survey, vessel
14682	Application for a Permit for Scientific Research or to enhance the survival or recovery of a stock under the Marine Mammal Protection Act and the ESA	University of Hawai'i	8/6/2010	11/15/2015	Off the western end of O'ahu, and in the Au Au Channel, in the Four-Island Region of the Hawaiian Main Islands	Bottlenose Dolphin, Hawaiian Stock (Adult; All); Humpback Whale (Adult; All); Killer Whale (Adult; Adult/ Juvenile; All); Melon-headed Whale, Hawaiian Stock (Adult; All); Risso's Dolphin, Hawaiian Stock (Adult; All); Rough-toothed Dolphin, Hawaiian Stock (Adult; All); Spinner Dolphin, Eastern Tropical Pacific Stock (Adult; All); Spinner Dolphin, Hawaiian Stock (Adult; All); Striped Dolphin, Hawaiian Stock (Adult; All); Beaked Blainville's beaked Whale, Hawaiian Stock (Adult; Adult/ Juvenile; All); Beaked Cuvier's beaked Whale, Hawaiian Stock (Adult; Adult/ Juvenile; All); Killer False killer Whale, Hawaiian Stock (Adult; Adult/ Juvenile; All); Killer Pygmy killer Whale, Hawaiian Stock (Adult; All); Short-beaked Common Dolphin (Adult; All); Short-finned Pilot Whale, Hawaiian stock (Adult; Adult/ Juvenile; All); Sperm Dwarf sperm Whale, Hawaiian Stock (Adult; All); Sperm Pygmy sperm Whale, Hawaiian stock (Adult; All); Spotted Pantropical spotted Dolphin, Hawaiian Stock (Adult; All); White-sided Pacific white-sided Dolphin (Adult; All)	Harass; Harass/Sampling	Survey, vessel
15240	Scientific Research and to enhance the survival and recovery of Central and Western Pacific cetacean species	Pacific Islands Fisheries Science Center	5/15/2012	5/31/2017	U.S. EEZ waters. International waters, and foreign waters, subject to permission of the sovereign host State	Blainville's beaked Whale (Adult/ Juvenile;All;Calf);Blue Whale (Adult/ Juvenile;All;Calf);Bottlenose Dolphin (Adult/ Juvenile;All;Calf);Bryde's Whale (Adult/ Juvenile;All;Calf);Cuvier's beaked Whale (Adult/ Juvenile;All;Calf);Fin Whale (Adult/ Juvenile;All;Calf);Fraser's Dolphin (Adult/ Juvenile;All;Calf);Hawaiian monk Seal, Hawaiian Islands (All);Humpback Whale (Adult/ Juvenile;All;Calf);Killer False killer Whale (Adult/ Juvenile;All;Calf);Killer False killer Whale, Hawaiian Stock (Adult/ Juvenile;All;Calf);Killer Pygmy killer Whale (Adult/ Juvenile;All;Calf);Killer Whale (Adult/ Juvenile;All;Calf);Kogia (dwarf/pygmy sperm) Unidentified Kogia (dwarf/pygmy sperm) Whale (Adult/ Juvenile;All;Calf);Longman's beaked Whale (Adult/ Juvenile;All;Calf);Melon-headed Whale (Adult/ Juvenile;All;Calf);Minke Whale (Adult/ Juvenile;All;Calf);North Pacific Right Whale (Adult/ Juvenile;All;Calf);Risso's Dolphin (Adult/ Juvenile;All;Calf);Rough-toothed Dolphin (Adult/ Juvenile;All;Calf);Sei Whale (Adult/ Juvenile;All;Calf);Short-beaked Common Dolphin (Adult/ Juvenile;All;Calf);Short-finned Pilot Whale (Adult/ Juvenile;All;Calf);Sperm Dwarf sperm Whale (Adult/ Juvenile;All;Calf);Sperm Pygmy sperm Whale (Adult/ Juvenile;All;Calf);Sperm Whale (Adult/ Juvenile;All;Calf);Spinner Dolphin (Adult/ Juvenile;All;Calf);Spotted Pantropical spotted Dolphin (Adult/ Juvenile;All;Calf);Striped Dolphin (Adult/ Juvenile;All;Calf);Unidentified beaked Whale (Adult/ Juvenile;All;Calf);Unidentified Dolphin (Adult/ Juvenile;All;Calf);Unidentified Mesoplodon Whale (Adult/ Juvenile;All;Calf);Unidentified rorqual Whale (Adult/ Juvenile;All;Calf)	Harass; Harass/Sampling; Import/export/receive only; Incidental take	Survey, aerial; Survey, vessel

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
15330	Studies of population size, population structure, habitat use, movements, behavior and ecology of cetaceans in the Pacific Ocean	Cascadia Research Collective	7/28/2011	8/1/2016	Pacific Ocean including U.S. states (AK, WA, OR, CA, HI), territories (*e.g.*, Palmyra, American Samoa, Guam, Wake), and International waters	Baird's beaked Whale (Adult/ Juvenile;All);Beluga Whale (All);Blainville's beaked Whale (Adult/ Juvenile;All);Blue Whale (Adult/ Juvenile;All);Bottlenose Dolphin (Adult/ Juvenile;All);Bryde's Whale (Adult/ Juvenile;All);California Sea lion (All);Cuvier's beaked Whale (Adult/ Juvenile;All);Dall's Porpoise (Adult/ Juvenile;All);Fin Whale (Adult/ Juvenile;All);Fraser's Dolphin (Adult/ Juvenile;All);Ginkgo-toothed beaked Whale (Adult/ Juvenile;All);Gray Whale, Eastern North Pacific (Adult/ Juvenile;All);Guadalupe fur Seal (All);Harbor Porpoise (All);Harbor Seal (All);Hawaiian monk Seal, Hawaiian Islands (All);Hubbs' beaked Whale (Adult/ Juvenile;All);Humpback Whale (Adult/ Juvenile;All);Indian Ocean bottlenose Dolphin (Adult/ Juvenile;All);Killer False killer Whale (Adult/ Juvenile;All);Killer False killer Whale, Hawaii Insular (Adult/ Juvenile;All);Killer False killer Whale, Hawaiian Stock (Adult/ Juvenile;All);Killer Pygmy killer Whale (Adult/ Juvenile;All);Killer Whale (Adult/ Juvenile;All);Killer Whale, Eastern North Pacific Southern Resident Stock (Adult/ Juvenile;All);Long-beaked Common Dolphin (Adult/ Juvenile;All);Longman's beaked Whale (Adult/ Juvenile;All);Melon-headed Whale (Adult/ Juvenile;All);Minke Whale (Adult/ Juvenile;All);North Pacific Right Whale (All);Northern elephant Seal (All);Northern fur Seal (All);Northern right whale Dolphin (Adult/ Juvenile;All);Pacific white-sided Dolphin (Adult/ Juvenile;All);Perrin's beaked Whale (Adult/ Juvenile;All);Pygmy beaked Whale (Adult/ Juvenile;All);Risso's Dolphin (Adult/ Juvenile;All);Rough-toothed Dolphin (Adult/ Juvenile;All);Sei Whale (Adult/ Juvenile;All);Short-beaked Common Dolphin (Adult/ Juvenile;All);Short-finned Pilot Whale (Adult/ Juvenile;All);Sperm Dwarf sperm Whale (Adult/ Juvenile;All);Sperm Pygmy sperm Whale (Adult/ Juvenile;All);Sperm Whale (Adult/ Juvenile;All);Spinner Dolphin (Adult/ Juvenile;All);Spotted Pantropical spotted Dolphin (Adult/ Juvenile;All);Stejneger's beaked Whale (Adult/ Juvenile)	Harass; Harass/Sampling	Other; Survey, aerial/ vessel; Survey, vessel
15409	Population and photo-id studies of small cetaceans in the Pacific Islands	Duke University	6/8/2010	6/15/2015	Nearshore waters of HI islands EEZ and American Samoa	Blainville's beaked Whale, Hawaiian Stock (All);Bottlenose Dolphin (All);Bottlenose Dolphin, Hawaiian Islands Stock Complex (All);Cuvier's beaked Whale, Hawaiian Stock (All);Fraser's Dolphin, Hawaii Stock (All);Killer Pygmy killer Whale, Hawaiian Stock (All);Killer Whale, Hawaiian Stock (All);Longman's beaked Whale, Hawaiian Stock (All);Melon-headed Whale, Hawaiian Stock (All);Risso's Dolphin, Hawaiian Stock (All);Rough-toothed Dolphin, Hawaiian Stock (All);Short-finned Pilot Whale, Hawaiian stock (All);Sperm Dwarf sperm Whale, Hawaiian Stock (All);Sperm Pygmy sperm Whale, Hawaiian stock (All);Spinner Dolphin, Hawaiian Islands Stock Complex (All);Spotted Pantropical spotted Dolphin, Hawaiian Stock (All);Striped Dolphin, Hawaiian Stock (All)	Harass	Survey, vessel
15453	Scientific Research Relating to Enhancing the Survival of the Hawaiian monk seal (*Monachus schauinslandi*) under the Marine Mammal Protection Act and the Endangered Species Act.	Waikiki Aquarium	4/30/12	4/30/2017	Waikiki Aquarium, University of Hawaii, 2777 Kalakaua Avenue, Honolulu, HI 96815.	Hawaiian monk seal	Captive animals (research, enhancement)	Captive

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
15685	Ocean capture research of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles in the Hawaiian Islands to determine growth rates, health status, stock and population structure, foraging ecology, habitat use, and movements.	NMFS Pacific Islands Fisheries Science Center (PIFSC)	1/26/2012	1/31/2017	Hawaiian coastal waters (bays, reefs, canals, etc.) / Most of the study sites are accessed by land, the exception being Kaneohe Bay which is accessed by boat. Public beach accesses, private residences, hotel and resort beaches, and State and National Parks are used.	Green sea Turtle (Adult/ Subadult/ Juvenile);Hawksbill sea Turtle (Adult/ Subadult/ Juvenile)	Capture/Handle/Release	Hand and/or Dip Net
16053	Measuring the hearing of stranded cetaceans in U.S. waters, beaches and rehabilitation centers using the evoked auditory potential procedure	Marine Mammal Research Program, Hawaii Institute of Marine Biology	2/22/2012	2/28/2017	Stranded on beaches/waters in U.S., in temporary pools on beaches, or in U.S. rehabilitation facilities while under care by authorized NMFS Stranding Network participants	Unidentified Cetacean (All)	Handle/Release	Captive
16163	Studies of movements, habitat use, ecology, behavior, and risk factors of cetaceans in the Pacific Ocean	NMFS Northwest Fisheries Science Center	6/5/2012	6/6/2017	Pacific Ocean / WA, OR, CA, HI, AK, High Seas North Pacific Ocean	Baird's beaked Whale (Adult/ Juvenile; All); Blainville's beaked Whale (Adult/ Juvenile; All);Blue Whale, Eastern North Pacific Stock (Adult/ Juvenile; All);Bottlenose Dolphin (Adult/ Juvenile; All); Bryde's Whale (All);California Sea lion, US Stock (All);Cuvier's beaked Whale (Adult/ Juvenile; All); Dall's Porpoise (Adult/ Juvenile; All);Fin Whale (Adult/ Juvenile; All); Fraser's Dolphin (All);Gray Whale, Eastern North Pacific (Adult/ Juvenile; All);Guadalupe fur Seal (All);Harbor Porpoise (Adult/ Juvenile; All);Harbor Seal (All);Hawaiian monk Seal, Hawaiian Islands (All); Hubbs' beaked Whale (All);Humpback Whale (Adult/ Juvenile; All);Killer False killer Whale (Adult/ Juvenile; All);Killer False killer Whale, Hawaiian Stock (Adult/ Juvenile; All);Killer Pygmy killer Whale (Adult/ Juvenile; All);Killer Whale (Adult/ Juvenile; All);Killer Whale, Eastern North Pacific Alaska Resident Stock (Adult/ Juvenile; All);Killer Whale, Eastern North Pacific Northern Resident Stock (Adult/ Juvenile; All);Killer Whale, Eastern North Pacific Offshore Stock (Adult/ Juvenile; All);Killer Whale, Eastern North Pacific Southern Resident Stock (Adult/ Juvenile; All);Killer Whale, Hawaiian Stock (Adult/ Juvenile; All);Killer Whale, West Coast Transient Stock (Adult/ Juvenile; All);Long-beaked Common Dolphin, California Stock (Adult/ Juvenile; All);Longman's beaked Whale (Adult/ Juvenile; All);Melon-headed Whale (Adult/ Juvenile; All);Mesoplodon beaked Whale, California/ Oregon/ Washington Stocks (Adult/ Juvenile; All);Minke Whale (Adult/ Juvenile; All);North Pacific Right Whale, Eastern North Pacific Stock (All);Northern elephant Seal (All);Northern fur Seal, Eastern Pacific Stock (All);Northern right whale Dolphin (Adult/ Juvenile; All);Pacific white-sided Dolphin (Adult/ Juvenile; All);Perrin's beaked Whale (All);Pygmy beaked Whale (All);Risso's Dolphin (Adult/ Juvenile; All);Rough-toothed Dolphin (Adult/ Juvenile; All);Sei Whale (All);Short-beaked Common Dolphin, California/Oregon/Washington Stock (Adult/ Juvenile; All	Harass;Harass/Sampling	Survey, aerial; Survey, vessel
16479	Whale surprise encounters and near misses: proxies of vessel strikes in Maui County waters	Pacific Whale Foundation	9/18/2012	6/1/2017	Maui County Waters / The study will take place in the four island region of Maui County, Hawaii Latitude: 20.901025 Longitude: -156.615839	Humpback Whale, Central North Pacific Stock (All);Killer False killer Whale, Hawaiian Stock (All)	Harass	Survey, vessel
16599	Evoked Potential Auditory Tests for Stranded Marine Mammals	National Marine Mammal Foundation	3/30/2012	4/1/2017	Nationwide: All US Waters / Stranding locations including beaches and rehabilitation centers	Unidentified Cetacean (All)	Handle/Release	Other
16992	Paul Nachtigall -- auditory research on captive cetaceans in Hawaii (HIMB)	Marine Mammal Research Program, Hawaii Institute of Marine Biology	5/29/2013	5/31/2018	University of Hawaii Institute of Marine Biology (Kaneohe, HI)	Bottlenose Dolphin (Adult; Juvenile);Killer False killer Whale (Adult)	Captive animals (research, enhancement, public display)	Captive

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
17159	Spinner dolphin filming at Midway Atoll	Parthenon Entertainment Ltd	5/24/2012	5/31/2017	Midway Atoll NWR, part of the Papahānaumokuākea Marine National Monument The anticipated areas will be opportunistic, but are most likely to include the lagoon, the channel between islands and nearshore shallow waters, including Wells Harbor	Spinner Dolphin, Hawaiian Islands Stock Complex (All)	Harass	Survey, vessel
17268	Honolulu Seawater AC	Honolulu Seawater Air Conditioning, LLC	9/25/2012	9/30/2013	Area offshore of Kakaako, island of Oahu, Hawaii	Blainville's beaked Whale, Hawaiian Stock (All);Blue Whale, Western North Pacific Stock (All);Bottlenose Dolphin, Hawaiian Islands Stock Complex (All);Bryde's Whale, Hawaiian Stock (All);Cuvier's beaked Whale, Hawaiian Stock (All);Fraser's Dolphin, Hawaii Stock (All);Hawaiian monk Seal, Hawaiian Islands (All);Humpback Whale, Western North Pacific Stock (All);Killer False killer Whale, Hawaii Insular (All);Killer Pygmy killer Whale, Hawaiian Stock (All);Killer Whale, Hawaiian Stock (All);Longman's beaked Whale, Hawaiian Stock (All);Melon-headed Whale, Hawaiian Stock (All);Minke Whale, Hawaiian stock (All);Risso's Dolphin, Hawaiian Stock (All);Rough-toothed Dolphin, Hawaiian Stock (All);Sei Whale, Hawaiian stock (All);Short-finned Pilot Whale, Hawaiian stock (All);Sperm Dwarf sperm Whale, Hawaiian Stock (All);Sperm Pygmy sperm Whale, Hawaiian stock (All);Sperm Whale, Hawaiian stock (All);Spinner Dolphin, Hawaiian Islands Stock Complex (All);Spotted Pantropical spotted Dolphin, Hawaiian Stock (All);Striped Dolphin, Hawaiian Stock (All)	Incidental take	Survey, vessel
17860	Acoustic Technology Experiments	U.S. Navy	7/8/2013	6/30/2014	Western Pacific	Baird's beaked Whale (All);Blainville's beaked Whale (All);Blue Whale, Western North Pacific Stock (All);Bottlenose Dolphin (All);Bryde's Whale (All);Cuvier's beaked Whale (All);Dall's Porpoise (All);Fin Whale (All);Fraser's Dolphin (All);Ginkgo-toothed beaked Whale (All);Gray Whale, Western North Pacific (Korean) (All);Hawaiian monk Seal, Hawaiian Islands (All);Hubbs' beaked Whale (All);Humpback Whale, Western North Pacific Stock (All);Killer False killer Whale (All);Killer Pygmy killer Whale (All);Killer Whale (All);Kogia (dwarf/pygmy sperm) Unidentified Kogia (dwarf/pygmy sperm) Whale (All);Longman's beaked Whale (All);Melon-headed Whale (All);Mesoplodon beaked Whale, California/ Oregon/ Washington Stocks (All);Minke Whale (All);North Pacific Right Whale (All);Pacific white-sided Dolphin (All);Risso's Dolphin (All);Rough-toothed Dolphin (All);Sei Whale (All);Short-beaked Common Dolphin (All);Short-finned Pilot Whale (All);Sperm Dwarf sperm Whale (All);Sperm Pygmy sperm Whale (All);Sperm Whale (All);Spinner Dolphin (All);Spotted Pantropical spotted Dolphin (All);Stejneger's beaked Whale (All);Striped Dolphin (All)	Harass	Other
18072	2013 Letter of Authorization - SURTASS LFA (USNS ABLE)	U.S. Navy	8/13/2013	8/14/2014	Northwest and North Central Pacific Ocean	Blue whale; Bryde's whale; Fin whale; Humpback whale; Common minke whale; North Pacific right whale; Sei whale; Western north Pacific gray whale; Baird's beaked whale; Blainville's beaked whale; Common bottlenose dolphin; Cuvier's beaked whale; Dall's porpoise; Dwarf sperm whale; False killer whale; Fraser's dolphin; Ginkgo-toothed beaked whale; Hubbs' beaked whale; Killer whale; Kogia spp.; Longman's beaked whale; Melon-headed whale; Mesoplodon spp.; Pacific white-sided dolphin; Pantropical spotted dolphin; Pygmy killer whale; Pygmy sperm whale; Risso's dolphin; Rough-toothed dolphin; Short-beaked common dolphin; Short-finned pilot whale; Sperm whale; Spinner dolphin; Stejneger's beaked whale; Striped dolphin; Hawaiian monk seal.	Harass	Other
18073	2013 Letter of Authorization - SURTASS LFA (USNS IMPECCABLE)	U.S. Navy	8/13/2013	8/14/2014	Northwest and North Central Pacific Ocean	Blue whale; Bryde's whale; Fin whale; Humpback whale; Common minke whale; North Pacific right whale; Sei whale; Western north Pacific gray whale; Baird's beaked whale; Blainville's beaked whale; Common bottlenose dolphin; Cuvier's beaked whale; Dall's porpoise; Dwarf sperm whale; False killer whale; Fraser's dolphin; Ginkgo-toothed beaked whale; Hubbs' beaked whale; Killer whale; Kogia spp.; Longman's beaked whale; Melon-headed whale; Mesoplodon spp.; Pacific white-sided dolphin; Pantropical spotted dolphin; Pygmy killer whale; Pygmy sperm whale; Risso's dolphin; Rough-toothed dolphin; Short-beaked common dolphin; Short-finned pilot whale; Sperm whale; Spinner dolphin; Stejneger's beaked whale; Striped dolphin; Hawaiian monk seal	Harass	Other

Permit/File Number	Project Title	Organization	Date Issued	Date Expires	Location	Species	Take Actions	Capture Methods
18074	2013 Letter of Authorization - SURTASS LFA (USNS VICTORIOUS)	U.S. Navy	8/13/2013	8/14/2014	Northwest and North Central Pacific Ocean	Blue whale; Bryde's whale; Fin whale; Humpback whale; Common minke whale; North Pacific right whale; Sei whale; Western north Pacific gray whale; Baird's beaked whale; Blainville's beaked whale; Common bottlenose dolphin; Cuvier's beaked whale; Dall's porpoise; Dwarf sperm whale; False killer whale; Fraser's dolphin; Ginkgo-toothed beaked whale; Hubbs' beaked whale; Killer whale; Kogia spp.; Longman's beaked whale; Melon-headed whale; Mesoplodon spp.; Pacific white-sided dolphin; Pantropical spotted dolphin; Pygmy killer whale; Pygmy sperm whale; Risso's dolphin; Rough-toothed dolphin; Short-beaked common dolphin; Short-finned pilot whale; Sperm whale; Spinner dolphin; Stejneger's beaked whale; Striped dolphin; Hawaiian monk seal	Harass	Other
18075	2013 Letter of Authorization - SURTASS LFA (USNS EFFECTIVE)	U.S. Navy	8/13/2013	8/14/2014	Northwest and North Central Pacific Ocean	Blue whale; Bryde's whale; Fin whale; Humpback whale; Common minke whale; North Pacific right whale; Sei whale; Western north Pacific gray whale; Baird's beaked whale; Blainville's beaked whale; Common bottlenose dolphin; Cuvier's beaked whale; Dall's porpoise; Dwarf sperm whale; False killer whale; Fraser's dolphin; Ginkgo-toothed beaked whale; Hubbs' beaked whale; Killer whale; Kogia spp.; Longman's beaked whale; Melon-headed whale; Mesoplodon spp.; Pacific white-sided dolphin; Pantropical spotted dolphin; Pygmy killer whale; Pygmy sperm whale; Risso's dolphin; Rough-toothed dolphin; Short-beaked common dolphin; Short-finned pilot whale; Sperm whale; Spinner dolphin; Stejneger's beaked whale; Striped dolphin; Hawaiian monk seal	Harass	Other
N/A	Take of marine mammals incidental to Navy training activities in the Hawaii Range Complex	U.S. Pacific Fleet	1/23/2013	1/5/2014	Hawaii Range Complex	Humpback whale; Minke whale; Sei whale; Fin whale; Bryde's whale; Sperm whale; Pygmy sperm whale; Dwarf sperm whale; Cuvier's beaked whale; Blainville's beaked whale; Longman's beaked whale; Rough-toothed dolphin; Bottlenose dolphin; Pan-tropical dolphin; Spinner dolphin; Striped dolphins; Risso's dolphin; Melon-headed whale; Fraser's dolphin; Pygmy killer whale; False killer whale; Killer whale; Short-finned pilot whale; Hawaiian monk seal	Incidental take	Other

Source:

NMFS Authorizations and Permits for Protected Species Website: https://apps.nmfs.noaa.gov and http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications; data as of August 16, 2013. Additional data obtained from NMFS Office of Protected Resources on August 27, 2013.

3.3.10.1 *Papahānaumokuākea Marine National Monument Permitted Activities*

The Papahānaumokuākea Marine National Monument (Monument) is administered jointly by three Co-Trustees: Department of Commerce (DOC) through NOAA, the Department of the Interior through USFWS, and the State of Hawai'i through DLNR ("Co-Trustees"). In addition, the Co-Trustee agencies work in close collaboration and consultation with the Office of Hawaiian Affairs to ensure that both cultural and natural resources are protected. More information about the Monument can be found in Section 3.4.11.2.

Permit applications are approved in one of six permit categories:

1) **Research –** projects that are designed to further understanding of Monument resources and qualities;
2) **Education –** projects that will further the educational value of the Monument;
3) **Conservation and Management –** projects that will assist in the conservation and management of the Monument;
4) **Native Hawaiian –** practices and activities that will allow Native Hawaiian cultural practices (non-commercial);
5) **Special ocean use –** projects that will allow a special ocean use (ecotourism, documentary filmmaking); or
6) **Recreational –** projects that will allow recreational activities such as snorkeling, wildlife viewing and kayaking.

For details of the permitted activities, please refer to the Papahānaumokuākea Marine National Monument 2011 Permitted Activities Annual Report (NOAA 2013). BMPs for activities permitted within the Monument are presented in Appendix L. Table 3.3-10 lists the number of 2011 active permits by category. Table 3.3-10 provides basic information about each activity - permit type, permittee affiliation and project title/description.

Table 3.3-10 Number of PMNM Permits issued in 2011 by Permit Type

Permit Type	2011 Permits
Research	19
Conservation and Management	6
Education	4
Native Hawaiian Practices	3
Recreation	0
Special Ocean Use	5
TOTAL	37

Adapted from: Permitted Activities 2011 Report (NOAA 2013)

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Table 3.3-11 Papahānaumokuākea Marine National Monument Permitted Activities 2011.

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
Research	Center for Coastal and Ocean Mapping/Joint Hydrographic Center, University of New Hampshire	1	Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge
	Department of Geosciences, Pennsylvania State University	1	Collection of Bryozoan Specimens
	Department of Earth, Ocean, and Atmospheric Sciences, Florida State University	1	Identification of Deep-Sea Coral and Sponge Beds
	University of Hawai`i Departments of Oceanography, Plant and Environmental Protection Sciences, Botany, and Anthropology	4	Algal Baseline Characterization Activities; Collection of Adult and Larval *Hyposmocoma* Moths to Conduct Species Descriptions and DNA Analysis of Their Evolutionary Relationships; Characterization of Large Deep-sea Scavenging Fauna, General Habitat Associations and Their Relationship to Water Depth Within the Monument; Documentation and Assessment of Cultural Sites on Mokumanamana and Nihoa Islands
	Hawai'i Institute of Marine Biology, University of Hawai'i at Mänoa	7	Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs Monitoring Incidence, Growth Rates, and Genetic Relatedness of Coral and Fish Diseases within NWHI Nearshore Reefs Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems Relative Role of Terrestrial Sources of Nutrients for Algae and Bivalve Productivity Quantify the Movements and Feeding Habits of Top Predators Coral Reef Bioerosion Rates as Indicators of Community Response to Ocean Acidification

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
	Department of Anthropology, University of Hawai'i at Mänoa	1	Documentation and Assessment of Native H Mokumanamana (Necker) Island
	Oceanic Institute, Hawai'i Pacific University	2	Plastic Ingestion of Black Footed and Laysan Albatross Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems
	Institute of Marine Sciences, University of California at Santa Cruz	2	Laysan and Black-footed Albatross Monitoring Red-footed, Masked, and Brown Booby Monitoring
	NOAA, National Marine Fisheries Service, Pacific Islands Fisheries Science Center	2	Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island Efforts to Increase Juvenile Monk Seal Survival
	NOAA, National Ocean Service, Office of National Marine Sanctuaries	2	Pacific Reef Assessment and Monitoring Program Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology
Conservation and Management	Monument Co-Trustees	1	Co-Trustee conservation and management activities (See below for details)
	NOAA Office of Marine and Aviation Operations	2	Support for permitted activities aboard NOAA Ship *Hi'ialakai*; Support for permitted activities aboard NOAA Ship *Oscar Elton Sette*
	NOAA National Ocean Service ONMS	1	Maritime Heritage Conservation and Management Activities
	NOAA National Marine Fisheries of Protected 1 Resources	1	Monitoring Shark Activity at Select Hawaiian Monk Seal Pupping Sites of French Frigate Shoals and the Removal of Predatory Sharks from these Areas
	University of Hawai`i, Marine Center	1	Support for Permitted Research Activities Using University of Hawaii Research Vessel Kilo Moana

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
Education	KGMB/KHNL/KFVE - TV Stations	1	Photographs and Video Film for 'Hawai'i News Now' Broadcasting Stations
	Sea Education Association	1	Sea Education Association Marine Conservation Field Studies Expedition
	University of Hawai'i, Hawai'i Institute of Marine Biology	1	Development of Multimedia Resources for Distance Learning Courses and Marine Exchange Programs
	Waikïkï Aquarium	1	Waikïkï Aquarium Live Reef Fish and Coral Collection Activities
Special Ocean Use	DUMA-Naturreisen	1	Guided Eco-tourism Activities on Midway Atoll
	Film und Medien Stiftung NRW and West German Television Cologne	1	Production of a Script for a German Cinema Documentary
	Private Citizen	1	Literary Publication on Resource Restoration Efforts
	Private Citizen	1	Literary Publication on Midway Tour Activities
	Red Sea Ocean Adventures	1	Filming for *Hawaii Skin Diver* Television Program
Native Hawaiian Practices	University of Hawai'i at Hilo	1	Using Traditional Ecological Knowledge to Examine Nearshore Ecosystems
	University of Hawai'i at Hilo - Ola Nä Iwi Hawaiian Language Program	1	Hawaiian Language Immersion Program (Ola Nä Iwi) on Midway Atoll
	University of Hawai'i at Hilo, Kïpuka Native Hawaiian Student Center, Edith Kanaka'ole Foundation, Hawai'i Community College	1	Autumnal Equinox Cultural Research and Native Hawaiian Practices on Mokumanamana (Necker Island)

Source: Adapted from: 2011 Monument Permitted Activities Report (NOAA 2013)

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A single conservation and management permit is issued annually, pending a stringent review process, to the Monument Co-Trustee agencies for conservation and management activities conducted within the Monument. These activities are:

- Management and Operation of Midway Atoll Field Station;
- Benthic Habitat Mapping;
- Management and Operation of French Frigate Shoals, Tern Island Field Station;
- Marine Maritime Surveys at Midway Atoll;
- Maintenance and Operation of Hawaiian Monk Seal Monitoring Field Stations;
- Marine Debris Removal; and
- Management and Operation of Kure Atoll Field Station.

3.4 SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the existing social and economic conditions in the area that may be affected by the proposed action and alternatives. The Project Area, as described in Section 1.3, is the State of Hawai`i, including both the NWHI and the MHI. Where available from reliable sources, information is also presented at the county- or island-level. The key social and economic resources addressed in this section include population trends; area economy (employment, income, and unemployment); commercial fishing; subsistence fishing; recreational fishing; cultural resources and historic properties; recreation and tourism; environmental justice; sanctuaries, monuments and refuges; and military activities within the project area.

3.4.1 Human Population Trends

The human population in the State of Hawai`i has grown by over 22% between 1990 and 2010, with an estimated population of close to 1.4 million (U.S. Census Bureau 1990, 2000, and 2010) (see Table 3.4-1). The City and County of Honolulu has the highest population and population density in the state, with almost 0.95 million people and 1,589 people per square mile.

Table 3.4-1 Human Population and Population Change

Area	Population			Population Change (%)			2010 Population Density (people/mi²)
	1990	2000	2010	1990-2000	2000-2010	1990-2010	
City and County of Honolulu	836,231	876,156	953,207	4.8%	8.8%	14.0%	1,589
Hawai`i County	120,317	148,677	185,079	23.6%	24.5%	53.8%	46
Kaua`i County	51,177	58,463	67,091	14.2%	14.8%	31.1%	108
Maui County *	100,504	128,241	154,924	27.6%	20.8%	54.1%	132
State of Hawai`i	1,108,229	1,211,537	1,360,301	9.3%	12.3%	22.7%	212
U.S.A.	248,709,873	281,421,906	308,745,538	13.2%	9.7%	24.1%	87

Note: * Information for Maui County includes Kalawao County, which has a population of 90 people according to the 2010 Census.
Sources:
U.S. Census Bureau (2010). *2010 Census National Summary File of Redistricting Data, Tables P1 and H1*. Website (http://factfinder2.census.gov/), accessed April 19, 2011.
U.S. Census Bureau (2000). *Census 2000 Summary File 1*. Website (http://factfinder.census.gov/), accessed April 19, 2011.
U.S. Census Bureau (1990). *DP-1, General Population and Housing Characteristics: 1990, 1990 Summary Tape File 1 (STF 1) - 100-Percent Data, United States*. Website (http://factfinder.census.gov/), accessed April 19, 2011.

3.4.2 *Area Economy*

The economy of Hawai`i and its counties is contingent upon employment, income, the unemployment rate, and industry employment characteristics. To understand the economic and social and economic makeup of the Project Area, key economic indicators such as employment and unemployment and income are further explored here.

Data in this section are presented at the county level, the level for which consistent data for economic indicators are available from reliable and published sources. However, it is acknowledged that the economies of some islands within the same county can be quite different from one another. To the extent that such differences are important for evaluating the effects of the proposed alternatives and that sufficient island-level information/data are available, the effects on these islands may be discussed individually in Chapter 4 of this PEIS.

3.4.2.1 *Employment*

Industry-specific employment information provides important insight into the characteristics of a regional economy. Total non-farm employment in Hawai`i consisted of 835,523 jobs in November 2009 (BEA 2011) (see Table 3.4-2). About 78% of non-farm employment in the state is private, while the rest is government. The counties more or less reflect this trend, with major employment in the private sector. The industry with the highest level of employment in Hawai`i is accommodation and food services (11%), followed by state and local

government (military) and retail trade, respectively. The high employment in the accommodation and food services industry reflects Hawai`i's dependence on tourism. Table 3.4-2 presents employment by industry in 2009 for the state and its counties.

Table 3.4-2 Employment by Industry in 2009

	Hawai`i County		City and County of Honolulu		Kaua`i County		Maui & Kalawao Counties		State of Hawai`i	
	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment
Total employment	94,859	100%	604,392	100%	41,023	100%	95,249	100%	835,523	100%
Farm employment	5,936	6%	2,224	0%	1,129	3%	2,587	3%	11,876	1%
Nonfarm employment	88,923	94%	602,168	100%	39,894	97%	92,662	97%	823,647	99%
Private employment	74,854	79%	451,264	75%	34,818	85%	81,750	86%	642,686	77%
Forestry, fishing, and related activities	(D)		1,177	0%	(D)		(D)		3,538	0%
Mining	(D)		731	0%	(D)		(D)		1,181	0%
Utilities	587	1%	2,277	0%	254	1%	495	1%	3,613	0%
Construction	(D)		28,566	5%	(D)		5,505	6%	43,034	5%
Manufacturing	(D)		12,839	2%	(D)		1,574	2%	16,917	2%
Wholesale trade	(D)		16,921	3%	(D)		1,900	2%	21,607	3%
Retail trade	10,892	11%	56,931	9%	4,773	12%	10,772	11%	83,368	10%
Transportation and warehousing	(D)		20,876	3%	(D)		3,053	3%	27,678	3%
Information	861	1%	8,769	1%	376	1%	1,073	1%	11,079	1%
Finance and insurance	(D)		23,915	4%	(D)		2,076	2%	29,389	4%
Real estate and rental and leasing	(D)		24,130	4%	(D)		5,846	6%	38,035	5%
Professional, scientific, and technical services	(D)		35,319	6%	(D)		4,056	4%	45,166	5%
Management of companies and enterprises	(D)		6,379	1%	(D)		405	0%	7,203	1%
Administrative and waste services	5,102	5%	38,646	6%	3,031	7%	6,902	7%	53,681	6%
Educational services	(D)		15,295	3%	(D)		1,458	2%	18,953	2%
Health care and social assistance	8,156	9%	54,786	9%	(D)		(D)		72,381	9%

	Hawai`i County		City and County of Honolulu		Kaua`i County		Maui & Kalawao Counties		State of Hawai`i	
	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment	Employees	% of Total Employment
Arts, entertainment, and recreation	(D)		12,310	2%	(D)		4,419	5%	21,857	3%
Accommodation and food services	(D)		57,443	10%	(D)		18,632	20%	94,869	11%
Other services, except public administration	5,936	6%	33,954	6%	2,870	7%	6,377	7%	49,137	6%
Government and government enterprises	14,069	15%	150,904	25%	5,076	12%	10,912	11%	180,961	22%
Federal, civilian	1,361	1%	30,601	5%	536	1%	881	1%	33,379	4%
Military	1,400	1%	52,528	9%	573	1%	1,162	1%	55,663	7%
State and local	11,308	12%	67,775	11%	3,967	10%	8,869	9%	91,919	11%
State government	8,532	9%	55,495	9%	2,711	7%	6,167	6%	72,905	9%
Local government	2,776	3%	12,280	2%	1,256	3%	2,702	3%	19,014	2%

Note:
(D) - Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
Source:
Regional Economic Information System, Bureau of Economic Analysis (BEA), US DOC. (April 2011). CA25N Footnotes. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N

Between 2001 and 2009, employment in Hawai`i increased by 9% (see Table 3.4-3). The highest gain is in the mining industry at almost 114%, followed by utilities. Jobs in the tourism-related sectors of accommodation and food services and arts, entertainment, and recreation increased by over 4% and over 11%, respectively. Three sectors that experienced job losses during this period include forestry, fishing, and related activities; information; manufacturing; transportation and warehousing; and retail trade.

Table 3.4-3 Industry Employment Growth, 2001 to 2009 (% Change)

	Hawai`i County	City and County of Honolulu	Kaua`i County	Maui & Kalawao Counties	State of Hawai`i
Total employment	16.2%	7.9%	8.9%	9.7%	9.0%
Farm employment	11.9%	-22.0%	-15.1%	-7.6%	-3.4%
Nonfarm employment	16.5%	8.1%	9.8%	10.2%	9.2%
Private employment	17.2%	8.3%	10.6%	9.6%	9.6%
Forestry, fishing, and related activities		-35.2%			-11.6%
Mining		116.9%			114.3%
Utilities		34.4%		25.3%	33.3%
Construction		31.5%		13.9%	27.5%
Manufacturing		-13.1%		-27.1%	-14.0%
Wholesale trade		3.6%		17.6%	5.5%
Retail trade	8.0%	-3.6%	-2.5%	0.7%	-1.6%
Transportation and warehousing		-7.8%		3.8%	-4.4%
Information	5.3%	-22.5%	-18.4%	-8.5%	-19.5%
Finance and insurance		17.1%		44.2%	21.8%
Real estate and rental and leasing		19.9%		16.8%	21.1%
Professional, scientific, and technical services		16.2%		20.2%	17.0%
Management of companies and enterprises		16.7%		1.0%	15.7%
Administrative and waste services	23.4%	10.8%	16.5%	33.3%	14.7%
Educational services		21.2%		56.9%	27.9%
Health care and social assistance	21.8%	20.0%			20.4%
Arts, entertainment, and recreation		1.2%		13.2%	10.5%
Accommodation and food services		7.5%		-2.9%	3.6%
Other services, except public administration	23.1%	7.3%	22.6%	13.8%	10.6%
Government and government enterprises	13.0%	7.2%	4.9%	15.7%	8.1%
Federal, civilian	40.3%	11.6%	43.3%	66.2%	14.0%
Military	-3.2%	4.4%	-11.7%	-6.4%	3.7%
State and local	12.7%	7.6%	3.9%	15.8%	8.8%
State government	10.3%	8.6%	-0.2%	11.5%	8.7%
Local government	20.6%	3.1%	14.1%	27.0%	9.1%

Source: Regional Economic Information System, Bureau of Economic Analysis (BEA), US DOC. (April 2011). CA25N Footnotes. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N

3.4.2.2 *Income*

Hawai`i's per capita personal income ($42,152) is slightly higher than that of the nation as a whole, with the annualized growth rate of 5.4% between 2001 and 2009 (DBEDT 2009a) (see Table 3.4-4). Among the counties, the City and County of Honolulu has the highest per capita personal income in 2009 of $45,496, while Hawai`i County has the lowest at $32,023. A high per capita income in a

community indicates the presence of high paying employment opportunities. See Table 3.4-4 for a summary of personal income the U.S., and the State of Hawai`i and its counties.

Table 3.4-4 Personal Income in 2001-2009

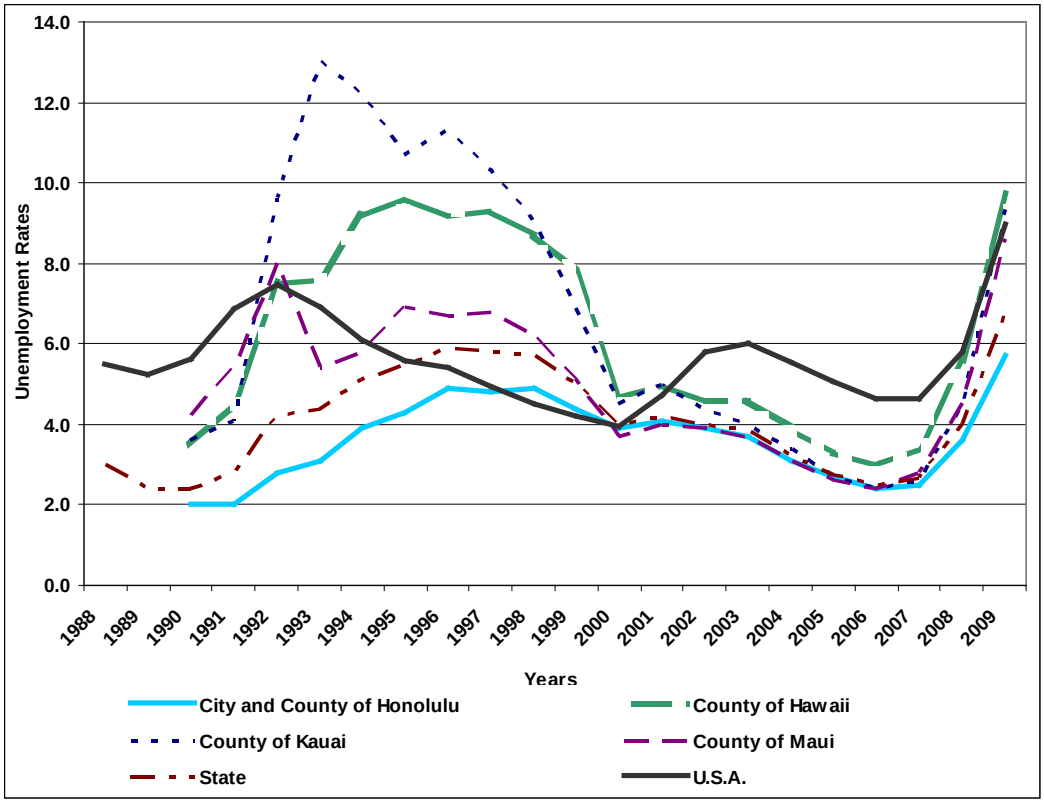
Area	Per Capita Personal Income ($)		
	2001	2009	Annualized Rate of Change (%)
City and County of Honolulu	31,304	45,496	5.7%
Hawai`i County	23,056	32,023	4.9%
Kaua`i County	25,393	35,560	5.0%
Maui County	26,669	36,585	4.6%
State of Hawai`i	29,497	42,152	5.4%
U.S.A.	31,145	39,635	3.4%

Source: DBEDT (2010). *County Social, Business and Economic Trends in* Hawai`i*: 1990 – 2010.*

3.4.2.3 Unemployment

The unemployment rate is a key economic indicator providing important insight into the economic health of a region. High unemployment is a sign of an unhealthy economy, which can lead to reduced spending, a decreased tax base, and more unemployment. In the recent recession, Hawai`i and its counties have faced high unemployment. Among the counties, in 2009 the highest unemployment rate was in the County of Hawai`i at 9.8%, followed by county of Kaua`i at 8.7% and County of Maui at 8.3% (see Figure 3.4-1). Despite these high rates, the national unemployment rate (9.6%) was higher than the State of Hawai`i. By the end of 2012, according to the Bureau of Labor Statistics, the unemployment rate in Hawaii was 5.1%.

Figure 3.4-1 Historic Unemployment Rates in the Counties in Hawai'i, the State of Hawai'i, and the United States



3.4.3 *Commercial Fishing*

Commercial fisheries in Hawai`i are extensive, and include fish caught for sale, as well as charter fishing services. An annually renewable commercial marine license (CML) is required for commercial fishing in the state. Based on CML data, there were 4,263 licensed commercial fishers in 2008 (Hawai`i Division of Aquatic Resources (DAR) and WPacFin 2010).

In 2010, about 28 million pounds of fish were caught for commercial purposes in the state, worth over $83.5 million (WPacFIN 2009) (see Table 3.4-5). The average value of commercial landings between 1990 and 2010 exceeds $64 million (WPacFIN 2009). The overall price per pound (based on amount paid to commercial fishers by dealers) for all commercial fish in 2010 was approximately $2.99. Key fishery categories include pelagic, coral reef, bottomfish, precious corals, and crustaceans.

Table 3.4-5 Quantity, Value, and Price per Pound of Commercial Landings in Hawai'i, 1990- to 2010

Year	Quantity (Millions of Pounds)	Value (Millions of Dollars)	Price per Pound (Dollars)
1990	17.9	$48.1	$2.68
1991	26.7	$64.4	$2.41
1992	26.8	$68.0	$2.53
1993	29.4	$73.4	$2.50
1994	23.2	$62.7	$2.70
1995	26.0	$59.2	$2.28
1996	24.1	$57.7	$2.39
1997	27.5	$61.6	$2.24
1998	28.5	$61.0	$2.14
1999	29.0	$62.9	$2.17
2000	28.6	$68.3	$2.38
2001	23.5	$48.1	$2.05
2002	24.0	$52.4	$2.19
2003	23.7	$52.8	$2.22
2004	24.5	$57.7	$2.36
2005	28.1	$71.0	$2.52
2006	25.7	$66.1	$2.58
2007	29.0	$75.8	$2.62
2008	30.7	$85.1	$2.77
2009	26.9	$71.2	$2.65
2010	27.9	$83.5	$2.99

Source: WPacFIN. (2011). 1982-2009 *Commercial Landings* (various data tables and charts). Retrieved from http://www.pifsc.noaa.gov/wpacfin/central/Pages/central_data.php

3.4.3.1 *Pelagic Fisheries*

Among the various categories of fisheries, the pelagic fishing industry is the largest and most valuable one, accounting for approximately 95% of commercial landings with 26.6 million pounds of pelagic fish caught commercially in 2010 (see Table 3.4-6). Pelagic fisheries primarily use longline gear, but also include the MHI troll and handline, offshore handline, and the aku boat (pole and line) fisheries (NMFS 2005). Tunas (especially bigeye tuna) and billfish (particularly blue marlin, striped marlin, swordfish) are the main target species for pelagic fishing, but other species, such as mahimahi, ono (wahoo), and moonfish are also important (NMFS 2005).

3.4.3.2 *Coral Reef Fisheries*

Coral reef fish made up about 1% of commercial landings in 2010 (see Table 3.4-6). With presently no active commercial coral reef fisheries in the NWHI, the commercial catch primarily comes from nearshore reef areas around the MHI (NMFS 2005). However, there has been a notable decline in nearshore coral reef fishery resources in recent decades because of overfishing (NMFS 2005). Coral reef fish species popular for commercial purposes include akule (which dominates nearshore commercial landings), soldierfishes, surgeonfishes, goatfishes, squirrelfishes, unicornfishes, and parrotfishes (WPRFMC 2010b). Numerous fishing gears are used to target these species, including nets, traps, hook and line, spear, hand, and other methods.

3.4.3.3 *Bottomfish Fisheries*

Catches of bottomfish accounted for about 1% of commercial landings in 2010 (see Table 3.4-6). Target species include snappers, jacks, and a single species of grouper that is concentrated at depths of 30 to 150 fathoms (fm) (NMFS 2005). The most desirable species are seven deepwater species known as the Deep 7 (opkapaka, onaga, hapuupuu, ehu, kalekale, gindai, and lehi), which made up 54% of the commercial bottomfish catch in 2008 (WPRFMC 2010a).

After the establishment of the NWHI Marine National Monument in 2006 (later renamed Papahānaumokuākea Marine National Monument [Monument]), bottomfishing was scheduled to end in the Monument in 2011 (WPRFMC 2010b). However, this fishery was closed in 2009 when permit holders surrendered their permits and received compensation from the federal government. Bottomfishing continues to take place in the MHI, where roughly about 50% of bottomfish habitat is located in state waters (WPRFMC 2010b). While bottomfishing around the MHI is conducted both commercially and by recreational fishermen, fishing in the NWHI was solely for commercial purposes (NMFS 2005). Methods and gear used in these fisheries are highly selective for desired species and sizes. In 2008, the Deep 7 fishery in the MHI was managed through the implementation of a federally-mandated total allowable catch (TAC) limit of 241,000 lbs, as a means to end overfishing of these species (DAR and WPacFin 2010).

3.4.3.4 *Precious Coral Fisheries*

The discovery of two species of commercially valuable black coral in 1958, including Au‘au, led to the establishment of a small black coral cottage industry for manufacturing black coral jewelry. Recently, this industry is threatened by changes in harvesting pressure and the introduction of an alien pest species (WPRFMC 2010b). Over the past 30 years, almost all of the black coral has been harvested from state waters and from a bed located in the Au‘au Channel (WPRFMC 2010b). The domestic fishery for pink, gold, and bamboo precious coral resumed in 1999 (NMFS 2005). Harvest of precious corals is only allowed by selective gear with submersibles or by hand (NMFS 2005).

3.4.3.5 *Crustaceans Fisheries*

The main target species under this category are a species of spiny lobster and the common slipper lobster and kona crab; other lobster in the family Scyllaridae are also desirable (WPRFMC 2010b). In the MHI, commercial catch of spiny lobsters dropped by 75 to 85% by the early 1950s (NMFS 2005). The NWHI had the largest crustacean fishery in Hawai`i, until it was closed by NMFS in 2000 due to uncertainties regarding accurate lobster stock assessments. This fishery remains closed due to the establishment of the Monument (NMFS 2005).

Table 3.4-6 Hawai'i Annual Reported Commercial Landings (Millions of Pounds) for Pelagic, Bottom, Reef, and Other Fisheries Categories, 2000 to 2010

Year	Pelagic Fishes	Bottom Fishes	Reef Fishes	Other Fishes
2000	26.74	0.72	0.2	0.95
2001	22	0.65	0.24	0.59
2002	22.34	0.62	0.35	0.67
2003	22.06	0.62	0.33	0.73
2004	23.03	0.62	0.24	0.56
2005	26.91	0.53	0.22	0.48
2006	24.51	0.44	0.2	0.51
2007	27.73	0.44	0.23	0.54
2008	29.57	0.43	0.27	0.41
2009	25.71	0.45	0.27	0.50
2010	26.62	0.39	0.36	0.57

Source: NMFS, PIFSC. (2010). *Annual Reported Commercial Landings of Pelagic Fishes, Bottomfishes, Reef Fishes, Other Fishes*. Retrieved from http://www.pifsc.noaa.gov/wpacfin/hi/Data/Landings_Charts/hr3a.htm

3.4.4 *Subsistence Fishing*

Hawai`i Revised Statutes (HRS) Section 188-22.6 defines subsistence fishing as the customary and traditional Native-Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing. Native Hawaiian in the HRS is defined as any descendant of the races inhabiting the Hawaiian Islands prior to 1778.

Annual fish consumption in Hawai`i is about 90 lbs per capita, over twice the national average (U.S. Department of the Navy 2008a). There is no license required for subsistence and recreational fishing in Hawai`i. Without a requirement for subsistence licenses, it is difficult to assess the overall level of subsistence fishing activity due to a lack of detailed catch data. No formal attempt to assess the subsistence fishing contribution to island economies has been made in the past, but the value of fishing for subsistence by contemporary

Native Hawaiians is known to be an important component of some communities, particularly rural communities (U.S. Department of the Navy 2008a).

3.4.5 *Recreational Fishing*

Fishing is a popular pastime for people in Hawai`i, with a quarter of the population participating in some form of fishing at least once a year (U.S. Department of the Navy 2008a). In addition, fishing is also popular with tourists visiting Hawai`i. However, as with subsistence fishing, data on recreational fishing in Hawai`i are very limited because no license was required for non-commercial saltwater fishing. While occasional surveys have been fielded over the years, there has been no systematic collection of such data.

The Marine Recreational Fisheries Statistical Survey collected data in Hawai`i for a period ending about 20 years ago. The program was recently restarted in Hawai`i as the Hawai`i Marine Recreational Fishing Survey (HMRFS). HMRFS is collecting data through a dual approach including random telephone surveys, as well as fisherman intercept surveys conducted at boat launch ramps, small boat harbors, and shoreline fishing sites. Given the HMRFS is a relatively recent undertaking, some scattered information is made available through the newsletters released by NMFS, but not enough intercepts of fishermen have occurred to date to allow catch and effort determinations for Hawai`i fisheries.

Based on the 2010 HMRFS data, it is estimated that 475,000 recreational fishermen took 2.4 million recreational fishing trips, of which approximately 1.9 million were shorefishing trips. The recreational fishery landed 2.1 million fish in 2010 weighing a total of 14.6 million pounds (NOAA 2012).[1]

A new initiative by NMFS, the Marine Recreational Information Program, is anticipated to collect better data and produce improved estimates of marine recreational catch and effort. The Marine Recreational Information Program is anticipated to replace the HMRFS (NOAA 2011). An important component of Marine Recreational Information Program is the National Saltwater Angler Registry. All Hawaii recreational fishermen (including indigenous fishermen) who fish more than 3 miles from shore (Federal waters) are required to register. The registration is valid for one year from the date of registration, and must be renewed.

Absent systematic data, it is believed that offshore recreational and subsistence catch is likely equal to or greater than the offshore commercial fisheries catch,

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1 NMFS, Fishery Statistics Division, April 13, 2012, Website (http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html).

with more species taken using a wider range of fishing gear (Friedlander *et al.* 2004).

The issue is further complicated by the overlapping behaviors of subsistence, commercial, and recreational fishermen. A recent study that surveyed the small boat pelagic fishermen reveals that within that specific fishery, while 42% of the survey respondents classified themselves as commercial fishermen, 60% actually sold fish in the 12 months preceding the study (PIFSC 2011). Also, over 30% of fishermen classifying themselves as recreational sold fish in the past one year. Most fishermen within this fishery participate in fish sharing networks, with 97% of those surveyed indicating that they give away a portion of the catch to friends or relatives (not immediate family). About 62% consider the fish they catch to be an important source of food for their family (PIFSC 2011).

3.4.6 *Cultural Environment*

The National Environmental Policy Act (NEPA; 42 U.S.C. §§ 4321 et seq., § 4331(a)(4)) requires this PEIS to take into consideration the possible effects of proposed Hawaiian monk seal recovery actions on cultural resources as part of the analysis of impacts to human environment. The cultural resources include not only places of historic and cultural significance but also traditional ways of life as manifested in cultural and customary practices.

Native Hawaiians have a rich traditional history of cultural and customary practices. Traditional Hawaiian customary practices are based on the relationship between Native Hawaiians and the land or *ʻāina*. Native Hawaiians see themselves as both children and stewards of their native lands. Traditional Hawaiian stewardship involves a resource management strategy based on the *ahupuaʻa* system, a system of land division that allows for equitable and sustainable use of natural resources. Most *ahupuaʻa* extend from the highest mountain ridge (*i.e.*, the top of the watershed) through the upland forests and the cultivated lowlands out to the submerged reef. While not part of local *ahupuaʻa*, the open ocean was nonetheless essential to cultural and customary practices, as deep-sea fishing was regularly practiced by Native Hawaiians.

To better understand the impacts that proposed Hawaiian monk seal recovery actions may have on Native Hawaiian cultural resources and practices, a Cultural Impact Assessment (CIA) was prepared. The CIA has been included as Appendix K of the present PEIS.

3.4.7 *Cultural Resources and Historic Properties*

3.4.7.1 *Hawaiian Monk Seals in Traditional Hawaiian Culture*

As part of the CIA, in-depth research was undertaken into the role that Hawaiian monk seals may have played in traditional Hawaiian society. This research included a thorough examination of the evidence for seal remains from

archaeological excavations, of the various Hawaiian language terms for seal, and of references to seals in traditional *oli* (chants), *moʻolelo* (stories, historical narratives, and mythologies), the accounts of early Western visitors, articles in Hawaiian language newspapers, and other historic documents.

The research revealed that, although monk seals appear to have been present within the Hawaiian archipelago as early as 3.5 million years ago, there is surprisingly little direct evidence of human and monk seal interactions, either in the archaeological record or the traditional literature. Seal bones have only been recovered from a small number of archaeological excavations, suggesting that for much of the period before Western contact, seal meat was not a major part of the Hawaiian diet. Seal bones may have been used in the manufacture of fishhooks and other bone tools, but this does not seem to have been a common practice.

Unlike the mammals that arrived in Hawaiʻi with the early Polynesian voyages, the dog (*ʻīlio*), pig (*puaʻa*), and rat (*iole*), all of which were identified by a single Hawaiian name, seals were found to be referred to in *ʻōlelo* Hawaiʻi (the Hawaiian language) by several different terms. Among these were *he ʻīlio o ke kai* (the dog of the sea, also *ʻīlio o ke kai*), *ʻīlio-holo-kai* (the dog that runs in the sea), *ʻīlio-holo-i-kauaua* (dog running in the toughness), *uwaʻlo* (to cry out), *hulu* (fur; possibly a historic usage to refer to arctic fur seals), and *kila* or *sila* (an adaptation of the English word seal). With their furred bodies and bark-like calls, it is easy to see how seals were identified as the dogs of the sea. The range of different names used to refer to these animals, however, some of which were derived from the English term seal, might suggest that seals were not frequently encountered by the Hawaiians of the late pre-Contact period.

References to seals in the traditional literature are relatively rare. Not until the historic period, when Hawaiian sailors began to take part in voyages to the arctic to capture fur seals for the China trade and local vessels began actively hunting the newly-discovered monk seal populations in the Northwestern Hawaiian Islands (NWHI), do accounts of seals begin to appear with any regularity in Hawaiian language sources. Although the early accounts of Western visitors to the islands are replete with detailed descriptions of the various plants and animals they encountered, there appear to be no references to the presence of Hawaiian monk seals within the main Hawaiian Islands (MHI). Descriptions of monk seals begin to appear when Western ships began visiting the NWHI. All of these archival sources appear to suggest that during the late pre-Contact and early historic periods in which monk seals were not common visitors to the MHI.

Although it has been suggested that the original range of the Hawaiian monk seal did not extend from the NWHI into the MHI, this does not seem reasonable given the similarity in the marine and coastal environments of the two areas. Both would have offered an equivalent range of suitable habitats for pupping and resting, an abundance of available food resources, and a relative scarcity of predators, at least until the advent of humans.

A more likely scenario is that, prior to the arrival of the first Polynesian voyagers, a population of monk seals existed within the MHI. Soon after human settlement, however, this indigenous seal population suffered much the same fate as many species of indigenous Hawaiian land birds, which appear to have been driven into extinction through a combination of human predation and the impacts of the rats, pigs, and dogs that accompanied the voyagers from central Polynesia. Monk seals hauled out on the beaches of the islands would have presented an easily obtainable food source for the first settlers. It is also well documented that monk seals do not adapt well to disturbance from dogs or humans. The monk seal population that occupied the MHI could have died out or have been forced out within a few generations.

While stray individual seals undoubtedly occasionally found their way down from the NWHI, it seems unlikely that monk seals were numerous enough within the MHI for there to have been regular and significant interactions with humans until the historic period. This lack of regular contact might explain why the Hawaiian monk seal seldom appears in the *oli* (chants), *mele* (songs), and *moʻolelo* (stories, legends and traditional history) of pre-Contact Hawaiʻi and why the seal seems strangely absent from the Hawaiian traditional world view.

This apparent absence of monk seal populations from the MHI dating back to the early period of human occupation may account for the feeling expressed by some present day Native Hawaiians that monk seals are not indigenous to the Islands and were never a significant part of traditional Hawaiian culture. Community meetings and individual interviews conducted by NOAA, both as part of the present CIA and previous public outreach programs, indicate that individuals within the Native Hawaiian community hold a range of perspectives and opinions concerning the Hawaiian monk seal.

As part of a research project commissioned by NMFS PIRO in 2010, ethnographic interviews were conducted with individuals from across the state (Kittinger *et al.* 2011). More than 30 Native Hawaiian community members, cultural practitioners, and *kūpuna* (elders) were interviewed or consulted. The results of the study showed that the individuals interviewed possessed varied perspectives on the cultural significance of the Hawaiian monk seal. Some Native Hawaiians interviewed did not believe the monk seal to be a native species, whereas other interviewees identified the monk seal as being associated with the Hawaiian god Lono or as being *ʻaumākua* (ancestral guardians). A somewhat similar range of opinions was expressed during public meetings held on Oʻahu, Maui, Lānaʻi, Molokaʻi, Kauaʻi, and Hawaiʻi Island as part of the present Cultural Impact Assessment process. The issues raised during these meetings are discussed in detail in Appendix K.

3.4.7.2 *Cultural Resources and Cultural Practices*

A wide range of cultural resources other than historic properties are known to be present within the area in which the proposed Hawaiian monk seal recovery

actions would be conducted, both along the shoreline and in the inshore waters. Present within the shore zone are dune and strand dwelling plants (such as *kauna‘oa*, *pa‘u o Hi‘iaka*, and *hinahina*) that are used in *lā‘au lapa‘au* (traditional Hawaiian medicine). Within the inshore zone are a range of fish, shellfish and other marine organisms that form an important component of the traditional Hawaiian diet.

Traditional cultural practices that regularly take place within the area include fishing and gathering. Other ocean related activities such as swimming and surfing can also be considered as traditional practices.

3.4.7.3 *Historic Properties*

This section provides a summary of historic properties, as defined in the National Historic Preservation Act of 1966, which are located within the project area. Appendix B of this PEIS presents a more detailed discussion of these properties.

The National Historic Preservation Act of 1966 (Section 101) authorized the Secretary of Interior to maintain and expand a National Register of Historic Places (National Register) that contains a listing of districts, sites, buildings, structures and objects significant in American history, architecture, archaeology, engineering and culture. The National Register is defined as an authoritative guide to be used by Federal, State, and local governments, private groups, and citizens to identify the nation’s cultural resources and to indicate what properties should be considered for protection from destruction or impairment.

The term "historic property" is defined in the National Historic Preservation Act (Section 301 Title III, 16 U.S.C. 470w – Definitions (5)) as: “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register.” Historic properties eligible for inclusion in the National Register include both properties formally listed on the National Register and all other historic and cultural sites that meet the National Register criteria (36 C.F.R. § 800.16(1)). These include properties of traditional religious and cultural importance.

A property may be listed on the National Register if it meets the criteria for evaluation as defined in Title 36 C.F.R. § 60.4:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> (a) That are associated with events that have made a significant contribution to the broad patterns of history; or
>
> (b) That are associated with the lives of persons significant in the past; or

(c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) That have yielded, or may be likely to yield, information important in prehistory or history.

The Secretary of Interior has also recognized the significance of Traditional Cultural Properties (TCP). The National Register Bulletin 38 "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (Parker and King 1990) defines "[a] traditional cultural property … as one that is eligible for inclusion on the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1990:1).

A TCP can be considered a historic property even if it does not possess any recognizable archaeological remains. The lack of any physical evidence of an area's past use and significance would in no way reduce its importance as a TCP. "Although many traditional cultural properties have visual physical indications, others do not. Importantly, the historical significance of most traditional cultural properties can only be evaluated in terms of the oral histories of the community" (Sebastian 1993:22). The Advisory Council on Historic Preservation (ACHP) 1985 guidelines also note that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value..." (ACHP 1985:7).

A historic property need not be formally listed on the National Register to receive NHPA protection. The property need only meet the National Register criteria (*i.e.*, be eligible for listing in the National Register).

A wide range of historic properties are known to be present within the Area of Potential Effect (APE) of the proposed monk seal recovery actions. NMFS has determined that the APE for this project encompasses the range where Hawaiian monk seals are found throughout the Hawaiian Archipelago, including the NWHI, MHI and Johnston Atoll. The APE includes the shore zone, encompassing those terrestrial areas up to twenty-five meters inland from the line where the shore meets the sea, and the inshore waters up to 300 meters off from the shoreline, as well as camp sites further inland on the NWHI, as described in Section 3.4.6. of this PEIS. Historic properties that may be present in these areas include both traditional Hawaiian and post-Contact sites.

Given the vast geographic extent of the APE for the proposed monk seal recovery actions, as well as the programmatic nature of the actions themselves, it is not practical to list all of the historic properties that have the potential to be affected by the undertaking. This list would easily extend into the thousands. There also remain many coastal areas within the MHI where the archaeological

sites have not yet been identified or adequately documented. In order to propose measures that may serve to mitigate these effects, however, it is necessary to examine the types of sites that may be affected.

Historic Properties in the Northwestern Hawaiian Islands

The total number of historic properties present within the NWHI is much fewer than in the MHI. This is due primarily to the relative lack of habitable land area on many of the islands, reefs, and atolls that make up the NWHI. Although recent studies suggest that several of the Leeward Islands were known to early Hawaiian voyagers (Kikiloi 2010), the only islands which contain evidence of traditional Hawaiian occupation are Nihoa and Mokumanamana (Necker), the closest islands to the main Hawaiian chain. The Nihoa Island Archaeological District (Site # 92-01-89) and the Necker Island Archaeological District (Site # 91-01-53) were both placed on the National Register in 1988. The two islands together contain over 140 documented archaeological sites. On Nihoa, these historic properties are located on the gentler upland slopes above the coastal cliffs, while monk seal activity is restricted to the basalt ledges washed by the tide. On Mokumanamana, the island's archaeological sites are all located along the upper slopes of its central ridge well away from the shoreline and outside the APE of the monk seal recovery project. Given the topography of these islands there is little likelihood that monk seal recovery actions will geographically overlap the areas occupied by their historic properties and therefore will not impact them.

No direct archaeological evidence of Polynesian presence has been found on the remaining islands of the NWHI or on Johnston Island. However, historic era shipwrecks are present in the offshore waters of several islands. Archival research indicates that there may be as many as sixty shipwreck sites, the earliest dating back to 1818 (Papahānaumokuākea Marine National Monument 2011:20-21), and at least sixty-one aircraft sites in the waters of the Papahānaumokuākea Marine National Monument. To date, seventeen shipwreck sites have been discovered and documented by NOAA archaeologists. These vessels range from nineteenth century whaling ships and cargo vessels to Liberty ships (Papahānaumokuākea Marine National Monument 2011:34-43). At least sixty-seven naval aircraft are recorded as being lost in the vicinity of the NWHI. During the Second World War an intense air battle was waged directly over and around Midway atoll. Numerous Japanese and American planes were lost and their wrecks are considered war graves (Papahānaumokuākea Marine National Monument 2011:22). Shipwrecks and underwater plane crash sites located within 300 meters of the shoreline have the potential to be affected by the anchoring of vessels associated with monk seal recovery actions.

During the historic period, Midway Atoll was the most heavily utilized of the NWHI, and the relics of that use remain today in a variety of forms. By 1903 a cable station was in operation on the island, and in the 1930s, Midway became a

stopover for the famous Pan American Airways flying clipper seaplanes on their five-day transpacific passage. The construction of a naval air facility at Midway began in 1940. The island played a major role in one of the most important battles of the war. The Battle of Midway, which took place from 4 to 7 June 1942 is considered the turning point of the war in the Pacific. Because of its association with the battle, Midway Atoll has been designated a National Memorial (Papahānaumokuākea Marine National Monument 2011:21-22). Historic properties present on the island include several ammunition magazines, a concrete pillbox, and gun and battery emplacements. For the most part, these historic properties are located outside the APE of the monk seal recovery program. Although Johnston Island was at one time the site of a U.S. Navy air station, today only the airfield remains.

Historic Properties in the Main Hawaiian Islands

Although relatively few of the archaeological and cultural resources located within the NWHI have the potential to be affected by undertakings associated with the Hawaiian monk seal recovery actions proposed in this PEIS, this is not the case in the MHI. The shoreline and immediate offshore areas within the MHI contain large numbers of both pre-Contact and historic archaeological sites. The individual sites are far too numerous to be listed here and, as noted above, many have not yet been identified or formally documented. The Hawai‘i State Historic Preservation Division (SHPD) is presently updating its Geographic Information System (GIS) database of historic properties, which have been assigned State Inventory of Historic Places (SIHP) site numbers. The database will show the exact location of all SIHP sites for which accurate location coordinates are available. Once the database is fully operational, it will be possible to quickly identify those documented sites that fall within the APE of the presently proposed actions. The SHPD GIS database can serve as a useful tool in planning monk seal recovery actions so as to avoid adversely impacting known historic properties.

Several types of archaeological and cultural resources dating to the traditional period are likely to be encountered within the APE for monk seal recovery actions. These can be grouped into onshore sites, sites located within the intertidal zone, and offshore sites.

Due to the fact that many onshore features occur within or atop sand dunes, coastal sites are often relatively fragile. The types of historic properties found up to twenty-five meters inland from the line where the shore meets the sea would include the following:

> Coastal house sites and other habitation structures: These might consist of stone faced platforms or terraces that served as the foundations of pole and thatch dwellings or walled house enclosures. They can be built on or immediately behind sand dunes, on coastal flats, or atop shoreline

promontories. The walls and facings of these structures, being of stacked stone, are relatively fragile and can be easily tumbled if climbed upon.

Buried cultural deposits: These subsurface deposits of cultural features (stone lined fire hearths, post holes, pits, etc.) and materials (artifacts, food remains, etc.) usually represent the remnants of former habitation areas. They are often present in sand flats and dunes situated just back of the high tide line and are visible as dark, charcoal stained layers exposed in the face of wave cuts. These deposits are highly susceptible to erosion by wave action or pedestrian traffic.

Canoe landings and canoe sheds: While canoe landings are often natural features such as small sand beaches or areas of gently sloping shingle where a canoe could easily be brought ashore, canoe sheds were long and narrow, stone walled enclosures that were originally roofed with thatch. Like other stacked stone structures, canoe sheds are susceptible to collapse.

Fishing shrines and other religious sites: Small fishing shrines (*ko'a*) were often build near the shoreline, usually on low promontories overlooking the sea. It was at these *ko'a* that the first fish of the catch was left as an offering to Kū'ulakai or one of the other patron gods of fishing. Larger religious structures (*heiau*) were usually set further back from the shore, but at times they can be found just above the high tide line. Both of these types of ceremonial sites, being stacked stone structures (platforms, terraces or enclosures), are susceptible to human impacts.

Human burials: It is relatively easy to excavate a shallow pit into soft sand. For this reason, sand dunes and sandy shorelines were among the preferred burial areas (*ilina*) utilized during both the pre-Contact and early historic periods. Dune burial was particularly frequent in the early years of the post-Contact era when epidemics of introduced diseases decimated the Hawaiian population, leaving little time for more elaborate burial measures. Some coastal burial areas consist of formal cemeteries with individual graves marked by stone mounds or headstones. Other *ilina* are unmarked and may not be immediately recognizable on the surface. It is always safest to assume that a sizeable sand dune is likely to contain burials. Dune burials, like the dunes themselves, are extremely fragile and can be easily disturbed and damaged if exposed by wave action or human activity.

Very little archaeological evidence of past human activities has survived in the turbid environment of the surf zone. Some traditional features, however, have been documented within more gentle intertidal areas. Most of the historic properties present within the inter-tidal zone are relatively impervious to minor disturbances such as those that might result from monk seal recovery actions. These inter-tidal sites may include:

Fishing related features: Along the shoreline where low promontories and fingers of lava extend out into the sea, it is not unusual to encounter

depressions of various sizes and shapes that have been battered or ground into the surface of *pāhoehoe*. These depressions were created and used for a range of purposes. They include bait cups, mortar like depressions used in grinding *palu* (bait), and fish poison basins, shallow depressions where plants like *ʻauhuhu* and *ʻakia* were pounded to extract their juices, which were then used to stun fish in tidal pools. These features were created by the Hawaiians who fished the tidal pools and the shallow offshore waters.

Salt pans: Some of the shallow depressions pecked and ground into the *pāhoehoe* lava at or just above the high tide line were used for the manufacture of salt. These basins were filled with sea water, which was then allowed to evaporate and the resulting salt crystals were collected and used to season food and for ceremonial purposes.

Rock Art: Some traditional Hawaiian petroglyphs are known to have been carved into the surface of level lava or sandstone benches which extend out into the intertidal zone. The primary example of an occasionally submerged petroglyph field is in the *ahupuaʻa* of Kahaluʻu on the island of Hawaiʻi.

While there are a substantial number of pre-Contact archaeological and cultural sites located within the shoreline zone of the monk seal APE, there are relatively few located in the offshore waters up to 300 meter of the shore. The sites that do exist are for the most part stacked stone structures that could potentially be disturbed by activities such as the capture and translocation of a monk seal.

Fishponds and fish traps: Stone walled fishponds (and, to a lesser extent, fish traps) were traditionally constructed in the shallow off-shore waters that fringe the leeward coasts (and sheltered portions of the windward coasts) of several of the MHI. The largest concentrations of traditional *loko iʻa* (fishponds) are located along the southern coastlines of Oʻahu and Molokaʻi, and the west coast of Hawaiʻi island, though *loko iʻa* can be found on almost all of the main islands. The State of Hawaiʻi Office of Planning maintains a Geographic Information System (GIS) database that shows the locations of several fishponds presently listed on the NRHP (Figures 3.4-10 through 3.4-13). Traditional fishponds are most commonly of two types, either *loko kuapā* (walled shoreline ponds) or *puʻuone* (inland ponds connected to the sea). While many ancient ponds are long abandoned (the walls of some having been damaged or destroyed, others silted in), some ponds have been restored and are actively used for aquaculture.

Ceremonial sites: There is archaeological evidence that some traditional ceremonial structures were located within the off-shore zone. Such sites are relatively rare. The most well known of these is the *heiau* of Hale o Kapuni located in Pelekane bay on the Kohala coast of the island of Hawaiʻi. This shrine is submerged just offshore below the larger *heiau* of Mailekini and Puʻu Koholā and near the former royal compound within Puʻu Koholā

National Historic Site. A site like Hale o Kapuni could be damaged by vessels unaware of its existence.

Post-Contact shoreline structures include piers, jetties, lighthouses and other historic properties associated with maritime activities. Stone walled livestock enclosures were sometimes constructed just back of the beach, particularly when cattle and other livestock were to be taken or swum out to vessels waiting offshore to transport them to other islands. The remains of historic residential sites are less common, but are sometimes present close to the shoreline. Also found are the remnants of the cement pillboxes erected during World War II as part of a coastal defense system aimed at defending against a potential Japanese invasion. These military defensive positions are located at strategic points along the coastlines of most of the main islands. In general, because of the materials used in their construction, post-Contact shoreline sites tend to be more robust than pre-Contact sites and are less likely to be impacted by monk seal recovery activities.

The most common offshore historic properties that date from the post-Contact period are historic shipwrecks. Shipwrecks in shallow water close to shore have been reported off most of the MHI. There are several shipwrecks off the coast of O‘ahu which are listed on the NRHP. Many of these are located within Pearl Harbor, including the U.S.S. Arizona, U.S.S. Bowfin, and U.S.S. Utah. Shipwrecks are generally much more fragile than most historic era shoreline sites, and have the potential to be impacted by vessels anchoring on or near them to conduct monk seal recovery actions.

Traditional Cultural Properties (TCP) are far more difficult to recognize than most archaeological sites since their significance often depends less on a physical structure than on some mythical or historic event that may have taken place there or some ritual associated with the place. At present, there are no TCP listed on the National Register for Hawai‘i. There are, however, numerous known *wahi pana* (storied places) which may be eligible for nomination. Sites eligible for listing as a coastal TCP may include physical features such as *leina a ke akua*, the leaping off points from which a departing spirit enters the next world. There are several of these within the main Hawaiian chain. Bays and beaches, stretches of shoreline and other natural landmarks may be associated with mythic or historic figures, traditional activities or historic events. An example is the westernmost tip of the island of Kaho‘olawe, which is known as Lae o Kealaikahiki, the point of the pathway to Kahiki (foreign lands). This point and the adjacent channel are traditionally associated with the epic sea voyages between Hawai‘i and the islands of Central Polynesia.

3.4.8 Recreation and Tourism

The economy of Hawai`i has been dependent on tourism and tourism-related activities since statehood in 1959. In 2009, 14% of jobs in the state were in industries directly involved with tourism, with many other indirectly associated

with the industry (see Table 3.4-2). Hawai`i is a popular destination for both national and international tourists, with Japanese and Canadian tourists being the top two international tourist groups. Due to the recent downturn in the national and international economies, tourism in the state has suffered over the past couple of years. However, the industry is recently showing signs of recovery, with total visitor spending increasing by double digits for all islands between 2009 and 2010.

Total spending by visitors to Hawai`i in 2010 was $11.2 billion, an increase of 12% compared to the same period in 2009 (HTA 2010) (see Table 3.4-7). Among the islands, the highest percent increase was in Maui with 17%, while O`ahu topped the list in terms of total spending at $5.7 billion. Per person per day spending increased by 2.8% and reached $168.9. Approximately 7.1 million people visited Hawai`i in 2010, an increase of 8.7% from 2009. About 4.4 million of these visited O`ahu, while almost 2.2 million visited Maui. Overall, the total visitor days increased 8.9% to 65.6 million in Hawai`i (HTA 2010) (see Table 3.4-7).

Recreation activities in Hawai`i are primarily centered around the ocean, while other non-ocean recreation is also popular. Ocean-based recreation includes surfing, pleasure boating (for various activities), fishing, swimming, snorkeling, SCUBA-diving, whale-watching, water-skiing, kite-boarding, kayaking, relaxing at beaches, and cruises, among others. The list of non-water recreation is also extensive, and includes, but is not limited to, hiking, golf, sightseeing, and hunting.

Various federal, state, and local agencies have specific roles and responsibilities for managing ocean-based recreation use in Hawai`i. Some of these include the USCG, NOAA, HLNR, Hawai`i State Department of Transportation, Hawai`i State Department of Health, and city and county governments (DOBOR 2009). Some of the regulatory tools for managing ocean-based recreation in the state include, among others, Designated Ocean Recreation Management Areas (ORMA), Non-Designated Ocean Recreation Management Areas, Fishery Management Areas, Local and Special Rules – Ocean Waters, Marine Life Conservation Districts, and Commercial Ocean Recreational Activity (CORA) permits (DOBOR 2009).

Select recreation resources in Hawai`i are presented in Table 3.4-8. The State of Hawai`i has many beaches and over 185 miles of sandy shoreline. Over 24 miles of this shoreline is safe, clean, accessible, and generally considered suitable for swimming. There are also 1,600 surfing sites throughout the state. There are a total of 55 wildlife sanctuaries and refuges. The 630 county parks extend over 8,764 acres, most of which are in O`ahu.

Table 3.4-7 Key Tourism Statistics for the State of Hawai'i and its Counties –2010 Versus 2009 and Percent Change

2010	Hawai'i	% Change	Maui	% Change	Lāna'i	% Change	Moloka'i	% Change	O'ahu	% Change	Kaua'i	% Change	State Total	% Change
Total Arrivals	1,378,921	6.1%	2,186,279	10.6%	72,152	7.6%	52,258	-1.2%	4,427,372	7.5%	1,042,633	4.4%	7,083,663	8.7%
Domestic Arrivals (by air)	986,086	3.7%	1,802,254	9.1%	57,710	9.8%	41,599	1.3%	2,587,557	5.8%	880,358	2.8%	5,022,883	7.5%
Int'l Arrivals (by air)	304,773	15.8%	289,815	20.5%	11,174	31.3%	8,653	19.2%	1,741,292	10.3%	84,366	18.0%	1,959,542	12.1%
Visitor Arrivals (by ship)	88,062	4.3%	94,210	11.5%	3,268	-45.8%	2,005	-56.1%	98,523	4.1%	77,909	10.0%	101,238	4.8%
Total Visitor Days	9,102,156	7.5%	16,886,015	11.2%	249,660	12.4%	245,258	3.9%	31,918,530	8.9%	7,196,459	5.5%	65,598,078	8.9%
Total Expenditures ($mil.)	1,345.73	7.6%	2,953.30	16.7%	72.4	14.4%	24.4	-2.8%	5,683.43	11.3%	1,086.95	6.9%	11,166.27	11.7%
PPPD[1] Spending ($)	145.1	0.2%	173.3	4.9%	290.0	1.9%	99.5	-6.4%	177.1	2.3%	148.8	1.3%	168.9	2.8%

Notes: 1/ PPPD - Per Person Per Day.

Source: Hawai'i Tourism Authority, Annual Visitor Research: 2010 Annual Research Tables, Website (http://www.hawaiitourismauthority.org/research/reports/annual-visitor-research/) accessed April 6, 2012.

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Ocean recreation in Hawai`i supports an $800 million industry (DOBOR 2011). As a result of population growth and demand for new products and destinations, ocean recreation in the state is increasing (DOBOR 2009). Economic and other data on most of these activities are older, sparse, and hard to obtain from public sources. A few older studies focusing on specific activities provide some information collected through surveys. Based on these, in 1999, the direct revenues from the ocean tour boat industry in the state were approximately $132 million (in 1999 dollars) (Utech 2000).

The tour boat industry includes whale watching, snorkeling, dinner cruises, and sunset cruises, and is a growing segment of Hawai`i's economy. The largest share of the revenue was from snorkeling tours (approximately $67 million) and dinner cruises (approximately $47 million). In geographical terms, tours in Maui brought in the highest revenue, followed by those in O`ahu. The total economic impact, including direct, indirect, and induced revenues was estimated to be $225 million (in 1999 dollars). The industry supported 3,232 jobs in 1999 (Utech 2000). Between 1990 and 1999, revenues from this industry in Big Island, Maui, and Kaua`i increased by 25% in real terms (Utech 2000).

Another large segment of ocean-based recreation industry in Hawai`i is the cruise industry. According to the U.S. Maritime Administration, Hawai`i was the seventh most popular cruise destination in North America in 2003 (DBEDT 2003). In 2003, over 83% of cruise visitors to Hawai`i were from within the United States, followed by Canada at 6.5% and Europe at 2.8%. The total direct economic impact of the cruise industry in Hawai`i in the same year (2003) was estimated at $268.7 million, with each cruise visitor brining about $157 into the state's economy per day. The largest impact was from out-of-state visitors, including cruise visitors and crew members, followed by that from cruise lines (DBEDT 2003). The direct, indirect, and induced effects from the cruise industry amounted to $390.5 million of Gross State Product in 2003, and the industry generated 4,582 jobs (DBEDT 2003).

Table 3.4-8 Select Recreation Resources in the Hawaiian Islands

Recreation Resources	Hawai`i	Maui	Lāna`i	Moloka`i	O`ahu	Kaua`i	Total
Swimming and Surfing Sites, by Island							
Miles of Sandy Shorelines[1]	19.4	32.6	18.2	23.2	50.3	41.2	184.9
Primary[2]	1.2	7.9	-	-	12.5	2.8	24.4
Other	18.2	24.7	18.2	23.2	37.8	38.4	160.5
Number of Surfing Sites[3]	185	212	99	180	594	330	1,600
State Parks and Historic Sites, 2009							
Number of State Parks and Historic Sites	20	9		2	28	10	69

Recreation Resources	Hawai`i	Maui	Lāna`i	Moloka`i	O`ahu	Kaua`i	Total
Acreage of State Parks and Historic Sites	7,253.6	317.5		244.2	11,956.4	13,750.5	33,4522.2
Developed Acreage of State Parks and Historic Sites	258.3	37.9		10.0	275.8	130.6	712.6
Recreation Visits per Year to State Parks and Historic Sites 4/	1,312,000	1,182,000		8,000	2,950,000	2,370,000	7,823,000
Wildlife Sanctuaries and Refuges, by Island, 2009							
Number of Wildlife Sanctuaries and Refuges (excluding hunting areas)	8	11	4	6	19	7	55
Acreage of Wildlife Sanctuaries and Refuges (1,000 acres) (excluding hunting areas)	83.3	0.3	Less than 50 acres	Less than 50 acres	0.6	10.5	94.8
County Parks, by Island, 2009							
Number of County Parks	126	122	6	14	288	74	630
Acreage of County Parks	1,734	1,307	15	73	5,148	487	8,764

Notes:
[1] Surveyed in 1962.
[2] Safe, clean, accessible, and generally suitable for swimming.
[3] Surveyed in 1971. A surfing site is defined as "a specific wave-breaking zone caused by a shoal and having sufficient consistency to be identified as a surfable riding area, either seasonally or in a combination of seasons, for example, Queen's Surf, Waikiki."
[4] State park visitation was not tracked in 2010. The total number of visitors by park was derived using the 2009 figure as provided by DBEDT and adjusting it with an year-to-date percentage change in visitor arrivals by island. (2010 number calculated using 2010 HTA survey data, Table 1: Summary of Visitor Statistics 2010 vs. 2009)..
Source: Department of Business, Economic Development & Tourism (DBEDT) (2009b). The State of Hawai`i Data Book 2009. Retrieved from http://hawaii.gov/dbedt/.

As presented in Table 3.4-9, there are seven major National Parks in Hawai`i, with a combined acreage of 369,113. In 2010, there were over 4.5 million visitors to these parks. The Hawai`i Volcanoes National Parks is the largest in terms of acreage and was visited by 1.3 million people. The most popular national park remains the U.S.S. Arizona Memorial, which received almost 1.4 million visitors in 2010.

Table 3.4-9 Acreage of and Visitation to National Parks in Hawai'i During 2009

National Park	Acreage			Visits
	Total	Federal	Non-Federal	
Hawai'i Volcanoes National Park 1/	323,431	323,431	-	1,304,667
Haleakala National Park	33,223	33,222	0.15	1,105,606
Pu'uhonua o Honaunau National Historical Park	420	419	1	419,590
Kaloko-Honokohau National Historical Park	1,163	616	547	132,731
Pu'ukohola Heiau National Historic Site	86	61	25	129,886
U.S.S. Arizona Memorial	11	11	-	1,372,724
Kalaupapa National Historical Park	10,779	23	10,756	27,919
Total	**369,113**	**357,783**	**11,329**	**4,493,123**

Notes:
1/ Federal land includes 9,654.67 acres under the custody and administration of the National Parks Service with their inclusion in the park pending.
Source: DBEDT (2010b). The State of Hawai'i Data Book 2009. Retrieved from http://hawaii.gov/dbedt/.

Hawai'i also has many state parks, of which the seven major ones are listed in Table 3.4-10. The Wailua River State Park received the most recreation visits in 2010, followed by Waimea Canyon State Park. The largest state park in terms of acreage is the Na Pali Coast State Park, spread over 6,175 acres. The Kokee State Park has the most developed acres (55).

Table 3.4-10 Acreage of and Visitation to Major State Parks in Hawai'i During 2009

State Park	Acreage		Recreation Visits (in 1,000) 1/
	Total	Developed	
Na Pali Coast State Park	6,175.0	4.0	317,780
Ahupua'a'O Kahana State Park	5,256.5	26.0	81,074
Kokee State Park	4,345.0	55.0	228,251
Waimea Canyon State Park	1,866.4	10.0	323,488
Kekaha Kai State Park	1,642.5	5.0	188,953
Sacred Falls (Kaluanui) State Park 2/	1,375.9	10.0	NA
Wailua River State Park	1,093.0	37.4	667,030

Notes:
1/ State park visitation was not tracked in 2010. The total number of visitors by park was derived using the 2009 figure as provided by DBEDT and adjusting it with an year-to-date percentage change in visitor arrivals by island . (2010 number calculated using 2010 HTA survey data, Table 1: Summary of Visitor Statistics 2010 vs. 2009).
2/ Park closed since May 1999.
3/ Parks having at least 500,000 recreation visits or 1,000 acres.
DBEDT (2010b). The State of Hawai'i Data Book 2010. Retrieved from http://hawaii.gov/dbedt/.

3.4.9 *Public Safety*

Since 1991, NMFS has documented numerous cases of human-seal interactions involving monk seals in the MHI (NMFS, unpublished data). The cases tend to fall into the following categories:

- Seals, which are habituated to people, biting swimmers or divers;
- Habituated seals conditioned by people through feeding and interactive play; and
- Interactions with a mother protecting a dependent pup (NMFS 2011).

As the MHI seal population increases, human-seal interaction events are likely to continue and will require more attention and, in some cases, intervention from NMFS to protect both people and seals. Events in recent years where interactions have necessitated NMFS intervention, have often resulted from seals becoming socialized to humans. Prevention, mitigation and documented human-seal interactions are summarized in Table 3.4-11 below.

Table 3.4-11 Prevention, Mitigation and Documented Human-Seal Interactions in the MHI (1991- April 2013)

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
The following seals remained in the MHI with no reported deleterious human-seal interactions post NMFS intervention to prevent socialization					
August 2000	RH44	Poipu, Kaua‘i	Human socialization concerns	Female weaned seal was translocated to Larson’s beach after weaning to avoid socialization with people in high human density area.	Seal pupped on Moloka‘i in 2007, 2008, 2010 and on Maui in 2009.
September 2000	RH58	Maha’ulepu, Kaua‘i	Human socialization concerns	Female translocated to Larson’s Beach after weaning to avoid human socialization.	Seal pupped on Kaua‘i in 2006, 2007, 2009 and 2010; observed on O‘ahu 2011. No reports of interaction with humans since translocation.
July 2012	RL10	Aliomanu, Kauai	Human socialization concerns and proximity to road.	Female weaned seal was translocated to North Larson’s beach after weaning to avoid socialization with people in high human density area.	No reports of interaction with humans since translocation.
December 2012 – January 2013	R6FQ	Salt Ponds, Kauai	R6FQ observed resting in the camp area, on the edge of the beach road in very close proximity to cars, tents and two leashed dogs. The seal approached people within three feet. Seal put his head in a tent, was sleeping under cars, approached leashed barking dogs, and rested in the beach roadway.	Seal was displaced into the water from the camp area by response staff. Volunteers and staff increased surveillance of R6FQ's normal haul out locations and developed plan to displace the seal if it hauled out in pre-determined undesirable areas or showed further signs of interaction with humans. Seal was subsequently displaced from Baby Beach I and II in Lawai.	Seal has engaged in no further observed human interaction.
The following seal remained in the NWHI with no reported deleterious human-seal interactions post NMFS intervention to prevent socialization					
June 1991	RZ20	Waialee Beach Park, O‘ahu	Female born near the mouth of a river with large outflow and potentially fatal conditions during a rainstorm.	Pup was initially translocated down the beach away from the river mouth. Due to proximity to a human-dense area and to prevent socialization with humans, the seal was translocated post weaning to Kure in June 1991.	Observed at Kure Atoll in 2008.

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
The following seals have since died or disappeared, but had no reported deleterious human-seal interactions post NMFS intervention					
September 2000	RM68	Poipu, Kaua'i	Weaned in area with high human density.	Male translocated to Larsen's beach after weaning to avoid human socialization.	Last observed in 2001.
September 2004	RI19	Maha'ulepu, Kaua'i	Human socialization concerns	Male translocated to Na Aina Kai after weaning to avoid human socialization.	Died from a gunshot wound April 2009.
September 2004	RI21	Poipu, Kaua'i	Human socialization concerns	Female translocated to Na Aina Kai after weaning to avoid human socialization.	Not resighted after 2004.
August 2005	R6AY	Hakalau, Big Island	Male born in close proximity to river mouth.	Due to disease concerns, the seal was captured and held in captivity for observation.	Died in captivity prior to release.
July 2006	RO32	Turtle Bay, O'ahu	Fishing line entanglement and human socialization concerns	Female translocated to Rabbit Island after weaning.	Died from entanglement drowning in October 2006.
July 2008	RW18	Mokuleia, O'ahu	Human socialization concerns	Male translocated to Rabbit Island after weaning to avoid human socialization.	Found dead at Waimanalo in October 2008.
The following seals remained in the MHI with no further reported human-seal interactions post NMFS intervention					
March 2003	R2AU	Poipu, Kaua'i	Three juvenile seals (2 male, 1 female) socializing among swimmers at Poipu Beach, Kauai.	Seals were tagged, instrumented with VHF transmitters and epidemiologically sampled. Seals were translocated to the north shore Kaua'i.	Seen in 2009. No reports of interaction with humans since translocation.
March 2003	RH40	Poipu, Kaua'i	Three juvenile seals (2 male, 1 female) socializing among swimmers at Poipu Beach, Kauai.	Seals were tagged, instrumented with VHF transmitters and epidemiologically sampled. Seals were translocated to the north shore Kāua'i.	Seen on Kaua'i2009. No reports of interaction with humans since translocation.
March 2003	R1AQ	Poipu, Kaua'i	Three juvenile seals (2 male, 1 female) socializing among swimmers at Poipu Beach, Kauai.	Seals were tagged, instrumented with VHF transmitters and epidemiologically sampled. Seals were translocated to the north shore Kāua'i.	Last seen in 2008. No reports of interaction with humans since translocation.
September 1991	RZ22	Haena Pt., Kaua'i	Female seal began socializing with swimmers post weaning.	Seal was translocated to Ni'ihau in and re-sighted in 1994.	RZ22 was reported killed by a boat propeller prior to 1999.
The following seals remained in the MHI but with continued human-seal interaction post NMFS intervention					

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
October 2005	RV18	Kiahuna, Kaua`i	Hooking	Male translocated to Kulikoa Pt. after weaning in October 2005 to avoid human socialization. Three separate dehooking events initiated by PIRO/PIFSC 2006–2008.	Observed on Kaua`i in 2011.
November 2007	RB24	Maha'ulepu, Kaua`i	Dog attack	Female seal was attempted to be translocated after weaning in November 2007 to avoid human socialization however the potential release site was deemed unacceptable and the seal was released at birth site. Seal was attacked by a dog in 2007 Maha'ulepu.	Observed on Kaua`i in 2011.
The following seals exhibited deleterious human-seal interactions and subsequently died or disappeared. NMFS did not intervene in these cases.					
April 1996 (seal birth date)	RP18	Kaneohe Bay Marine Corp Air Station, O`ahu	Male seal was reported socializing with humans. The seal began to move around the island post weaning.	Disappeared prior to NMFS planned translocation efforts.	Disappeared several moths post weaning in 1996.
September 1997	TEMP 700 ("Humpy")	Molokini	Seal, unknown sex, was reported interacting with snorkelers including biting, grabbing and mounting. Additional sightings of "Humpy" were reported although it was not clear if it is the same seal.	None	Permanent identification of the seal was not made therefore current status is unavailable.
August 1999	RD34	Pacific Missile Range Facility, Kaua`i	Female born in close proximity to a drainage canal.	Pup was tagged but not translocated August 1999.	Pup reported dead September 1999.

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
December 2011 - February 2013	RK68	Mahukona area, Big Island	Male weaned in December 2011 in Waimanu Valley, Hawaii and there were reports of human interaction. Seal travelled to Mahukona area in March 2012. There was at least one report in July 2012 of seal being provisioned.	In February 2013, RK68 was brought to Oahu for captive care due observations of labored breathing.	Seal died in captive care due to large mass of tissue occluding trachea, which resulted from an ingested circle hook, which punctured the esophagus and trachea. Additionally, there were six healing rib fractures on the right side of his body, suggestive of blunt force trauma, which had likely been healing over a matter of months.
The following seals do not remain in the MHI post NMFS intervention due to translocation out of the MHI, death, or placement into captivity.					
October-December 2003	RM34	South Point, Hawaiʻi	Male born on the Big Island and became habituated to humans within first two years. Two separate fishing gear entanglements and dehooking events initiated by PIRO/PIFSC. First reported interaction on 15 October 2003 at Kealakekua Bay, Hawaiʻi.	Translocated back to birth location at South Point on 19 October 2003. Returned to Kealakekua Bay within seven days and re-initiated human interactions. Translocated to Kahoolawe Island on 28 October 2003. Observed at Big Beach, Maui on 18 November 2003, again interacting with humans. Recaptured on 21 November 2003 and moved to Kewalo Basin NMFS facility for holding. Translocated to Johnston Atoll on 1 December 2003.	Not relocated or detected via satellite tag following release in December 2003.

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
October 2003 – January 2004	RK07	Nawiliwili Harbor, Kauaʻi	Adult male approaching people at Nawiliwili Harbor to be fed. The first record of feeding was on 15 October 2003. Anecdotal stories reported seal was fed beginning in 2001 although no reports were received at that time. Socialization with people also occurred at Waikaea canal in Kapaa at the boat ramp where feeding interactions most likely took place.	Observations of the seal were conducted and educational outreach for the community was provided in an effort to stop people from feeding the seal.	Last reported human interaction on 15 January 2004. Found dead January 22, 2004. Cause of death systemic Toxoplasma gondii infection.
September 2006-February 2009	RO42	Black Point, Hawaiʻi	Female born on the Big Island near a stream mouth and translocated after weaning due to disease and habituation concerns.	The seal moved to Kapanai Beach where there was risk of human socialization as well as disease concerns due to proximity of freshwater stream. Animal then translocated a second time on 19 September 2006 three miles south of Lapakahi State Park but began interaction with the public. Captured on 24 August 2007 and translocated Keahaou however began interaction with people again. Translocated a fourth time on 26 August 2008 to Molokaʻi. Observed interacting with people on Lānaʻi. Translocated a fifth time to captivity on Oahu 23 February 2009, translocated and released at Nihoa Island (NWHI) in February 2009.	Not re-sighted on Nihoa Islands following release.

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
February – November 2009	RW46 (KP2)	Kaunakakai Wharf, Molokaʻi	Male born to a mother who had abandoned first pup therefore second pup (KP2) was immediately taken into captivity and raised to wean. While in captivity he developed an eye problem, cause was never definitive. Seal was released at age 8 mo. at Kalaupapa, Molokaʻi in December 2008. Two months post release reports of socialization with people at Kaunakakai Wharf.	Seal monitored and displaced when hauled out at the Kaunakakai Pier or other locations where interactions with humans occurred. Translocated June 2009 back to Kalaupapa, Molokaʻi. Community outreach to stop people from interacting with the seal. Veterinary exam during subsequent translocation in October 2009 resulted in seal being held for permanent captivity due to near blindness and human socialization concerns.	Placed in permanent captivity at the Waikiki Aquarium
Seal interactions with humans that involved biting and other aggressive behavior 2003-2013					
October 2003	Temp700	Kealakakua Bay, Hawaiʻi	Male seal had been fed and interacted with by humans and was conditioned to human interaction. The seal was known for mounting, grabbing and nipping; one diver sustained bite wounds to the neck.	Seal was relocated to Johnston Atoll.	N/A
September 2005	N/A	Poiʻpu Beach, Kauaʻi	Man was bit in buttocks after snorkeling in close proximity to female with dependent pup	Female is being monitored and when pupping occurs outreach is provided to public	N/A
May 2007	RS00	Rabbit Island, Oʻahu	Female with dependent pup bit a male swimmer on the arm when he got in close proximity to the seal pair	OLE investigation and response program investigation. Female is being monitored and when pupping occurs outreach is provided to public	Seen through 2012.
January 2009	R042	Kaumalapau, Lānaʻi	Spearfisher diver sustained bite to the left calf through his wetsuit from a female seal that had been fed and interacted with by humans	NMFS relocated seal to NWHI (Nihoa Islands)	N/A
December 2009	RK12	Mahalepuʻu, Kauaʻi	Female with dependent pup attacked woman in the water; injury to woman's face and arm/hand	OLE investigation and response program investigation, NMFS and DAR staff also followed up with woman.	Seal was resighted in MHI through 2011.
The following seals were currently being monitored for possible management action as of Spring 2013.					

Date	SEAL ID	Location	Type of Interaction	NMFS Response	Status
March 2012-April 2013	R017	Lahaina Harbor, Oahu	Seal being fed and interacting with people.	OLE and response program investigation. Volunteers conducted daily monitoring of seal and performed outreach in the harbor. Seal is seen infrequently in the harbor but does haul out on crowded beaches on Maui with no observations of human interaction with humans on land.	Continued monitoring and outreach.
May 2012 – April 2013	RT02	Olowalu, Maui	Multiple reports of seal interacting with spear fishers, snorkelers, divers, kayaker, etc. Reported to closely approach and follow spear fishers, and to take or attempt to take catch from gear bag/dive float.	Extensive outreach and monitoring conducted at Olowalu and nearby harbors. Plan to capture and apply a satellite tag to seal, but the haulout location of the seal in unknown.	Continued monitoring and outreach.
February 2013 – April 2013	RK72	Waikiki, Oahu	Multiple reports of seal approaching spear fishermen, nudging their hands, and stealing fish from their spears. Seal was also reportedly "herding the fish" in a specific area for the men to spear.	NMFS would like to capture this animal to apply a satellite tag for further monitoring.	RK72 has not hauled out in a suitable area for capture
March 2013 – April 2013	RL06	Olowalu, Maui	Multiple reports of seal interacting with spear fishers, snorkelers, divers, kayaker, etc. Reports of approaching spear fishers and attempting to take catch. Making contact with humans and their gear in water. Reports of seal being fed. Reports that seal attempts to climb up on kayaks, boards and swim steps of boats. Reportedly has grabbed legs of snorkeler/diver with foreflippers more than once.	Extensive outreach and monitoring conducted at Olowalu and nearby harbors. Plan to capture and apply a satellite tag to seal, but the haulout location of the seal in unknown.	Continued monitoring and outreach. RL06 has not hauled out in a suitable area for capture.

Note:
N/A = Data Not Available

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Mitigation for human-seal interactions must consider the unique circumstances of each event and accordingly, use various techniques to minimize harm to humans and seals. NMFS prepared a "Technical Review of Aversive Conditioning and Monk Seal-Human Interactions in the Main Hawaiian Islands" (NMFS 2009a) resulting from a workshop on the subject. The purpose of aversive conditioning is to change an animal's behavior by pairing a negative 'experience' with the undesired behavior to condition against the behavior (Shivik and Martin 2000). Methods used on monk seals must involve a detailed understanding of animal behavior and training techniques as well as the availability of aversive stimuli. The 2009 technical review provides an overview of mitigation techniques NMFS has historically used with monk seals to address interactions including, but not limited to:

- Roping off small sections of beach around resting monk seals (this area is typically approximately 80 ft in diameter or 5,072 square ft). Barriers (ropes) are removed once the seal(s) has left the area.
- Translocation to remote areas; and
- Use of aversive stimuli to encourage seals to move away (for example, loud noises, motioning with palm fronds, etc).

As part of this PEIS, NMFS is considering other methods that will be effective to reduce human-seal interactions as described in Section 2.5. An evaluation of potential impacts of human-seal interactions is provided in Sections 4.8.1 and 4.8.5.

3.4.10 Environmental Justice

Under EO 12898, Environmental Justice (59 CFR 7629), NMFS is required to identify if minority, low-income, or Native American populations are present in the action area. Using demographic data, if such populations are in the project area, a determination must be made whether or not carrying out the proposed action may cause disproportionately high and adverse human health or environmental impacts on those populations. The analysis of impacts is found in Section 4.8.6.

The Council on Environmental Quality (CEQ) defines the term "minority" as persons from any of the following U.S. Census categories for race: Black/Africa American; Asian, Native Hawaiian or Other Pacific Islander; and American Indian or Alaska Native. Additionally, for the purposes of this analysis, "minority" also includes all other nonwhite racial categories that were added to census definitions in the most recent (2000) censure, such as "two or more races."

The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts. Hispanic origin is considered an ethnicity, not a race; therefore Hispanics may be of any race. For the purposes of environmental justice analysis all persons except

for "white, non-Hispanic" are considered "minority." The Interagency Federal Working Group on Environmental Justice guidance states that a "minority population" may be present in an area if the minority percentage in the area of interest is "meaningfully greater" than the minority population of the general population (CEQ 1997).

For the purposes of this demographic analysis the 2010 Census of the population estimates for the racial categories mentioned above were used. Selected economic characteristics, such as poverty data, are not available from the 2010 Census and are only available through the Census Bureau's American Community Survey Program.

Demographic analysis for Hawai`i covers each county separately, but is also aggregated into statewide totals. There are five counties; Kaua`i County, Honolulu County (City and County of Honolulu), Maui County, Kalawao County, and Hawai`i County.

Kaua`i County includes the privately owned Island of Ni`ihau that contains a small population of Native Hawaiians. Census data for Ni`ihau are not available separately, but are included in Kaua`i County totals. Kalawao County is located on the Kalaupapa Peninsula which encompasses a portion of the Island of Moloka`i. Kalawao County is a separate county from the rest of Moloka`i and Maui County. Maui County includes the islands of Maui, Moloka`i, and Lāna`i. While 2010 population estimates are used for Maui County totals, these data are not available for each island within Maui County. Therefore, data from the Census-Designated Places (CDPs) of Kaunakakai (Moloka`i) and Lāna`i City (Lāna`i) were used to provide poverty estimates. CDPs are delineated for each decennial census as the statistical counterparts of incorporated places. CDPs are delineated to provide census data for concentrations of population, housing, and commercial structures that are identifiable by name but are not within an incorporated place. CDP boundaries usually are defined in cooperation with state, local, and tribal officials.

Table 3.4-12 illustrates the racial and ethnic composition of the potentially affected communities by county and Hawai`i as a whole. The proportion of minority on the islands of Moloka`i and Lāna`i are 83.9% and 86.0% respectively. These proportions are significantly higher than Hawai`i in total, which has a minority population of 75.3%.

Table 3.4-13 illustrates the proportion of people with income considered below poverty in the potentially affected counties, as well as Hawai`i as a whole. The proportion of people with income below poverty level in Hawai`i County and the Island of Moloka`i, in Maui County, is 14.4% and 13.4% are notably higher than other islands or counties which range from 2.9 percent to 8.9%. The State of Hawai`i proportion of people below the poverty level is 9.6%.

Table 3.4-12 Study Area Race and Ethnicity, 2010

	Kaua`i County**	City and County of Honolulu	Maui County			Kalawao County	Hawai`i County	State of Hawai`i
			Island of Maui*	Moloka`i *	Lāna`i*			
					Lāna`i City			
Total population	67,091	953,207	144,477	7,255	3,102	90	185,079	1,360,301
White	22,159	198,732	51,733	1,168	435	24	62,348	336,599
	33.0%	20.8%	35.8%	16.1%	14.0%	26.7%	33.7%	24.7%
Black or African American	278	19,256	837	28	5	-	1,020	21,424
	0.4%	2.0%	0.6%	0.4%	0.2%	0.0%	0.6%	1.6%
American Indian and Alaska Native	254	2,438	581	20	2	-	869	4,164
	0.4%	0.3%	0.4%	0.3%	0.1%	0.0%	0.5%	0.3%
Asian	21,016	418,410	41,727	1,131	1,737	7	41,050	525,078
	31.3%	43.9%	28.9%	15.6%	56.0%	7.8%	22.2%	38.6%
Native Hawaiian and Other Pacific Islander	6,060	90,878	13,967	1,879	205	44	22,389	135,422
	9.0%	9.5%	9.7%	25.9%	6.6%	48.9%	12.1%	10.0%
Some Other Race	608	10,457	3,023	23	5	1	2,868	16,985
	0.9%	1.1%	2.1%	0.3%	0.2%	1.1%	1.5%	1.2%
Two or More Races	16,716	213,036	32,609	3,006	713	14	54,535	320,629
	24.9%	22.3%	22.6%	41.4%	23.0%	15.6%	29.5%	23.6%
Total Minority	44,932	754,475	92,744	6,087	2,667	66	122,731	1,023,702
	67.0%	79.2%	64.2%	83.9%	86.0%	73.3%	66.3%	75.3%
Hispanic or Latino (of any race)	6,315	77,433	14,960	496	254	1	21,383	120,842
	9.4%	8.1%	10.4%	6.8%	8.2%	1.1%	11.6%	8.9%

Notes:
*Maui County Total includes the islands of Maui, Moloka`i, and Lāna`i. Moloka`i and Lāna`i census data presented here includes West Moloka`i, East, Moloka`i, and Lāna`i City Census-Designated Places.
**Kaua`i County includes the Island of Ni`ihau
***Hispanic origin is considered an ethnicity, not a race. Hispanics may be of any race.
Source: U.S. Census Bureau, American FactFinder, Census 2010.

Table 3.4-13 Study Area Income Below Poverty Level, 2010

	Kaua`i County**	Honolulu County	Maui County			Kalawao County	Hawai`i County	State of Hawai`i
			Maui County Total*	Moloka`i * Kaunakakai	Lāna`i* Lāna`i City			
Total Population	67,091	953,207	154,834	3,425	3,102	90	185,079	1,360,301
Persons Below Poverty Line	8.8%	8.8%	8.9%	13.4%	2.9%	4.1%	14.4%	9.6%

Notes:
*Maui County Total includes the islands of Maui, Moloka`i, and Lāna`i. Moloka`i and Lāna`i census data presented here includes Kaunakakai and Lāna`i City Census-Designated Places. Poverty estimates for Kaunakakai and Lāna`i City Census-Designated Places is representative of 2006-2010, 5-year data.
**Kaua`i County includes the Island of Ni`ihau
Sources:
U.S. Bureau of Census: 2008 Estimate. U.S. Bureau of Census: 2006-2010 American Community Survey
U.S. Bureau of Census: 2010 Census

3.4.11 *Sanctuaries, Monuments, and Refuges*

The State of Hawai`i has a system of conservation areas that include wildlife and marine sanctuaries, monuments, parks, refuges, natural area reserves, and marine life conservation districts (see Figure 3.4-13). These public lands have a variety of management structures, jurisdictional authorities, and permit requirements. The following section highlights the public lands and their managing agencies that NMFS interacts with more frequently and where notable overlap of boundaries and/or jurisdictions exist regarding monk seals and their management.

3.4.11.1 *Hawaiian Islands Humpback Whale National Marine Sanctuary*

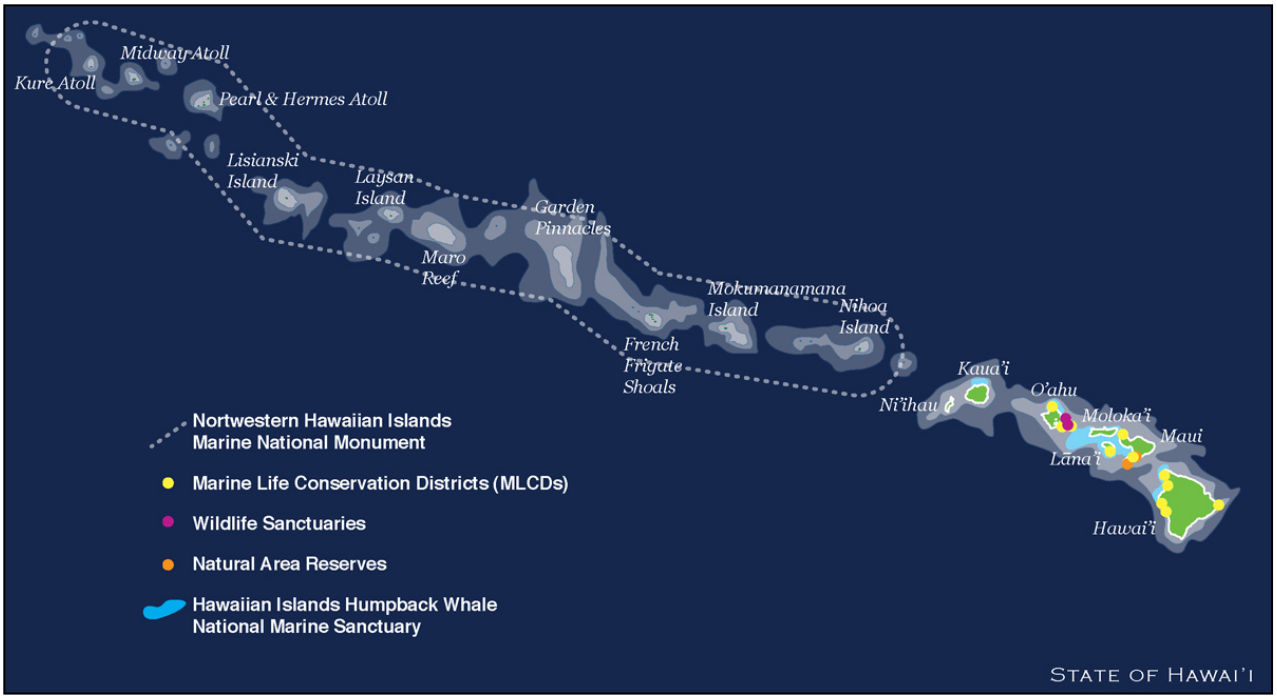
The HIHWNMS was established in 1992 by the Hawaiian Islands National Marine Sanctuary Act and is managed by the NOAA National Ocean Service (NOS), ONMS in co-management partnership with the State of Hawaii, Department of Land and Natural Resources. The primary purpose of the HIHWNMS is to protect humpback whales and their habitat.

The Revised Management Plan (2002) identified a strategy to "develop and implement a process that identifies and evaluates resources for possible inclusion in the sanctuary." This strategy is derived from the Hawaiian Islands National Marine Sanctuary Act Section 2304(b)(4), which required this be done. The Revised Management Plan (2002) committed to addressing this requirement, and the plan notes public support at Sanctuary Advisory Council meetings to include other marine species such as the monk seals.

With the current management plan revision (see Section 1.9.2), the addition of Hawaiian monk seals (and other species as part of an ecosystem-based management approach) is being evaluated and as such, NOAA NOS must coordinate efforts with NMFS to develop and/or adjust the focus of appropriate Sanctuary programs, "including expansion of the scope and type of research, monitoring, education, and outreach programs; enforcement efforts, and the use of management tools such as zoning" (NOAA NOS 2002).

NOAA NOS must also consult with NMFS to comply with Section 7 of the ESA with regard to monk seals any time the management plan is revised, which is currently underway. The consultation must occur to review the possible effects to monk seals that could result from preparation and implementation of the revised management plan and any new rules. Resulting mitigation from the consultation would direct NOAA NOS' management activities with regard to monk seals.

Figure 3.4-14 Sanctuary and Conservation Areas Map



Source: Hawai`i DLNR 2010

3.4.11.2 *Papahānaumokuākea Marine National Monument*

Established on June 15, 2006 by Presidential Proclamation of President George W. Bush, the Monument is co-managed by U.S. DOC NOAA NOS, the USFWS, and the Hawai`i DLNR. The Monument boundaries surround the NWHI as one of the world's largest marine protected areas, and is home to several endangered and threatened species. The NWHI are considered a sacred place for many Native Hawaiian people and Nihoa and Mokumanamana Islands have many

wahi kūpuna (ancestral sites) (PMNM 2008). Because of the Monument's outstanding and unique natural and cultural qualities significant to the international community, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) designated it a World Heritage Site in July 2010 (UNESCO 2011).

Research scientists wishing to conduct research and/or enhancement activities within the Monument are required to obtain a Research Monument Permit. The permit allows the permit holder to conduct their permitted activities within the Monument. The permit also covers activities that are proposed in the Hawaiian Islands National Wildlife Refuge, the Midway Atoll National Wildlife Refuge, Battle of Midway National Memorial, Northwestern Hawaiian Islands State Marine Refuge, Kure Atoll Hawai'i State Seabird Sanctuary, and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve as these conservation units are within the Monument boundaries. The permit applications must go through a public process and any regulatory and agency reviews (PMNM 2008). Notably, the Office of Hawaiian Affairs review all permit applications from a cultural perspective (Johnson personal communication 2011).

3.4.11.3 *Hawaiian Islands National Wildlife Refuge*

USFWS manages the Hawaiian Islands National Wildlife Refuge, which was established in 1909 by an executive order from President Theodore Roosevelt. The Refuge includes the NWHI excluding Midway and Kure Atolls; thus its boundaries coincide with the Monument. The eight islands, reefs, and atolls within the Refuge provide habitat for monk seals and other threatened and endangered species like the Hawaiian green turtle and endemic songbirds and waterfowl. Much like the Monument, the Refuge includes unique cultural resources (USFWS 2011).

The Refuge is not open to public visitation nor are there any permanent human inhabitants. As with the Monument, research scientists must obtain a Research Monument Permit to conduct their activities within the Refuge. The permit process is conducted through the Monument (USFWS 2011). A description of research camps in the Monument is provided in Section 3.3.1.9.

3.4.11.4 *Kalaupapa National Historic Park*

Hawaiian monk seals have established a year-round resident and breeding population on the Kalaupapa Peninsula, "has emerged as a premier birthing location for the seals in the MHIs" (NPS 2010). The Kalaupapa National Historic Park (NHP) was established in 1980 on the north shore of Moloka'i on the remote Kalaupapa Peninsula below 2,000-foot sea cliffs. The Kalaupapa NHP is about 10,700 acres of non-federal land. NPS co-manages the NHP with the Hawai'i DOH. As part of the NPS management structure, several cooperative agreements exist with the land owners, which include the Hawai'i Departments of Health, Transportation, Land and Natural Resources, and Hawai'i Homelands.

Specifically, NPS operates, preserves, and protects the park and the Hawai‘i DOH provides health services to the residents. The Moloka‘i Lightstation is owned and operated by the USCG (NPS 2011 and NPS 2010).

Although NPS does not have management authority concerning monk seals, NPS must consult with NMFS to comply with Section 7 of the ESA within the context of implementing its various management duties (for example, with the recent proposal to repair the existing dock structures). NPS management activities are bound by mitigation required as a result of consultation. NPS also cooperates and assists NMFS with protecting hauled out seals.

3.4.11.5 Hawai‘i State Marine Life Conservation Districts

The Hawai‘i DLNR, DAR manages 11 Hawai‘i State Marine Life Conservation Districts (MLCD) on O‘ahu, Hawai‘i, Lāna‘i, Maui, and Molokini. The first MLCD was established in 1967 at Hana‘uma Bay on O‘ahu. These districts have restricted uses but allow some fishing and consumptive uses (DLNR DAR 2011). DAR consults and coordinates with NMFS when necessary and appropriate with regard to their management actions that could affect monk seals.

3.4.12 Military Activities within the Project Area

This section provides information on military installations within Hawai‘i. Detail on individual installations is organized based on the five branches of the military including; U.S Air Force, U.S. Army, USCG, U.S. Marine Corp and the U.S. Navy. Only those installations located along the shoreline or have training exercises within the Pacific Ocean have been highlighted and discussed.

The military is the second most important sector to the Hawaiian economy, behind only tourism. The military contributes more than $4.6 billion annually to the Hawaiian economy and employs 27,000 civilians. There are an estimated 55,000 active duty military, 65,000 family members and 10,000 National Guardsmen in Hawai‘i. Furthermore, in Hawai‘i there are 13,000 retirees and 101,000 veterans receiving more than $55 billion in benefits from the U.S. government (U.S. Department of the Navy 2008).

3.4.12.1 Air Force

The Air Force has one base located in Hawai‘i, the Hickam Air Force base, which is currently under reorganization with Naval Base Pearl Harbor. Details regarding Hickam Air Force Base are discussed below.

Hickam Air Force Base (O‘ahu)

Hickam AFB is a 2,850 acre base located next to the Honolulu International Airport along the eastern shore of Pearl Harbor. The base is home to the 15th Airlift Wing and 67 partner units (U.S. Department of the Navy 2008a).

As part of a realignment strategy of the Base Closure and Realignment Commission, Hickam AFB and Naval Station Pearl Harbor are realigning to establish Joint Base Pearl Harbor-Hickam (U.S. Department of the Navy 2010). The individual mission areas of each branch will remain the same, while the installations management functions will be combined. In total, the combined land area of the establish Joint Base Pearl Harbor-Hickam will be approximately 27,700 acres. Hickam AFB has approximately one mile of shoreline.

3.4.12.2 *Army*

The U.S. Army Garrison-Hawai`i consists of Fort Shafter and Schofield Barracks communities, which include many other installations and sites (U.S Department of the Army 2010). Including active military, civilian, contractors and retirees, the Army population in Hawai`i is over 93,000 people with nearly 190,000 acres of land within Hawai`i (U.S Department of the Army 2010).

The two Army installations that directly border the shoreline include Makua Military Reservation and Dillingham Military Reservation. The Sikes Act requires that each military facility complete and implement an Integrated Natural Resource Management Plan ("Resource Plan") unless there is a significant lack of natural resources at those installations (US Army 2001). The Army has completed Resource Plans for both the Makua Military Reservation and Dillingham Military Reservation. Personal communication with a NMFS Marine Mammal Response representative reveals that the Army has not had any Hawaiian monk seal response events on their installations in Hawai`i (NMFS, personal communication 2011).

Makua Military Reservation (O'ahu)

Makua Military Reservation is an Army facility located on 4,190 acres in the Makua Valley on the northwestern side of O`ahu and has approximately two miles of shoreline (U.S Department of the Navy 2008a).

Since 2004, the use of Makua Military Reservation has been limited to non live-fire training including unmanned aerial vehicle training, blank ammunition training, and engineer training. The area has also been used as a staging base for ground or air movement, and to control elements for activities elsewhere in Hawai`i. A Record of Decision (ROD) for an increase in training activities at the Makua Military Reservation was approved in July of 2009. This ROD approves for up to 32 combined arms live-fire exercises (CALFEX) and 150 convoy live-fire exercises (LFX) per training year at the site (U.S. Army Environmental Command *et al.* 2009a).

The U.S. District court has recently found that the Army violated agreements required for its EIS to conduct a subsurface archaeological survey of areas within the Makua Military Reservation. Furthermore, the court ruled that the Army did not adequately study the effects of training activities on the *limu* along the

shoreline of the area. Addition litigation surrounding increased military training on subsistence activities is scheduled for February 23, 2011 (Kobayashi 2010).

The Makua Military Reservation Resource Plan does not identify Hawaiian monk seals as being found on the Makua Military Reservation (US Army 2001). However, the recently completed EIS stipulates that the shore adjacent to the military reservation provides suitable habitat for Hawaiian monk seals (U.S. Army Environmental Command *et al.* 2009a). The EIS also claims that there has been at least one anecdotal sighting of a monk seal at the beach.

Mitigation measures for the Preferred Alternative identified in the Makua Military Reservation Final EIS include:

- The Army will inspect Makua Beach immediately prior to training exercises and will not begin a training exercise if there are Hawaiian monk seals present; and
- Additional mitigation measures beyond those proposed for ground training may be incorporated after informal consultation with NOAA.

The Makua Military Reservation Resource Plan provides that the current management for endangered species includes surveying, monitoring, protection and the management of the natural communities from military training. The Army proposes to survey for new rare vertebrate species in unsurveyed areas and establish and update GIS information for rare invertebrates at the Makua Military Reservation. Furthermore, the Army proposes to monitor and determine military impacts on threatened, endangered and rare vertebrates at the Makua Military Reservation.

Dillingham Military Reservation (O'ahu)

The Dillingham Military Reservation is located on a 664 acres parcel of land with a beach and airfield near the northwestern corner of O'ahu and is approximately one mile north of the Makua Military Reservation. Mokuleia Beach borders the Dillingham Military Reservation for approximately one mile, but due to the heavy surf and coral beds amphibious training does not occur. (Global Security 2011h) There are no resident rare animal species documented at the Dillingham Military Reservation (U.S. Army 2001). Despite this, Hawaiian monk seals may potentially use the reservation or adjacent areas (U.S. Army 2001). Current management for threatened, endangered and rare vertebrates on the Dillingham Military Reservation includes surveying, but monitoring and management of rare species is not possible because no such populations have been identified.

3.4.12.3 Coast Guard

USCG District 14 is headquartered in Honolulu, Hawai'i. The USCG is the only military branch organized under the Department of Homeland Security. Under the USCG natural resource policy, the USCG must obtain all the necessary permits and conduct consultations with NMFS when preparing for work that

may impact marine mammals, such as the construction or maintenance of structures along beaches. The USCG is also required to notify the chain of command when prohibited encounters with marine mammals occur (USGC 1997).

Under the Marine Mammal Health and Stranding Response Program (MMHSRP), NMFS and USCG have a Memorandum of Understanding (MOU), where the USCG assists NMFS with marine mammal response. The USCG provides transport via vessel or aircraft for NMFS to translocate monk seals; between three to five seals are transported by the USCG annually (NMFS Response Coordinator personal communication 2011). These translocation activities are conducted under the MMHSRP Permit No. 932-1905 and are separate from the translocation activities considered in this PEIS.

Air Station Barbers Point (O'ahu)

The USCG is stationed at Air Station Barbers Point on Kalaeloa Airport in Honolulu on a former Navy base and is located along approximately three miles of shoreline. However, the Air Station is self-contained and separated from the shoreline by a highway. NMFS is responsible for HMS response along this section of shoreline. The USCG Air Station Barbers Point is the only Coast Guard Air Unit in Hawai`i and is responsible for search and rescue missions over a vast area of the Pacific including the Hawaiian Islands, Marianas, Caroline and the Marshalls. Air Station Barbers Point has four Aerospatiale HH-65A helicopters and four Lockheed HC-130H aircraft (U.S. Department of the Navy 2008a; Global Security 2005d).

3.4.12.4 *Marine Corps*

The Marine Corps has one base in Hawai`i along with an installation at Bellows Airfield. These facilities, which are located along the shoreline, are discussed below. The INRMP guides implementation of Marine Corps Base Hawaii (MCBH) integrated natural resource management program on their properties. Objectives of the MCBH INRMP outline the MCBH Environmental Departments management actions, which describe the incorporation of the marine mammal policy into base plans, projects and protocols as appropriate.

In total, MCBH properties have 12.5 miles of shoreline and coastal and MCBH resource responsibilities extend seaward from Mokapu Peninsula shoreline for 500 yards. Therefore, it is assumed that the MCBH manages approximately four square miles of nearshore area. Amphibious training maneuvers are conducted along the coastal areas of the MCBH in order to prepare USMC personnel for forced entry by sea (U.S. Marine Corps 2006). HMSs regularly come ashore on the MCBH-Kaneohe Bay beaches to rest. Furthermore, in 1996 there was a documented birth of a HMS pup at this location.

NMFS and the MCBH have a standing agreement where U.S. Marine Corps personnel notify NMFS in the event a HMS is located along MCBH shoreline.

MCBH personnel cordon off the area where the HMS is located and notifies NMFS. A photo is then taken by either NMFS or MCBH personnel for documentation. (NMFS Response Coordinator personal communication 2011)

Marine Corps Base Hawai'i (O'ahu)

The MCBH is a 2,951 acre site on the Mokapu Peninsula, which is located along the southeastern shoreline of O`ahu. A large portion of the base is designated as urban and is located approximately 12 miles northeast of Honolulu (Global Security 2005e). As of 2005, there are approximately 10,000 marines and navy personnel stationed at the base (Global Security 2005f).

Marine Corps Training Area/Bellows (O'ahu)

The Marine Corps Training Area/Bellows is located on 1,078 acre site on the southeastern portion of O`ahu. The onsite airfield is inactive; however, it is occasionally used for Marine Corp helicopter training (U.S. Department of the Navy 2008a).

3.4.12.5 *Navy*

The Navy has the largest military presence in Hawai`i and contributes more than $2 billion to the local economy annually. The Navy accounts for more than 15,000 military personnel and over 10,000 civilian employees in Hawai`i (U.S. Department of the Navy 2011a). As of 2008, the United States Department of the Navy conducted more than 9,300 training and Research, Development, Test and Evaluation activities around Hawai`i each year (U.S. Department of the Navy 2008a).

The Navy's application to NMFS for authorization to incidentally harass marine mammals outlines the Navy's mitigation measures for acoustic effects and training exercises (U.S. Department of the Navy 2007). During anti-submarine warfare events, Navy ships have two or more personnel on watch. The bridge team has at least three officers whose responsibilities include observing the water. When marine mammals are close, operating procedures are implemented to avoid adverse effects, including the shutting down of active sonar operation. The Navy requires marine species awareness as part of its training for its bridge lookout personnel on ships and submarines as required training for Navy lookouts.

NMFS has a Protocol and Communication Plan with the Navy pertaining to training exercises and they are currently in the process of drafting an MOU (NMFS personal communication 2011). The Navy notifies NMFS 72 hours prior to major training exercises (NMFS personal communication 2011). NMFS and the Navy have a standing agreement where Navy personnel notify NMFS in the event a HMS is found along Navy installation shorelines. Navy personnel cordon off the area where the seal is located and notify NMFS. A photo is then taken by

either NMFS or Navy personnel for documentation (NMFS personal communication 2011).

If major exercises must occur in an area where conditions may contribute to marine mammal stranding, the conditions must be fully analyzed in environmental planning documentation (U.S. Department of the Navy 2007). The Navy will also use aircraft to survey the area and detect marine mammals prior to the use of the area by exercise participants. Advance survey should occur within about two hours prior to mid-frequency active sonar use, and periodic surveillance should continue throughout the exercise. Unusual conditions, such as presence of sensitive species, should be reported to the Office in Tactical Command (OTC), who should give consideration to delaying, suspending or altering the exercise.

The Letter of Authorization for the taking of marine mammal's incidental to U.S. Navy training in Hawai`i Range Complex was issued on January 23, 2013 and expires on January 5, 2014 (see Table 3.3-8). This permit allows for the take of 121 monk seals through level B harassment (NMFS 2013).

Kaula

Kaula is an uninhabited island located approximately 50 miles southwest of Kaua`i Island. The federally owned island is approximately 108 acres in size. The Navy uses approximately 10 acres along the south side of the island for aircraft gunnery and target practice (U.S. Department of the Navy 2008a).

Pacific Missile Range Facility (Kaua'i)

The Pacific Missile Range Facility is the world's largest instrumented range capable of supporting surface, subsurface, air and space operations simultaneously (U.S. Department of the Navy 2011c). There are over 1,100 square miles of instrumented underwater range and 42,000 square miles of controlled airspace.

The Pacific Missile Range Facility is located on the west side of Kaua`i, where the majority of Pacific Missile Range Facility's facilities and equipment are located upon the 1,925 acre main base (U.S. Department of the Navy 2008a). The facilities that support Pacific Missile Range Facility range operations include Kaua`i Test Facility, Makaha Ridge, Kokee, Hawai`i Air Nation Guard Kokee, Kamokala Magazines, Port Allen, Kiliaola Small Boat Harbor and Mt. Kahili.

A recently issued Record of Decision for the Hawai`i Range Complex EIS/Overseas EIS states that the number of Pacific Missile Range Facility training events and Research, Development, Test and Evaluation programs will be increasing effective June 26, 2008 (U.S. Department of the Navy 2008a).

Puuloa Underwater Range (O'ahu)

The Puuloa Underwater Range is a 2 square nm underwater demolition area. Puuloa Underwater Range is located near Ewa Beach, west of the entrance to

Pearl Harbor. The range is located in water depths ranging from 9 feet to 228 feet, while the majority of the range is in water less than 39 feet deep (U.S. Department of the Navy 2008a).

Naval Defensive Sea Area (O'ahu)

The Naval Defense Sea Area is the restricted area extending outward from the mouth of Pearl Harbor and encompasses an area of approximately ten square miles. No vessels are allowed into Naval Station Pearl Harbor without permission of Commander Naval Region Hawai'i. The Naval Defense Sea Area is used for underwater training and Research, Development, Test and Evaluation activities (U.S. Department of the Navy 2008a).

Ewa Training Minefield (O'ahu)

The Ewa Training Minefield is a surface ship mine avoidance training area located offshore of Ewa Beach on O'ahu and is approximately ten square miles in size (U.S. Department of the Navy 2008a).

Barbers Point Underwater Range (O'ahu)

The Barbers Point Underwater Range is located offshore from the USCG Air Station and the Kalaeloa Airport on O'ahu and encompasses an area of approximately one square mile (U.S. Department of the Navy 2008a).

Naval Underwater Warfare Center (O'ahu)

The Naval Underwater Warfare Center, Shipboard Electronic Systems Evaluation Facility range is located off of Barbers Point on O'ahu and is approximately 35 square miles in size. The range is used to test combat systems which emit electromagnetic radiation. Furthermore, the NUWC conducts tests within the Fleet Operations Readiness Accuracy Check Site, which is an area approximately 30 square miles in size. The Naval Underwater Warfare Center Range control officer conducts visual lookout and radar searches of the Fleet Operations Readiness Accuracy Check Site range to determine if non-participating vessels are located within the area (U.S. Department of the Navy 2008a).

Naval Station Pearl Harbor (O'ahu)

Naval Station Pearl Harbor is a 25,170 acre site located on the southern shore of O'ahu (U.S. Department of the Navy 2008a). Furthermore, Naval Station Pearl Harbor hosts a population of approximately 35,000.

The Harbor is divided into three lochs; the West Lock, Middle Lock and East Loch. A major portion of the area adjacent to ship berthing and repair areas is used for maintenance, supply and storage (U.S. Department of the Navy 2008a). The base is currently undergoing realignment with the neighboring Hickam AFB as previously described. Pearl Harbor has nearly ten square miles of water and approximately 40 miles of shoreline.

Lima Landing Range (O'ahu)

Lima Landing Range is located within Joint Base Pearl Harbor-Hickam and is used a small underwater demolition training area. This range is less than one square mile in size. At this time, approximately five training events occur each year at the site (U.S. Department of the Navy 2008a).

Shallow-water Minefield Sonar Training Area (Maui)

The Shallow-water Minefield Sonar Training Area is used by Pearl Harbor based submarines to conduct mine sonar training and is approximately two square miles in size. Submarines utilize high-frequency active sonar and training can occur when marine mammals are present (U.S. Department of the Navy 2008a).

Kawaihae Pier (Hawai'i)

Kawaihae Pier is one of two deep water ports located on the island of Hawai`i. Expeditionary assault events are conducted by the Navy at the pier and primary activities include the loading and unloading of vehicles and equipment from vessels (U.S. Department of the Navy 2008a).

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the predicted consequences, or potential effects, on the physical, biological, and human environment from implementing the alternatives described in Chapter 2. The chapter begins by describing the Project Area (Section 4.1), defining frequently used terms (Section 4.2), and explains how incomplete or unavailable information is dealt with in this document (Section 4.3). Section 4.4 describes the steps used for determining the level of impact including the resource-specific criteria used in the evaluation. Section 4.5 provides an overview of the approach to cumulative effects assessment. Section 4.6 presents resources not carried forward for further analysis. Sections 4.7 and 4.8 provide analyses of impacts to the biological environment and to the social and economic environment, respectively, from each of the alternatives.

4.1 *Project Area and Scope for Analysis*

The project area for this Programmatic Environmental Impact Statement (PEIS) encompasses the range where Hawaiian monk seals are found throughout the Hawaiian Archipelago (including the Northwestern Hawaiian Islands [NWHI] and Main Hawaiian Islands [MHI]) and Johnston Atoll (Figure 1.3-1).

More specifically, the Project Area includes portions of the open ocean and nearshore environment where monk seals may be found; and, the shorezone of the islands, islets and atolls that make up the Hawaiian Archipelago and Johnston Atoll. For the purposes of this project, the shore zone generally includes those terrestrial areas 5 meters (m) inland from the line where the shore meets the sea. In addition, secondary use areas, such as research field camps in the NWHI, are also considered for inclusion in the analysis.

In the NWHI, monk seals have six main reproductive sites including Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and French Frigate Shoals. Necker and Nihoa Islands have smaller breeding sub-populations and monk seals have been observed at Gardner Pinnacles and Maro Reef. Monk seals are also found throughout the MHI where the population appears to be increasing (National Marine Fisheries Service [NMFS] 2007).

The time frame for this analysis is defined as 1958 through approximately 2024. As described in more detail in Section 3.3.1, 1958 marks the point in time when the first beach counts of Hawaiian monk seals were conducted in all the primary NWHI. That year is considered a benchmark for the species' known historic high point of abundance. By the year 2024, NMFS will have potentially completed two more permit cycles for authorizing Hawaiian monk seal research and enhancement activities; in addition, 10 years is considered a reasonable amount of time for the life of an EIS document. Within this 10-year timeframe, NMFS will

continue to monitor the Hawaiian monk seal research and enhancement program to evaluate its potential impacts and to comply with NEPA as described in more detail in Chapter 5.

4.2 *Definition of Terms*

The following terms are used throughout this document to discuss potential effects. In this analysis, the terms "effects" and "impacts" are used interchangeably.

- Direct Effects – caused by the action and occurring at the same time and place (40 Code of Federal Regulations [CFR] § 1508.8).
- Indirect Effects – effects "caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8).
- Cumulative Effects – additive or interactive effects that would result from the incremental impact of the proposed 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 (40 CFR 1508.7). Direct impacts pertain to the proposed action and alternatives only, while cumulative impacts pertain to the additive or interactive effects that would result from the incremental impact of the proposed action and alternatives when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
- Reasonably Foreseeable Future Actions – reasonably foreseeable future actions (RFFA) are those that are likely to occur and are not purely speculative. Typically, they are based on documents such as existing plans, permit applications, or announcements. The process for determining what is considered reasonably foreseeable is further described in Section 4.5.2.

4.3 *Incomplete and Unavailable Information*

The CEQ guidelines require that:

"When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking (40 CFR 1502.22)."

In the event that there is relevant information, but "the overall costs of obtaining it are exorbitant or the means to obtain it are not known" (40 CFR 1502.22), the regulations instruct that the following should be included:

- A statement that such information is unavailable;
- A statement of the relevance of such information to evaluate reasonably foreseeable significant adverse impacts;
- A summary of existing information that is relevant to evaluating the adverse impacts; and
- The agency's evaluation of adverse impacts based on generally accepted scientific methods.

This PEIS identifies those areas where information is unavailable to support a thorough evaluation of the environmental consequences of the alternatives. In particular, as described in more detail in Section 4.8, there are challenges to analyzing potential impacts on fisheries resources (commercial, subsistence and recreational) due to constraints associated with data confidentiality, and also cases where little or no relevant data exist. Evaluations of direct and indirect effects on fisheries were largely based on a recent NMFS analysis of fish biomass, fishery landings and monk seal prey consumption (Sprague 2013). In that publication, whenever there was uncertainty, assessments erred on the side of overestimating impacts.

Similarly, the analysis of potential effects on cultural and historic properties is based on known properties listed in the National Register of Historic Places (NRHP) and other data publicly available from the State of Hawai'i Division of Land and Natural Resources (DLNR). While additional cultural and historic properties exist, the assessment presented in this PEIS is based on publicly available information on documented sites and any information available on sites eligible for listing in the National Register. Efforts have been made to obtain all relevant information regarding cultural and historic properties as defined under NEPA, and a separate National Historic Preservation Act (NHPA) Section 106 compliance process was undertaken (see Appendix B) to gather unpublished information on historic properties as defined under NHPA. This compliance process included gathering additional information via NHPA Section 106 consultations. However, where data gaps still exist, the implication is that these areas qualify for the CEQ guidelines above.

Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on any historic properties located within the Area of Potential Effect (APE) of a proposed project. These effects may be either direct or indirect. Impacts to historic and cultural resources, including historic structures, archaeological sites, and traditional cultural properties, would be considered significant if they result in adverse effects to the integrity of historic properties that are listed or are eligible for listing on the National Register of Historic Places (National Register). Integrity can be considered to mean not simply the physical integrity of a structure, but "the integrity of [its] location, design, setting, materials, workmanship, feeling, and association" (Title 36 C.F.R. § 60.4). Adverse effects are those that detract from the qualities that give a property its significance and contribute to its NRHP eligibility. Direct effects are those that physically alter the historic property in some way. Indirect effects diminish some significant aspect of the historic property, but do not physically alter it.

4.4 *Steps for Determining Level of Impact*

The CEQ regulations implementing NEPA state that an EIS should discuss the significance, or level of impact, of the direct, indirect, and cumulative effects of the proposed alternatives (40 CFR 1502.16).

- Significance is determined by considering both the context in which the action will occur and the intensity of the action (40 CFR 1508.27).
- Context can be referred to as the extent of the effect (geographic extent or extent within a species, ecosystem, or region) and any special conditions, such as endangered species status or other legal status.
- Intensity of an impact is the result of its magnitude and duration.

Actions may have both adverse and beneficial effects on a particular resource. A component of both the context and the intensity of an effect is the likelihood of its occurrence.

Geographic extent of potential impacts to wildlife may be described using the following terms:

- Species level – change in species or population throughout its range that would likely affect its long-term survival.
- Subpopulation or local level – change in a species age- or size-classes in a limited area of its range. Subpopulations are described in Section 3.3.1.3 Hawaiian Monk Seal Population Status and Trends.
- Individual level – change to a specific animal or small number of animals.

Duration or frequency provides the context of time and may use the following terms:

- Short-term – temporary effect that lasts from a few minutes to a few days, after which the affected animals or resource revert to a "normal" condition.
- Long-term – more permanent effects that may last for years or from which the affected animals or resource never revert to a "normal" condition.
- Intermittent or infrequent effects – effects that only occur a couple times a year or fewer.
- Frequent – effects that occur on a regular or repeated basis each year.

Other species-specific characteristics, such as whether the effects occur during a sensitive or critical part of the year (for example, breeding), are described in the analyses for each species or resource.

The combination of context and intensity is used to determine the level of impact on each type of resource. Analysts follow these steps to accomplish this analysis:

1) Examine the mechanisms by which the proposed action could affect the particular resource.
2) For each type of effect, develop a set of criteria to distinguish between major, moderate, minor, or negligible impacts (defined in Tables 4.4-1 through 4.4-8).

3) Use these impact criteria to rank the expected magnitude, extent, duration, and likelihood of each type of effect under each alternative.

Determining the likelihood of an effect serves to assess whether it is plausible or just speculative. For the purposes of this analysis, "likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50 percent (%). This does not imply that the analysts will perform a formal probability calculation but, in their professional judgment, the probability of the effect occurring is more likely than not.

Tables 4.4-1 through 4.4-8 provide guidelines for the analysts to assess the context of a potential effect and serve as tools for comparing the alternatives based on the conclusions drawn from the analysis. The impact criteria tables use terms and thresholds that are both quantitative and qualitative.

Qualitative thresholds are used where resource-specific baseline data may be lacking or potential effects are difficult to predict quantitatively (*e.g.*, quality of life is difficult to measure in quantitative terms). For a qualitative assessment, analysts must use professional judgment about where a particular effect falls in the continuum from "negligible" to "major."

The criteria and definitions of levels of impact provided in Tables 4.4-1 through 4.4-8 are used only in reference to effects projected to occur within 10 years (see Section 4.1 Project Area and Scope for Analysis). Predictions beyond 10 years are challenging due to uncertainty and the number of independent factors that may alter the environment. Thus potential long-term effects are described using more qualitative terms.

4.4.1 IMPACT CRITERIA FOR HAWAIIAN MONK SEALS

Table 4.4-1 presents criteria for analyzing potential effects on Hawaiian monk seals. The effects of various actions on population status through direct and indirect mortality or through improvements in survival can be evaluated by various metrics. The choice of the appropriate metric to be used depends on a suite of factors including the nature of the actions, the mechanism of potential demographic effects, and our confidence in predicting the expected effects.

As described in Chapter 3, in the NWHI, protracted low juvenile survival has led to an ageing breeding population and dwindling numbers of pups being born. If juvenile survival improves naturally, or as a result of enhancement actions, the number of monk seals at the six most-studied NWHI is projected to continue to decline at least for several years before the inertia in current age structures can be overcome. As such, population modeling suggests the NWHI subpopulations will decline for some time under *all* PEIS alternatives. However, some alternatives will slow the decline, improve population status, and ultimately reverse the decline more rapidly than others.

The quantitative metrics used to compare and contrast the expected outcome associated with the different actions included in the alternatives are:

- Population growth rate;
- Age-specific survival rates and survivorship; and
- Population reproductive value (V_{pop}).

Additionally, the expected benefits associated with certain new interventions for which applicable data are not yet available, are evaluated qualitatively. For each intervention, the approach or metric believed to be most revealing for describing the expected outcome of the action is presented.

The intrinsic growth rate, or lambda (λ) for a subpopulation or group of subpopulations is determined from the demographic rates (age-specific survival and reproductive rates) for that population. When all of the demographic rates are assembled into a single table or matrix, they form the lifetable for that population.

Mathematical analysis of that lifetable allows the calculation of certain lifetable descriptors, including λ, that reveal much information about the expected behavior of the population in the future. The value of λ provides an estimate for the long-term likelihood that a population will grow or decline, with values above 1.0 representing growth and values below 1.0 representing decline. A value of exactly 1.0 would correspond to a stable population that will remain at approximately the same abundance over time.

The actual growth rate of a population will vary from the intrinsic growth rate depending on the age structure of the population. For example, more females that can reproduce in a population than normally expected within the population's lifetable may allow the population to exceed the growth rate predicted by λ. Conversely, fewer reproductive females than normally expected might mean the population would fail to meet λ. In recent years, subpopulations in the NWHI have typically had $\lambda < 1.0$ (declining), whereas, in contrast, the MHI have had λ well above 1.0 (growing). Also, as described in Chapter 3, most subpopulations in the NWHI now have poor age structures that are likely to limit their capacity to achieve the growth rate predicted by λ.

One can think of V_{pop} as analogous to the quantity of potential energy stored in the population, which is likely to translate into future pup production.

Survival rates are often the most direct measure for describing the expected outcomes for an action, or for comparing effects across the alternatives. Age-specific survival (often abbreviated as p_x) indicates the probability that a seal will survive from age x to the next age, or age $x+1$. Similarly, survivorship (abbreviated l_x) gives the probability that a newborn pup will survive to age x. Of particular interest for recovery of the monk seal is survivorship to the subadult stage (approximately age 4yr); shorthand for this measure is l_4. A number of the research and enhancement activities included in Alternatives 1, 3 and 4 are specifically targeted at improving the value of l_4 in the NWHI.

The metric population reproductive value (V_{pop}) is used to evaluate the effects of certain actions included in some alternatives. This metric is an extension of a

related demographic measure known as *age-specific reproductive value*, or v_x. This measure essentially informs us about the relative value of female seals of different ages in terms of their probable contribution to future population growth.

Females of prime reproductive age have a higher v_x than very young females that might not survive to reproductive maturity, or very old females that are past their prime reproductive years and may not produce many more pups. V_{pop} extends the concept of age-specific reproductive value by incorporating information on the current population size and age/sex composition. This parameter is the sum of the age-specific reproductive values for all of the females currently in the population.

One can think of V_{pop} as analogous to the quantity of potential energy stored in the population, which is likely to translate into future pup production. Thus:

- An action that increases the number of reproductively aged females will result in a higher V_{pop} as compared to a "baseline" scenario without the action.
- An action that results in the loss of reproductively aged females will lower V_{pop} at that site.

The effects of some actions may also be expressed as simply the change in number of reproductively-aged females in a subpopulation. Reproductively- aged females are defined as those of age 5-20.

V_{pop} is ideally suited for assessing potential effects of the proposed translocations because that activity is focused on augmenting the number of reproductively-aged females within the high v_x age classes, thereby increasing V_{pop} for the treated subpopulation.

For clarity, and because V_{pop} may be an unfamiliar concept to some readers, the effects of some actions may also be expressed as simply the change in number of reproductively-aged females in a subpopulation. This value expresses much the same thing as V_{pop}, but is slightly less informative as it does not account for the differences in v_x among females of different ages. For this measure, "reproductively aged females" are defined as those of age 5-20, corresponding to the youngest age of first reproduction through the approximate age at which fecundity tapers off in the monk seal.

In addition to evaluating the number of potential mortalities, it is important to understand how sublethal effects may result in changes to the species' status. For the purposes of this analysis, we evaluate sublethal effects in terms of how they could result in changes to reproductive success.

Finally, in order to understand how the proposed research and enhancement activities contribute to conservation of the species more broadly, the proposed actions are compared against specific actions listed in the 2007 Hawaiian Monk Seal Recovery Plan (NMFS 2007). This element of the effects analysis qualitatively discusses how well the scope of research and enhancement

represented under each alternative would be able to address information needs for taking management actions that would promote recovery of the species.

The goal of the Recovery Plan is to promote the recovery of Hawaiian monk seals to the point that they could be down-listed from "endangered" to "threatened" and ultimately to the point that it could be removed from the list of threatened and endangered species under the ESA. Additional information on the 2007 Recovery Plan and its relevance to this PEIS is provided in Section 3.3.1.8.

Table 4.4-1 Impact Criteria for Hawaiian Monk Seals

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Mortality or survival enhancement	Magnitude and Intensity	Sufficient to cause measurable change in population status (*i.e.*, population growth rate, survival rates, V_{pop})	Equivocal change in population status (*i.e.*, population growth rate, survival rates, V_{pop})	Mechanism for effects on population status (*i.e.*, population growth rate, survival rates, V_{pop}), but status indistinguishable from baseline	NA
	Geographic extent/Biological level	Affects entire species throughout range	Effects limited to a single or a few subpopulations	Effects limited to a small number of individuals	NA
	Duration and Frequency	Long-term duration and high frequency	Moderate duration with high frequency or long-term duration with medium frequency	Short-term duration with moderate frequency or moderate duration with low frequency	NA
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely
Reproductive effects	Magnitude and Intensity	Sufficient to cause measurable change in reproductive success	Equivocal change in reproductive success	Mechanisms for effects but reproductive success similar to baseline	No mechanisms for reproductive effects
	Geographic extent/Biological level	Effects entire species throughout range	Effects limited to a single or a few subpopulations	Effects limited to a small number of individuals	No measurable effects
	Duration and Frequency	Long-term duration and high frequency	Moderate duration with high frequency or long-term duration with moderate frequency	Short-term duration with moderate frequency or moderate duration with low frequency	No measurable effects
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely
Contribution toward conservation objectives	Magnitude and Intensity	Addresses all conservation objectives in Recovery Plan	Addresses multiple conservation objectives in Recovery Plan	Addresses a few conservation objectives in Recovery Plan	Addresses no conservation objectives in Recovery Plan
	Geographic extent/Biological level	Research and enhancement benefits conservation of species throughout range	Research and enhancement benefits conservation of a single or a few subpopulations	Research and enhancement benefits a small number of individuals	Provides no enhancement benefits or useful information for management

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	Duration and Frequency	Provides immediate and long-term enhancement benefits and/or information needs	Provides periodic and long-term enhancement benefits and/or information needs	Provides periodic and short-term enhancement benefits and/or information needs	Provides no enhancement benefits or information for management
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

4.4.2 *IMPACT CRITERIA FOR OTHER BIOLOGICAL RESOURCES*

Tables 4.4-2 through 4.4-5 indicate the types of effects Hawaiian monk seal research and enhancement activities may have on other biological resources (species other than monk seals) that are assessed in this NEPA analysis. These tables summarize the criteria for determining the level of impact based on the magnitude, extent, duration and likelihood of occurrence. Where additional resource-specific information may provide further insight into the rationale behind impact criteria, these details are presented following each table. Sections 4.7.2 through 4.7.7 summarize the anticipated direct, indirect and cumulative effects under each alternative for other biological resources.

Table 4.4-2 Impact Criteria for Sea Turtles

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Reproductive effects	Magnitude or Intensity	Population level changes in reproduction over several breeding seasons.	Population changes in reproduction over one breeding season.	Changes in reproduction at the individual rather than population level.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location (bay or beach)	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Mortality	Magnitude or Intensity	Population-level effects observed	Sub-population or community level effects observed	Individual mortality observed but not sufficient to affect population survival.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

Table 4.4-3 Impact Criteria for Cetaceans

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Mortality	Magnitude or Intensity	Population-level effects observed	Sub-population or community level effects observed	Individual mortality observed but not sufficient to affect population survival.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Reproductive effects	Magnitude or Intensity	Population level changes reproduction in several species over several seasons.	Population changes in reproduction over one season.	Changes in reproduction effect a small number of individuals	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes that are likely to be permanent	Periodic, temporary, or short-term changes in an annual or several season cycle	Periodic, temporary, or short-term changes over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

Table 4.4-4 Impact Criteria for Fish

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Mortality	Magnitude or Intensity	Mortality to large numbers of fish.	Mortality to individual fish; no population level effects.	Mortality to very small numbers of fish.	No measurable effects
	Geographic Extent	Effects realized in multiple locations	Effects realized in multiple locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term changes that are likely to be permanent	Periodic, temporary, or short-term changes in an annual or several season cycle	Periodic, temporary, or short-term changes over one or two seasons	No measurable effect
	Likelihood	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

Table 4.4-5 provides criteria for analyzing the potential direct, indirect and cumulative impacts to birds based on their nesting, brood-rearing, and seasonal use patterns within the terrestrial portion of the Project Area. This area includes beach habitat up to 5 m inland from the upper reaches of the wash of the waves, as described in Section 1.3 Project Area Description, and areas where seasonal field camps at French Frigate Shoals, Pearl and Hermes Reef, Midway and Kure Atolls, and Laysan and Lisianski Islands are located (see Section 3.3.1.9).

Impact levels for the endangered Laysan finch were based on the Incidental Take Statement in the USFWS 2009 Biological Opinion for the Issuance of a Permit to Conduct Field Research on Hawaiian monk seals (USFWS 2009c).

Table 4.4-5 Impact Criteria for Birds

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Altered survival or reproduction (other than Laysan finch)	Magnitude or Intensity	Changes in survival or productivity in one or more avian species over several years.	Changes in survival or productivity in one avian species over several years.	Changes in survival or productivity in one avian species during one year.	No measurable effects
	Geographic Extent	Regional effects observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Habitat loss or alteration	Magnitude or Intensity	Population level changes in one or more avian species over several years.	Sub-population or level changes in one avian species over one or two years.	Impacts to individuals observed during one year.	No measurable effect
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Altered survival or reproduction of Laysan Finch	Magnitude or Intensity	Disturbance of more than 200 Laysan finch and/or more than 10 Laysan finch are incidentally injured over 5 years.	Disturbance of 200 Laysan finch and/or incidental injury or mortality of 10 Laysan finch over 5 years.	Disturbance of less than 200 Laysan finch and/or incidental injury or mortality of less than 10 Laysan finch over 5 years.	No measurable effect
	Geographic Extent	Effects realized at Laysan Island and Pearl & Hermes Reef	Effects realized at Laysan Island and Pearl & Hermes Reef	Effects realized in one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

1 - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

4.4.3 *IMPACT CRITERIA FOR SOCIOECONOMIC RESOURCES*

Table 4.4-6 presents a summary of mechanisms used to measure the effects that Hawaiian monk seal research and enhancement actions would have on the social and economic environment, and the criteria for determining the level of impact based on the magnitude, extent, duration, and likelihood of occurrence. These effects are primarily related to commercial fishing, subsistence fishing, recreational fishing, and recreation and tourism activities. Section 4.8 summarizes the anticipated direct and indirect effects under each alternative for these resources.

This analysis takes into account the economic and distributional effects of the various alternatives and their associated elements. The criteria in Table 4.4-6 specify the impact level in the context of existing socioeconomic activity. The impacts identified are translated into measures of overall expected changes in jobs, income, and quality of life in MHI.

The analysis of socioeconomic effects also discusses the distribution of effects of the proposed action – *e.g.*, what human populations are likely to be affected and

how, where the effects will occur, and what businesses or industries will be advantaged or disadvantaged.

Specifically, the analysis considers how certain elements of the alternatives would affect fishing and recreation/tourism in the MHI in terms of income and employment. It further looks into the specific populations that could be affected, such as commercial fishermen, residents involved in subsistence fishing, and residents and tourists recreating in the MHI. Social and economic effects are related to effects of an action or alternatives on human populations. Given that the NWHI is designated as the Papahānaumokuākea Marine National Monument (Monument), the only human presence relates to research or other permitted activities. There are no recognized communities on these islands. Further, there is no commercial fishing allowed in the Monument. Therefore, social and economic effects of the alternatives are unlikely in the NWHI, and this analysis focuses on the MHI.

For commercial fishing, the key indicator for measuring effects is the value of commercial landings, whereas effects on recreation/tourism and recreational fishing are largely based on the number of tourists or residents recreating in the MHI. Finally, effects on subsistence fishing are evaluated by looking at potential changes in the quantity of fish consumed for subsistence purposes and how that might vary across alternatives.

Table 4.4-6 Impact Criteria for Socioeconomics

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Changes in commercial fishing	Magnitude or Intensity	More than 10% increase or decrease in quantity and/or value of commercial landings	3% - 10% increase or decrease in quantity and/or value of commercial landings	Less than 3% increase or decrease in quantity and/or value of commercial landings	No measurable effects
	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood[1]	Likely	Likely	Somewhat unlikely	Unlikely
Changes in subsistence fishing	Magnitude or Intensity	More than 10% change in quantity of fish consumed for subsistence	3% - 10% change in quantity of fish consumed for subsistence	Less than 3% change in quantity of fish consumed for subsistence	No measurable effects
	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood	Likely	Likely	Somewhat unlikely	Unlikely
	Magnitude or Intensity	More than 10% change in number of recreational fishing trips	3% - 10% change in number of recreational fishing trips	Less than 3% change in number of recreational fishing trips	No measurable effects
Changes in recreational fishing	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood[1]	Likely	Likely	Somewhat unlikely	Unlikely
	Magnitude or Intensity	More than 10% change in recreation/tourist visits or expenditures	3% - 10% change in recreation/tourist visits or expenditures	Less than 3% change in recreation/tourist visits or expenditures	No measurable effects
Changes in recreation or tourism	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood	Likely	Likely	Somewhat unlikely	Unlikely
	Likelihood	Likely	Likely	Somewhat unlikely	Unlikely

NEPA requires the consideration of possible effects of proposed Hawaiian monk seal recovery actions on cultural resources as part of the human environment. The impact criteria for cultural resources (other than historic properties, which are dealt with separately) and traditional cultural practices are presented below. Cultural impacts are considered to be significant if they result in adverse effects to cultural resources or in any way impeded traditional cultural practices.

Table 4.4-7 Impact Criteria for Cultural Resources and Traditional Cultural Practices

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Changes to cultural resources or traditional cultural practices	Magnitude or Intensity	Adversely affects cultural resources and impedes traditional cultural practices	Cultural resources are affected, but not adversely; traditional cultural practices not significantly impeded	Possible contact with cultural resources, but no effect; no effect on traditional cultural practices	No contact with cultural resources; no effect on traditional cultural practices
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of their undertakings on any historic properties located within the Area of Potential Effect (APE) of a proposed project. These effects may be either direct or indirect. Impacts to historic and cultural resources, including historic structures, archaeological sites, and traditional cultural properties, would be considered significant if they result in adverse effects to the integrity of historic properties that are listed or are eligible for listing on the National Register of Historic Places (National Register). Integrity can be considered to mean not simply the physical integrity of a structure, but "the integrity of [its] location, design, setting, materials, workmanship, feeling, and association" (Title 36 C.F.R. § 60.4). Adverse effects are those that detract from the qualities that give a property its significance and contribute to its NRHP eligibility. Direct effects are those that physically alter the historic property in some way. Indirect effects diminish some significant aspect of the historic property, but do not physically alter it.

Table 4.4-8 Impact Criteria for Historic Properties

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Changes to Archaeological Sites	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility	Site is affected, but not adversely	Possible contact with site, but no effect	No measurable effects
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized few locations	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Changes to Historic Structures	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility	Site is affected, but not adversely	Possible contact with site, but no effect	No contact with site
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Changes to traditional cultural properties	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility or that significantly impede traditional cultural practices	Property is affected, but not adversely; traditional cultural practices not significantly impeded	Possible contact with property, but no effect; no effect on traditional cultural practices	No contact with property
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

Impact Criteria for Environmental Justice

According to 1997 CEQ guidelines, federal agencies must evaluate whether a proposed action would have a disproportionately high adverse impact on low income populations, minority populations or Indian tribes due to a proposed

action (CEQ 1997). Analysis of potential impacts may rely on available demographic data from credible sources such as the U.S. Census. The analysis of potential Environmental Justice impacts is based on the results of the other socioeconomic impact assessments such as fisheries, cultural and historic resources and tourism. Therefore, no specific impact criteria are presented here.

Impact Criteria for Military Activities

The criteria presented in Table 4.4-8 provide a scale on which to measure potential impacts of the proposed alternatives on military activities. Specific details and results of the analysis are presented in Section 4.8.7.

Table 4.4-8 Impact Criteria for Military Activities

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Changes to military training or operational activities	Magnitude or Intensity	Year-round change in military use or operations	Seasonal change in military use or operations	Slight change of military use or operations	No measurable effects
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Long-term or permanent	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50%.

4.5 Steps for Identifying Cumulative Effects

The CEQ guidelines for evaluating cumulative effects state that the greatest environmental effects may result not from the direct effects of a particular action but from the combination of individually minor effects of multiple actions over time (CEQ 1997). The CEQ regulations for implementing NEPA define cumulative effects as follows:

> *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 effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).*

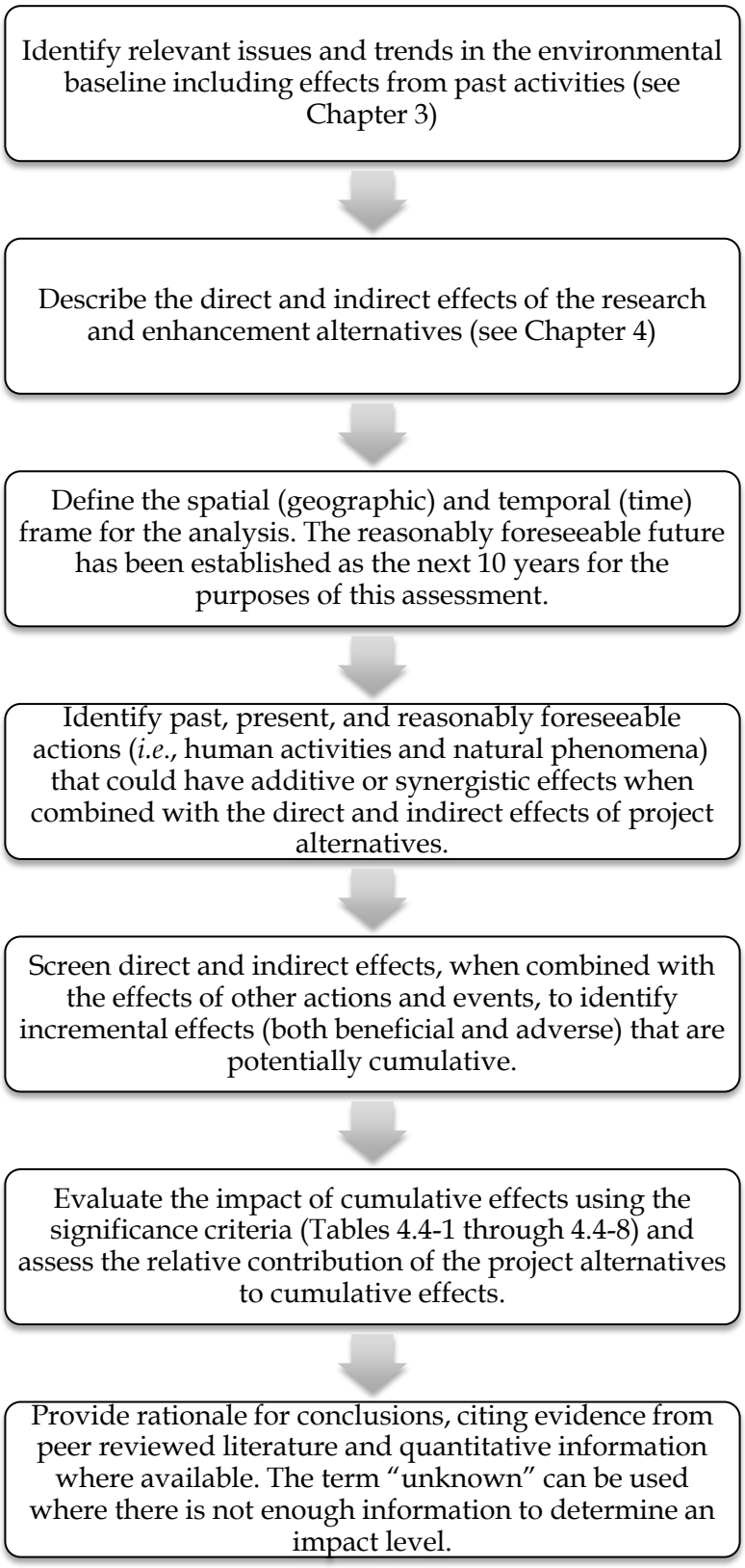
For this PEIS, assessment of cumulative effects requires an analysis of the direct and indirect effects of the proposed research and enhancement alternatives, in combination with other past, present, and RFFAs potentially affecting monk seals and other biological, physical, and socioeconomic resources. The intent of this analysis is to capture the total effects of many actions over time that would

be missed by evaluating each action individually. It is important to note that if the results of the analysis of direct or indirect effects of the proposed action are negligible, the contribution of the proposed action to a cumulative effect would not occur and thus an analysis of cumulative effects would not be presented. For example, physical oceanography will not be directly or indirectly affected by the proposed action and is therefore not carried forward for a cumulative analysis (see Section 4.6). Therefore, for resources where there would be negligible direct or indirect effects of alternatives (*i.e.*, marine water quality and environmental justice) do not have a detailed analysis of potential cumulative effects per CEQ guidance. Exceptions to this are certain topics of particular concern raised during the public comment period. For example, although negligible effects of proposed monk seal research and enhancement alternatives are expected for recreation and tourism, a more detailed assessment of potential cumulative impacts is presented due to specific stakeholder concerns.

Another purpose of this analysis is to assess the relative contribution the proposed action and its alternatives have on cumulative effects. The cumulative effects assessment then describes the additive or synergistic result of the research and enhancement alternatives as they are reasonably likely to interact with actions external to the proposed actions. The ultimate goal of identifying cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the alternatives.

The methodology used for cumulative effects analysis includes the steps outlined below. The advantages of this approach are that it closely follows 1997 CEQ guidance, employs an orderly and explicit procedure, and provides the reader with the information necessary to make an informed and independent judgment concerning the validity of the conclusions.

Figure 4.5-1 Steps in the Impact Assessment



4.5.1 RELEVANT PAST AND PRESENT ACTIONS WITHIN THE PROJECT AREA

Relevant past and present actions (federal and non-federal) and events are those that have influenced the current condition of a resource. For the purposes of this PEIS, past and present actions/events include both human controlled events (such as shipping or commercial fisheries), and natural events, such as predation. Table 4.5-1 provides a list of past actions and events considered in the cumulative effects analysis in this PEIS.

Table 4.5-1 Relevant Past and Present Actions within the Project Area

Action / Event	Region	Status	Resource(s) Potentially Affected	Source
Natural Events				
Natural Events (Tsunami, Volcano, Earthquake, Hurricane)	Hawaiian Archipelago	Ongoing	All	Pacific Disaster Center 2012
Climate Change	Hawaiian Archipelago	Ongoing	All	Hare & Mantua 2000; Friedlander et al. 2009; etc.
Introduction of Invasive species	Hawaiian Archipelago	Ongoing	1, 3, 4, 5, 6, 7, 8, 10	HISC
Shark predation	Hawaiian Archipelago	Ongoing	1	NOAA
Male monk seal aggression	Hawaiian Archipelago	Ongoing	1	NOAA
Scientific Research				
Research and enhancement permits issued since 2000 (HMS only)	Hawai`i	Ongoing	1	NOAA
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) (6 missions)	Hawai`i	August 16, 2008 - August 15, 2009	1, 3, 4, 5, 6, 7, 8	SURTASS 2012
Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island	Nihoa Island	Complete	1, 3, 6	PMNM
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge	Necker Ridge to Hawaiian Ridge	Complete	3, 4, 5, 6	PMNM
Comparison Study of the Biological Community Structure and Diversity of Maritime Heritage Resource Sites	PMNM	New permit	11	PMNM
Coral Reef Bioerosion Rates as Indicators of Community Response to Ocean Acidification	PMNM Shallow water reefs	New permit	8	PMNM
Determine prevalence of disease on coral reefs in shallow waters	PMNM shallow waters	New permit	8	PMNM
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems	PMNM	New permit	1, 2, 3, 4, 5, 6, 7, 8	PMNM
Humpback whale research	Maui, Molokai, Lanai, and Kahoolawe	Complete	4	NOAA
Incidence and Effects of Coral and Fish Disease within Shallow Water Reefs	PMNM shallow water reefs	New permit	6, 8	PMNM

Action / Event	Region	Status	Resource(s) Potentially Affected	Source
Long term monitoring Laysan & black footed albatross	Midway, FFS, Laysan	New permit	7	NOAA
Monitoring shark activity on monk seal pupping sites	FFS	New permit	1, 5	PMNM
Pacific Reef Assessment and Monitoring Program	PMNM	New permit	8	PMNM
Permit to conduct level B harassment and biopsy sampling of cetaceans in Hawaiian waters	Leeward coast of the island of Hawai`i	Complete	4	NOAA
PR 1 Permit #1071-1770 Long-term population studies of cetacean species in North Pacific Ocean	Main study area is Hawai`i	Complete	4	NOAA
PR 1 Permit #731-1774 cetacean scientific research	Hawai`i	Complete	4	NOAA
PR 1 Permit #978-1791 auditory research on stranded and rehabilitated cetaceans	Hawai`i (waters and rehabilitation facilities)	Complete	4	NOAA
PR1 Permit #587-1767 scientific research on long-term social affiliations among humpback whales	Alaska/Hawai`i	Complete	4	NOAA
Numerous PR1 Permits for cetacean research throughout Hawai`i and Pacific Ocean	Hawai`i	Complete	4	NOAA
Military Activities				
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS); NOAA Incidental Harassment Permits 18702 - 18705	Hawai`i	Ongoing	1-7, 10, 14	NOAA
Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai`i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	Hawai`i	Ongoing	1-7, 10, 14	NOAA
Permit 17860 US Navy Acoustic Technology Experiments	Hawai`i	Ongoing	1-7, 10, 14	NOAA
Other Activities				
Whaling	Hawai`i	19th Century	4	DLNR 2005
Guano mining	PMNM	19th and 20th Century	1, 3, 7	Rauzon 2001
Feather poaching	PMNM	20th Century	1, 3, 7	Rauzon 2001
Whale watching (tour boats)	MHI	Ongoing	4, 12	USN
Removal of marine debris from high entanglement zones	Hawai`i	Ongoing	1, 3, 4, 5, 6, 7, 8, 10, 12	NMFS

Action / Event	Region	Status	Resource(s) Potentially Affected	Source
Entanglement of Hawaiian monk seals in marine debris or fishing gear	Hawai`i	Ongoing	1	NMFS
MMHSRP and other NMFS Permits to disentangle, dehook and relocate seals away from harmful situations; Permit also includes activities for other marine mammals and sea turtles including: stranding networks ; responses/investigations of mortality events Biomonitoring; tissue/serum banking; and analytical quality assurance.	Hawai`i	Ongoing	1, 3, 4, 10	NMFS
Intentional shooting, maiming, injury or other harm of Hawaiian monk seals	MHI	Ongoing	1	NMFS
Habitat protection, loss mitigation and restoration	Hawai`i	Ongoing	1, 3, 4, 5, 6, 7, 8, 10, 12	NMFS
Natural resource and species education and outreach	MHI	Ongoing	1, 3, 4, 5, 6, 7, 8, 10, 12	NMFS
SEIS Measures to End Bottomfish Overfishing in the Hawaiian Archipelago	Hawai`i	Complete	6, 8, 10	WPRFMC 2006
Final EIS Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (2005)	Hawai`i	Complete	6, 8, 10	WPRFMC
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	NWHI	Complete	6, 8, 10	WPRFMC
Fishery Ecosystem Plan for the Hawai`i Archipelago	Hawai`i	Complete	1-10, 12, 14	WPRFMC
Pilot Aquaculture Project (Tuna cultivation)	2.6 mi. off Malae Point, Hawai`i	Complete	10	USACE 2010
UNESCO World Heritage Site Monument	NWHI	Designated 2010	11	UNESCO
Building islands using dredge and fill	PMNM	Mid-20th Century	1-8	Rauzon 2001
LORAN station	PMNM	Mid-20th Century	1-8	DLNR 2005
Wailupe Stream Flood Control	East Honolulu	Underway as of 2008	1, 2, 3, 5, 6, 7, 8	HRC FEIS/OEIS 2008
Beach Park Improvements	MHI (various sites)	Ongoing	12	DLNR 2013
Wai`anae Wastewater Treatment Plan (deep ocean outfall)	Wai`anae Coast (Oahu)	NPDES Permit 2011-2016	1, 2, 3, 4, 5, 6, 7, 8, 10	HRC FEIS/OEIS 2008
Lā`ie Wastewater Collection System Expansion Phase II	Lā`ie (Oahu)	2004	1 - 10	HRC FEIS/OEIS 2008
Permit 17268 Honolulu Seawater AC (Incidental Take)	Offshore Kakaako (Oahu)	September 2012 – 2013	4	NOAA
Seabird consumption, egg harvest, nest loss to	Lay, Lis, Mid	1842-1915	7	Schultz et al. 2011.

Action / Event	Region	Status	Resource(s) Potentially Affected	Source
guano harvest, introduced species, chick mortality due to removal of adults				
Monk seal harvest for meat, skins and shark bait	NWHI	19th century	1	Schultz et al. 2011.
Turtle harvest for meat, eggs and shark bait	NWHI	18th-19th centuries	3	Schultz et al. 2011.
Shark harvest for fins and oil.	NWHI	1859-1900; 2000	5	Schultz et al. 2011.
Unregulated fishing	NWHI	1913-2002	6, 10	Schultz et al. 2011.
Commercial, recreational and subsistence fisheries	Hawai`i	Ongoing	1, 3, 5, 6, 10	WPFMC 2013
Sea cucumber harvest	Lay, Lis, PHR, FFS	1882	6, 10	Schultz et al. 2011.
Black-lipped oyster harvest	PHR	1928-1930	6, 10	Schultz et al. 2011.
Coral harvest and illegal poaching	NWHI, Gardner, Lay	1965-1980s	8, 10	Schultz et al. 2011.
Lobster harvest	NWHI	1970-1999	6, 10	Schultz et al. 2011.
Legislation				
Hawai`i Act 165 (Class C felony to harass or kill monk seals	Hawai`i	June 2010	1	State of Hawai`i
Hawai`i Cultural Impact Assessment Bill: House Bill 2895	Hawai`i	January 1, 2012	11	State of Hawai`i
Hawai`i Environmental Justice Bill: Senate Bill 2145	Hawai`i	2006	10, 11, 13	State of Hawai`i
Hawai`i Environmental Policy Act (HRS 343)	Hawai`i	1974	All	State of Hawai`i
National Historic Preservation Act	United States	1966	11	U.S. Government
EO 12898: Environmental Justice	United States	1994	10, 11, 13	U.S. Government
Resource Key: 1 – Hawaiian monk seals 6 – Other Fish Species 11 – Cultural & Historical	2 – Water Quality 7 – Birds 12 – Recreation & Tourism	3 – Sea Turtles 8 – Coral 13 – Environmental Justice	4 – Cetaceans 9 – Invasive Species 14 – Military Activities	5 – Sharks 10 – Fishing (Commercial, Recreational & Subsistence NA - Not available

4.5.2 *Reasonably Foreseeable Future Actions*

Reasonably foreseeable future actions (RFFAs; federal and non-federal human-controlled actions and natural events) are those that:

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

Judgments concerning the probability of future impacts must be informed rather than based on speculation. RFFAs to be considered must also fall into the temporal and geographic scope described in Section 1.3 (Project Area Description).

Reasonably foreseeable future human controlled actions and natural events were screened for their relevance to the alternatives proposed in this PEIS. Because the regulations in 40 CFR 1508.8 state that the actions and events must be considered probable, not just possible, only those actions with an occurrence probability of high or medium have been included for analysis and shown in Table 4.5-2. Due to the large geographic scope of the Project Area, the identification of RFFAs was conducted on a broad scale, although some specific RFFAs were considered where applicable. Table 4.5-2 provides a list of RFFAs considered in the cumulative effects analysis in this PEIS. Also included in the following table is a list of resources that may potentially be affected (beneficially or adversely) by the activity. The resources listed are limited to only those that have been carried forward for analysis in this PEIS.

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Table 4.5-2 Reasonably Foreseeable Future Actions Within the Project Area

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
Natural Events						
Climate Change	Hawaiian Archipelago	Ongoing	Ongoing	High	All	NOAA
Tsunami, Volcanic eruption, Earthquake, Hurricane	Hawaiian Archipelago	Ongoing	NA	Medium	All	NOAA
Japanese Tohoku earthquake and tsunami debris	Hawaiian Archipelago	Ongoing	Ongoing	High	All	IPRC 2012a, b
Introduction of invasive species	Hawaiian Archipelago	Ongoing	Ongoing	Medium	1-10	HISC
Disease	Hawaiian Archipelago	Ongoing	Ongoing	High	All	NOAA
Commercial Activities						
Inter-Island Transmission Cable	Maui, Oahu	Draft EIS	2014	High	1, 2, 3, 4, 5, 6, 8, 9, 10	DBED Hawai`i State Energy Office
Kampachi Farms, LLC permit to Culture and Harvest Coral Reef Fish Species (*Seriola rivolialla*); Permit WP-CRSP-01	Island of Hawai`i (west coast)	Permitted	Ongoing	High	10	NMFS
Residential & Commercial construction (beach, near shore)	Various	Ongoing	Ongoing	High	1, 2, 3, 9, 10, 11, 12	DBED (Hawai`i) CIP List
Honolulu Harbor Pier 12 & 15 Improvements	Honolulu, Hawai`i	Permitting	2013/2014	High	8	DOT Harbors Division
Kalaeloa Barbers Point Harbor Fuel Pier	Ewa, O'ahu	EIS	September 9, 2013	High	2	DOT Harbors Division
Whale & dolphin watching tours	MHI	Permitted	Ongoing	High	1, 3, 4, 12	NOAA
Other Activities						
Hawaiian Monk Seal Rehabilitation Facility at Natural Energy Laboratory of Hawai`i Authority	Keahole Point, Hawai`i	Permitted	Operational 2013	High	1	National Energy Laboratory
Kalaupapa NHP General Management Plan and EIS	Moloka`i	Draft EIS	2013-2014	High	11, 12	NPS
Fishery Ecosystem Plan for the Hawai`i Archipelago	Hawaiian Archipelago	Ecosystem Plan	Ongoing	High	1-12, 14	WPRFMC

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
Commercial, recreational and subsistence fisheries	MHI	Ongoing	Ongoing	High	1, 3, 5, 6, 10	Sprague et al 2013
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions	Hawaiian Archipelago	DEIS Fall 2013	Ongoing	High	1-9	NOAA
Hawaiian Spinner Dolphin Human Interaction Protection Measures	MHI	DEIS/Proposed Rule	Ongoing	High	1, 3, 4, 10, 12	NOAA
Hawaiian Monk Seal Critical Habitat Revisions	Hawaiian Archipelago	Proposed Rule Under Revision	Ongoing	High	1	NOAA
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	MHI	2011 Declaratory Ruling	Ongoing	High	1-12	USACE
Shark Removal Activities. Permit Number: PMNM-2013-017	PMNM	Permitted	May 31, 2014	High	1, 5	NOAA
ESA Proposed Listing of 82 Coral Species	Hawaiian Archipelago	Status Review	Unknown	High	8	NOAA
Kukuiula Bay Beach Nourishment	Koloa, Kaua`i	Draft EA	2013/2014	High	12	DLNR
CDUA: MA-3633 Stable Road Beach Groins project (beach restoration)	Wailuku, Mau`i	Permit Application	DLNR Recommendation for approval March 2013	High	12	DLNR
Waikoloa Beach Tsunami Restoration Project	South Kohala, Hawai`i	Permit Application	September - December 2013	High	11, 12	DLNR
Military Activities						
Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai`i Range Complex (Hawai`i Southern California Training and Testing Activities [HSST])	Hawai`i (235,000 nm^2 around the MHI	Permitted	Permitted	High	1, 4, 14	US Navy
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA); Permits 18702 - 18705	Pacific Ocean	FEIS	Permitted	High	4, 5, 14	SURTASS
Permit 17860 US Navy Acoustic Technology Experiments	Hawai`i	Permitted	Permitted	High	1, 4, 5	NOAA

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
Joint High Speed Vessel	Hawai‘i	Ongoing	2012 Vessel Trials	Medium	3, 4, 5	NOAA
Scientific Research						
Permit 15453 Enhancing Survival of Hawaiian monk seal (*Monachus schauinslandi*) (Captive animals [research enhancement])	Waikiki Aquarium, University of Hawai‘i 2777 Kalakaua Avenue Honolulu, HI 96815	Permitted	April 2012 – April 2017	High	1	NOAA
Permit 10018 Level B Harassment of Humpback Whales in the Near Shore Waters Around Maui, Hawai‘i (Harass)	Waters of the Au-Au Channel and in the near shore waters of Maui, Molokai‘i, Lāna‘i, and Kaho‘olawe.	Permitted	June 2010 – June 2014	High	4	NOAA
Permit 13427 Vessel surveys and photo-id of non-listed cetaceans (Harass)	Pacific Ocean deeper waters (>100 fathoms) South and West of Lanai and Kahoolawe	Permitted	June 2008 – June 2014	High	4	NOAA
Permit 13545 Global ecology and toxicology of cetaceans (Harass / Sampling)	Pacific Ocean, High seas	Permitted	June 2010 – June 2015	High	4	NOAA
Permit 13846 Behavior, social organization and communication in humpback and gray whales in Hawai‘i, Alaska and Washington (Harass; Sampling)	MHI	Permitted	July 2010 – July 2015	High	4	NOAA
Permit 14097 NMFS Southwest Fisheries Science Center (SWFSC) pinniped, cetacean and sea turtle studies (Harass)	North Pacific Ocean	Permitted	July 2010 – June 2015	High	3, 4	NOAA
Permit 14118 Medium to long-term satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans (Harass)	HI, including PMNM	Permitted	May 2012 – April 2017	High	4	NOAA
Permit 14245 Cetacean Research at the National Marine Mammal Laboratory (Harass)	Alaska and US West Coast (CA, HI, OR, WA)	Permitted	April 2011 – May 2016	High	4	NOAA

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
Permit 14353 Humpback whale research around Maui, Hawai`i (Harass; Harass / Sampling)	Au-au Channel; Moloka`i; Maui; Kaho'olawe, and Lāna`i	Permitted	July 2010 – July 2015	High	4	NOAA
Permit 14381 Sampling sea turtle bycatch in Hawaiian Longline Fisheries (Handle / Release)	Hawai`i Shallow-Set Longline Fishery	Permitted	February 2010 – March 2015	High	3	NOAA
Permit 14451 Assessing distribution and abundance of marine mammals on Navy operational area; surface vessel surveys, photo identification, videography, and acoustic recording (Harass)	MHI; HIHWNMS; PMNM; US Navy PMRF	Permitted	July 2010 – July 2015	High	4	NOAA
Permit 14585 Behavior and biology of humpback whales (Harass; Harass / Sampling)	Hawaiian Islands EEZ	Permitted	July 2010 – July 2015	High	4	NOAA
Permit 14682 Scientific Research or to enhance the survival or recovery of a stock (Harass; Harass / Sampling)	Western O`ahu; Au Au Channel	Permitted	August 2010 – November 2015	High	4	NOAA
Permit 15240 Scientific Research and to enhance survival and recovery of Central and Western Pacific cetacean species (Harass; Harass/Sampling; Import/export/receive only; Incidental take)	U.S. EEZ waters. International waters, and foreign waters, subject to permission of the sovereign host State	Permitted	May 2012 – May 2017	High	4	NOAA
Permit 15330 Studies of population size, population structure, habitat use, movements, behavior and ecology of cetaceans (Harass / Sampling)	Hawai`i, territories (*e.g.*, Palmyra, American Samoa, Guam, Wake), and International waters)	Permitted	July 2011 – August 2016	High	4	NOAA
Permit 15409 Population and photo-id studies of small (Harass)	Pacific Islands (EEZ and American Samoa)	Permitted	June 2010 - June 2015	High	4	NOAA

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
Permit 15685 Ocean capture research of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles in the Hawaiian Islands (Capture/Handle/Release)	Coastal waters (bays, reefs, canals, etc.); Kaneohe Bay	Permitted	January 2012 – January 2017	High	3	NOAA
Permit 16053 Measuring the hearing of stranded cetaceans in U.S. waters, beaches and rehabilitation centers using auditory evoked potential procedures (Captive)	U.S. coasts and rehabilitation centers	Permitted	February 2012 – February 2017	High	4	NOAA
Permit 16163 Studies of movements, habitat use, ecology, behavior, and risk factors of cetaceans in the Pacific Ocean. (Harass; Harass/Sampling)	Pacific Ocean: WA, OR, CA, HI, AK, High Seas North Pacific Ocean	Permitted	June 2012 – June 2017	High	4	NOAA
Permit 16479 Whale surprise encounters and near misses: proxies of vessel strikes in Maui County waters (Harass)	Maui County Waters (Latitude: 20.901025 Longitude: -156.615839)	Permitted	September 2012 – June 2017	High	4	NOAA
Permit 16599 Evoked Potential Auditory Tests for Stranded Marine Mammals (Handle / Release)	All US Waters - Stranding locations; beaches and rehabilitation centers	Permitted	March 2012 – April 2017	High	4	NOAA
16992 Paul Nachtigall – auditory research on captive cetaceans (HIMB) (Captive)	Hawaii Institute of Marine Biology	Permitted	May 2013 – May 2018	High	4	NOAA
Permit 17159 Spinner dolphin filming at Midway Atoll (Harass)	Midway Atoll; PMNM	Permitted	May 2012 – May 2017	High	4	NOAA
Permit 727-1915 scientific research (Harass; Harass / Sample)	Hawai'i / Palmyra Atoll	Permitted	February 2008 – February 2014	High	4	NOAA
File No. 14809 Permit to take cetaceans for ecological and bioacoustic research using tagging and behavioral research methodologies (Harass / Sampling)	Coastal and offshore waters surrounding MHI and NWHI	Application for 5-year permit	In-process	High	4	NOAA

RFFA	Region	Status	Time Frame	Probability	Resource(s) Potentially Affected	Source
File No. 16239 Aerial and vessel surveys, behavioral focal follows, and PAM monitoring techniques to further our understanding of marine mammals sharing waters with US Naval training, offshore energy development, and construction (Harass)	Pacific Ocean - Focal areas include Navy Hawaii Range Complex	Application for 5-year permit	In-process	High	4	NOAA
File No. 17312 Study of Marine Mammal Use of Sound and Response to Anthropogenic Impacts (Harass; Harass / Sample)	Hawai`i	Application for 5-year permit	In-process; will replace Permit 727-1915	High	4	NOAA
File No. 17845 Habitat use and behavioral dynamics of maternal-female, calf and juvenile humpback whales in feeding and breeding regions (Harass)	Coastal waters around Main Hawaiian Islands / All coastal waters and inter-island channels around MHI; Kauai and Ni'ihau, Oahu, Big Island and Penguin Banks, west of Lanai.	Application for 5-year permit	In-process; will replace Permit 10018	High	4	NOAA
Monitoring of Red-footed, Brown, and Masked Boobies from Midway Atoll and French Frigate Shoals	Tern Island, FFS, Eastern Island, Midway Atoll NWR	Permit Application	Dec 2010 - Dec 2015	High	7	PMNM
Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas	Kure, Lisianski, FFS, Nihoa	Permitted	NA	High	1, 3, 4, 5	PMNM
Tuna Tagging	Near NOAA weather buoys in MHI	Permitted	Ongoing	High	6	PFRP (SOEST)

Resource Key:
1 – Hawaiian monk seals
2 – Water Quality
3 – Sea Turtles
4 – Cetaceans
5 – Sharks
6 – Other Fish Species
7 – Birds
8 – Coral
9 – Invasive Species
10 – Fishing (Commercial, Recreational & Subsistence
11 – Cultural & Historical
12 – Recreation & Tourism
13 – Environmental Justice
14 – Military Activities
NA - Not available

4.6 *Resources and Characteristics Not Carried Forward for Analysis Under Environmental Consequences*

CEQ regulations require NMFS to focus attention on important issues and avoid extraneous material in this impact statement (40 CFR 1502.15). Under CEQ regulations for implementing NEPA:

- "Direct effects" are effects that are caused by the action and occur at the same time and place (40 CFR 1508.8[a]).
- "Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]).

Agencies must only consider indirect effects that are "reasonably foreseeable." Several of the resources and characteristics described in Chapter 3 may contribute to cumulative effects but would not be affected measurably by any of the alternatives for Hawaiian monk seal research and enhancement measures. Thus, additional analysis of these resources would not be useful to the decision makers or public.

As described in Section 2.6 Alternatives Carried Forward for Analysis, the range of Hawaiian monk seal research and enhancement activities proposed could include:

- Conducting land-based, vessel, and aerial surveys and observations;
- Mitigating infectious disease, and fishery and human/domestic animal interactions;
- Translocating seals to improve survival;
- Translocating seals to alleviate male aggression, and mitigating adult male aggression using chemical intervention;
- De-worming seals and providing supplemental feeding; and
- Capturing, restraining and handling seals for marking and attaching scientific instruments, measuring, and sampling (*e.g.,* for health and genetics).

None of these activities would have a measurable effect on the resources described below. The following subsections present each resource or factor not carried forward for detailed analysis.

4.6.1 *PHYSICAL ENVIRONMENT - CIRCULATION PATTERNS, WATER TEMPERATURES AND NUTRIENT REGIMES, AIR QUALITY, CLIMATE CHANGE*

None of the research and enhancement alternatives would be expected to have any effects on the circulation patterns in the Pacific Ocean, water temperatures and nutrient regimes, or air quality. Therefore, detailed analysis for these parameters under the alternatives is not warranted. In addition none of the proposed project alternatives would be expected to induce measurable effects on climate change. However, climate change is being considered from the

perspective of cumulative effects. The potential effects of climate change generated by other sources are evaluated as part of the cumulative effects analyses for each resource evaluated in Chapter 4.

4.6.2 *SHARKS*

As described in Section 3.3.4, approximately 40 species of sharks are found in Hawaiian waters. None of the proposed Hawaiian monk seal research and enhancement alternatives covered by this PEIS and that would occur in the coastal waters surrounding the Hawaiian Islands is likely to have direct or indirect effects on sharks. Researchers accessing beaches and inshore areas by small boat to observe, capture, handle or transport Hawaiian monk seal would not be likely to disturb pelagic sharks. Research vessels might encounter sharks while traveling in small or large vessels between islands to areas where Hawaiian monk seal are located, but any encounters are not expected to impact sharks. In addition it is not expected that the small increase in numbers of monk seal pups that could be realized in the MHI under Alternative 4 would attract additional large numbers of sharks.

As described in Table 1.6-1, NMFS currently has a permit for "Selective removal of predatory sharks at Hawaiian monk seal pupping sites of French Frigate Shoals" (Monument Permit No. PMNM-2013-017). This activity is not part of the proposed research and enhancement actions covered by this PEIS, and it has been documented under a separate NEPA process (Section 1.7).

4.6.3 *ESA-LISTED PLANTS*

Proposed Hawaiian monk seal research and enhancement activities would have no effect on any of the endangered plants that occur in the NWHI or MHI (NMFS 2009b). The proposed activities would be located in coastal waters on the beach or within 5 m inland of the splash zone. Field research camps in the NWHI are located further inland than this immediate shoreline area.

Some listed plants may occur near field camps or trail paths leading to beaches where monk seals haul out. These species are threatened by human disturbance and are known to exist in areas where humans access beaches. Monument Permit PMNM 2011-001 (Appendix L) allows NMFS researchers to enter the Monument to conduct research and enhancement activities, and covers field camp support and supply activities. Although the permit does not specifically identify procedures for protecting ESA-listed plants, NMFS would take all precautions necessary to avoid contact with these plants. This includes training biologists on the identification and locations of such plants and working with the USFWS to develop a training protocol to implement for work in the MHI (similar to that implemented for work in the NWHI). When accessing beaches by foot, researchers would stay on the path where no vegetation occurs. When accessing beaches by boat, they would only land on sandy beaches below the vegetation

line. It would be highly unlikely that research biologists would encounter coastal ESA-listed plant species, or they would be easily avoidable.

4.6.4 SANCTUARIES, MONUMENTS, AND REFUGES

As described in Section 3.4.11 Sanctuaries Monument and Refuges, the State of Hawai`i has a system of conservation areas that include wildlife and marine sanctuaries, monuments, parks, refuges, natural area reserves, and marine life conservation districts (MLCD). The jurisdictional authorities for these public lands are described in Section 3.4.11. The majority of these areas are federally managed; however the MLCDs are managed by the state. Some of the proposed research and enhancement activities could occur on or near Hawaiian shorelines and waters that fall under one or several of these special designations.

Whether under state or federal jurisdiction, these areas are protected; therefore, research and enhancement activities that would access coastal or refuge lands would require permits and/or approvals for access to these areas. For example, research scientists wishing to work within the Monument are required to obtain a Monument research permit. The permit allows the permit holder to conduct their permitted activities within the Monument. For work within the state protect areas, a Special Activity Permit for Scientific, Educational or Propagation Purposes is required under HRS 187A-6. The permit allows any person with a bona fide scientific, educational or propagation purpose to legally take certain aquatic life, use certain gear, and gain entrance into certain areas otherwise prohibited.

The permit applications required in sanctuaries, monuments and refuges must go through a public process as well as regulatory and agency reviews. Thus, impacts to protected lands and waters from research and enhancement activities are not expected because of imposed requirements such as mitigation to avoid adverse effects to these areas. Also, none of the proposed alternatives would be expected to affect or change the designations of these protected areas in any way. Therefore, sanctuaries, monuments and refuges are not carried forward for detailed analysis.

4.7 Biological Environment

4.7.1 HAWAIIAN MONK SEALS

This section presents the analyses of the effects of the four different research and enhancement alternatives on Hawaiian monk seals. The general methodology for performing this assessment is introduced in Section 4.4. However, a description of the Hawaiian monk seal-specific analysis is presented here in more detail. The alternatives represent discrete sets of research and enhancement activities varying in scope, each with a range of research and enhancement techniques and intensities that could be authorized by NMFS OPR.

Research and enhancement activities on endangered species are intended to determine factors limiting recovery, design intervention measures and execute those measures, evaluate their efficacy and repeat the process as warranted. However, any research and enhancement activity that has the potential to disturb animals has some risk of adverse effect for animals exposed. Animals disturbed by research and enhancement may exhibit a variety of behavioral and physiological responses that could result in injury, reduced reproductive success, or mortality. Similarly, animals' behavioral and physiological responses to capture, chemical or physical restraint, tissue sampling, attachment of tags or instruments, and exposure to various other marking or sampling procedures can result in injury, infection, reduced fitness, and mortality.

For each type of research and enhancement activity there are one or more possible responses from the animals. For some research and enhancement activities (*e.g.,* aerial surveys) most monk seals exhibit no observable response, although it is possible they may have elevated adrenaline levels or other internal stress responses. For research and enhancement activities that require the presence of researchers on land near monk seals, most animals will remain sleeping undisturbed, others will simply watch researchers, and others may move their bodies, vocalize or enter the water.

Seals that are captured and handled will be subject to additional types of stress and risks compared to those that are simply observed. The intensity and probability of potential responses is a function of a variety of factors including the sex/age class of the animal, the tendency of the individual animal to respond in certain ways, the approach and handling technique of the researchers, timing and location of the research or enhancement activity, and environmental factors such as sea conditions and weather. Each research and enhancement activity therefore has inherent potential risks, which are influenced by all the above factors.

Potential population- or species-level impacts could result depending on the nature of all individual responses and the number of animals involved. The effect of exposure to a variety of research and enhancement procedures may be additive or synergistic (*i.e.,* the effect of two or more procedures combined could be greater than simply adding them together). For all of the procedures analyzed, it is assumed that all researchers are experienced and qualified to fill their assigned roles and that all procedures are carried out under "best practices" conditions, including all mitigation measures specified in program protocols and the relevant permits.

The analysis of the direct and indirect effects of research and enhancement activities is divided into three major components:

- An assessment of research- and enhancement-related injuries that lead to serious injury or mortality;

- An assessment of research and enhancement-related effects on reproductive success; and
- An assessment of how well each alternative research and enhancement strategy would address recovery and conservation objectives for the species.

Potential positive effects of research and enhancement are evaluated based on the project's likelihood of contributing to the species recovery or conservation, in consideration of the potential adverse effects. The criteria for determining the impact level of each component are summarized in Table 4.4-1.

4.7.1.1 *ASSESSMENT OF DIRECT AND INDIRECT MORTALITY OF HAWAIIAN MONK SEALS DUE TO RESEARCH AND ENHANCEMENT*

There are many potential mechanisms for research and enhancement-related injuries to occur, some of which may lead directly or indirectly to the death of individual animals. Some injuries may affect the ability of an animal to forage or behave normally but are not directly fatal (*i.e.*, sub-lethal effects). The thresholds for sub-lethal effects (*i.e.*, when they start to affect an animal's ability to survive) are not well known. There are many other natural and anthropogenic factors that also affect survival of individual animals, so attributing the fate of an animal to a particular factor is often highly uncertain. The key question for this impact assessment is whether or not effects on individuals translate into population-level effects such as population growth rate.

The following begins with an extensive narrative describing the potential or hypothetical ways that the research and enhancement activities represented in the various PEIS alternatives (see Chapter 2) might affect survival of individual seals. Following that, available information from published studies, publications in development and unpublished data are brought to bear to guide the quantitative and qualitative analysis of potential effects of research and enhancement activities on monk seal mortality.

4.7.1.2 *MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM DISTURBANCE*

The extent to which human activities may have adverse effects on wildlife has recently become a source of conservation interest. Human disturbance causes a deviation in an animal's behavior from normal patterns that occur without human influence. There are numerous potential responses to different disturbances that could affect an individual's chance of survival and reproductive success. If the disturbance is severe and/or frequent enough to affect the fitness of many individuals, it may have population-level effects.

One type of response to disturbance is an animal's decision to move away from disturbed areas. This decision may be influenced, other than by the disturbance itself, by factors such as quality of the site being occupied, distance and quality to

other suitable sites, relative risk of predation, density of competitors, and the investment the individual has made onsite (Gill *et al.* 2001a). The decisions made by animals in response to human disturbance, and the consequences thereof, have been compared to the decisions they make in response to predation risk (Frid and Dill 2002). Animals with suitable habitat nearby may move away from a disturbance simply because there is an alternative site. Conversely, animals with no suitable habitat nearby may remain despite disturbance and regardless of the survival or reproductive consequences (Gill *et al.* 2001b).

A review of available literature on responses of numerous species to a variety of human activities suggests that the behavioral and physiological responses of individuals and their consequences are highly variable and influenced by multiple factors. For example, Anderson *et al.* (1996) found that there were no long-term effects of military activities on moose, and Englehard *et al.* (2002) concluded there were no long-term effects on elephant seals from human disturbance. However, Kerley *et al.* (2002) found that roads and traffic affected the reproductive success and survivorship of Amur tigers, and Blackmer *et al.* (2004) found that human disturbance affected hatching success and nest-site fidelity of Leach's storm petrel.

In addition to assessing behavioral responses and population parameters, a frequently measured indicator of the vertebrate stress response is stress hormones: glucocorticoids (GC), typically cortisol and corticosterone (Wingfield *et al.* 1997). Research on drivers influencing hypothalamic-pituitary-adrenal (HPA) activation, GC release and related physiological and behavioral processes are also numerous (Keay *et al.* 2006). A short-term stress response to an acute, ephemeral stressor represents an adaptive ability to cope with the stimulus, focusing on the immediate survival of the animal while suspending future processes such as energy storage as fat, production of gametes and growth (Reeder & Kramer 2005). A chronic stress response to a persistent stressor, however, can be detrimental to the organism and result in cell death, immunodeficiency, muscle wasting, reproductive suppression, and memory impairment (Reeder & Kramer 2005).

Studies on a wide range of vertebrates indicate that physiological stress responses can be reliably and repeatedly characterized by measuring GCs pre- and post-disturbance or among population subsets that vary in their exposure to a disturbance (Baker *et al.* 2013; Busch & Hayward 2009). Assessing adrenal activity through GC measurement in blood and fecal samples has become increasingly popular in recent decades, however, other physiological measures, such as cardiac response and immuno-competence are also common (MacArthur *et al.* 1979; Moen *et al.* 1982; Tarlow and Blumstein 2007).

In a review of 290 studies on stress responses of wildlife to ten disturbances, the effect of capture and handling was most frequently examined, followed by land use and alteration, human presence (*e.g.* tourism, number of people in an area, human-flushing, human interaction) and husbandry activities (*e.g.* confinement,

herding, hot-branding, stocking, feeding) (Baker *et al.* in review). An increase in GCs was consistently associated with capture and handling (significant in 80% of tests) and land use and alteration (significant in 100% of tests) across species tested; whereas the effects of human presence and husbandry were more variable (significant in 62-65% of tests) (Baker *et al.* in review).

GCs have been measured in a number of marine mammals in association with disturbances. For example, GCs increased with toxin exposure, predators, capture, and entanglement, but not significantly influenced by isoflurane anesthesia and hot-branding; other correlates were also influential (pregnancy, lactation, other hormones, age, season, time of day, gender) (Gulland *et al.* 1999; Ortiz *et al.* 2000; Oki & Atkinson 2004, Bozza & Atkinson 2005; Petrauskas *et al.* 2005; Hunt *et al.* 2004; Mashburn and Atkinson 2007; Mellish *et al.* 2007). Most of these studies focused on captive animals.

For wild marine mammal populations, identifying, monitoring and analyzing covariates demonstrated to be relevant to stress physiology in other vertebrates (*e.g.,* age, reproductive state, social status) may aid in accurate characterization and interpretation of results (*e.g.*, Goymann *et al.* 2001 and Gobush *et al.* 2008). A failure to account for a sufficient number of relevant variables may preclude an adequate context for sound evaluation. For example, significant GC patterns may be masked by noise from other biological factors and a particular disturbance may incorrectly be deemed to have no effect on stress physiology, contributing to some inconsistent trends between vertebrate stress responses and disturbances that are apparent across studies and species.

A measured temporary rise in GCs in response to capture or disturbance might have consequences on individual fitness if it became chronic. However, though baseline GC measures can predict the relative fitness of individuals and populations, the relationship is not always consistent or present for a particular population or species (Bonier *et al.* 2009). For example, increased GCs were associated with increased probability of death (of individuals) or diminished viability (of offspring) in 73% of tests across 42 vertebrate studies (Baker *et al.* in review). GCs may be evaluated in Hawaiian monk seals in the future to help indicate stress.

Behavioral indices can provide a useful complement to GC measures and can help determine the risks of their activities to populations. For example, some studies have considered post-disturbance recovery to be attained when a certain percentage of the animals present at the time of the disturbance return to shore (*i.e.*, Allen *et al.* 1984) or by applying statistical approaches that consider average densities and daily variation in numbers onshore (*i.e.*, Kucey 2005). Alternatively, long-term population assessment, which can determine relationships between disturbances such as handling events and individual condition and survival, offer considerable insight.

In the case of Hawaiian monk seal research and enhancement activities, great pains are taken to avoid disturbance. In the cases when it does occur, it typically involves only a single or at most a few animals at once. Disturbances that occur during activities that do not involve capture or handling monk seals, usually amount to the seal simply looking at the researcher, perhaps swinging its head and lying back down. The most dramatic response is that a seal may move down the beach, enter the water and swim some distance away. Even in these cases, the seals rarely exhibit what would be interpreted as a panic flight response.

Thus, observable monk seal response to disturbance is entirely distinct from research on other types of pinnipeds which congregate in dense colonies, where hundreds to thousands of animals can be disturbed in a single event, leading to stampedes to the water (Lewis 1987). One study (McMahon *et al.* 2005) tracked the survival of endangered southern elephant seal pups (*Mirounga leonina*) that had been handled repeatedly and subjected to intrusive research procedures in their first six weeks of life and found no short-term (24 day nursing period) or long-term (first year of life and beyond) effects on survival. The results from studies of stress on one species may not apply to the responses of another species. No physiological studies of Hawaiian monk seal response to disturbance alone (*i.e.*, not involving capture and handling) have been conducted.

The most common scenario for disturbance of Hawaiian monk seals is during research activities that involve the presence of researchers on NWHI beaches where seals are resting. The seals tend to be distributed around the islands in singles or small clusters usually fewer than a dozen in number. Perhaps because most Hawaiian monk seals are rarely captured following a brief tagging event soon after they wean as pups, they are typically not particularly wary of human presence.

However, it is thought that past circumstances, especially those involving prolonged, frequent and intense harassment and disturbance associated with military and USCG activities on NWHI beaches, caused Hawaiian monk seals to avoid certain important beach habitats (Ragen 1999).

In response to researcher presence, seals often simply return to sleep, or watch the researcher until they are no longer visible. Sometimes, however, seals do get agitated and move a few body lengths down the beach before settling down. While the above describes the most common disturbance scenario, not all seals exhibit the same response to the same disturbance, nor does an individual seal necessarily exhibit the same response on any given day. Hawaiian monk seal researchers have noted that juvenile seals tend

Past circumstances, especially those involving prolonged, frequent and intense harassment and disturbance associated with military and USCG activities on NWHI beaches, caused Hawaiian monk seals to avoid certain important beach habitats (Ragen 1999).

to be more wary and likely to respond to researchers.

Thermoregulation may also play a role in seals' responses. Commonly, seals that have slept on land overnight spend the morning resting as well. As the temperature rises during the day they often slowly make their way to the water to cool off. This transit from the beach berm to the water may take several hours, with the seals sleeping for periods on the way. However, if a seal is feeling hot and is on the way to the water, seeing a researcher may hasten their entering the sea. Finally, seals that have recently been captured and handled understandably tend to be more likely to go to the water the next time they see a researcher. At the other extreme, there are individual seals that seem to have no concern about human presence. For example, when field camps are established on NWHI, it is common that one or more seals will habitually haul out and sleep in camp.

In the MHI, seals have been exposed to the large resident and transient human populations. Many seals have become extremely habituated to people and choose to rest on beaches with hundreds of humans in proximity.

However, Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people.

This suggests that beach habitat selection of MHI Hawaiian monk seals may be influenced by human disturbance. A similar avoidance of the vastly smaller scale of human presence in the NWHI has not been detected.

Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people.

Despite the fact that outwardly, Hawaiian monk seals do not usually exhibit strong disturbance responses, it is not possible to rule out that there may be unobserved deleterious responses. Indeed, human disturbance has long been considered a threat to monk seal conservation, due mostly to population declines and local extinctions associated with the long history of first persecution and hunting by people up to the early 20th Century, and subsequent intensive prolonged harassment by military personnel and others visiting the NWHI prior to the seals receiving protection (Ragen 1999). As noted above, the frequency and intensity of research and enhancement related disturbance is vastly less than the seals' historical treatment.

Thus, while there is reason to believe that the level of disturbance associated with human disturbance from research and enhancement activities that do not involve capture and restraint are benign, we must consider the potential that disturbance could cause injury or harm. The following is a list of conceivable potential mechanisms for such harm:

- Increased corticosteroid levels or other physiological stress responses;

- Seals sustaining scrapes or cuts while fleeing over abrasive substrates (*e.g.*, coral);
- Increased risk of shark predation to seals that enter water when they would otherwise be on the beach;
- Increased risk of pups being subjected to adult male seal aggression if they enter the water in proximity to an aggressive male seal; and
- Disruption of nursing of mother/pup pairs leading to lower energy and nutrient intake by the pup.

4.7.1.3 *MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM CAPTURE AND RESTRAINT*

In contrast to simple disturbance described above, seals that are captured and restrained during research and enhancement activities are subject to additional risks. As described in Chapter 2, capture and restraint can involve a range from brief procedures for tagging to longer procedures involving sedation, attachment of instruments, biomedical sampling, etc. Upon release from capture and restraint, most seals immediately flee to the water. The exception is that recently weaned pups often remain on land after being captured, tagged and measured. The following are mechanisms by which animals may be injured during capture and restraint without sedation:

- Efforts to avoid or escape capture could lead to contusions, lacerations, abrasions, hematomas, concussions, and fractures, as well as hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) and myopathy from increased muscle activity;
- Increased energy expenditure with the potential for hyperthermia for those animals involved in strenuous or prolonged activity; and
- Capture myopathy is associated with prolonged or repeated stress responses in many mammals (though whether it occurs in pinnipeds is uncertain) and is characterized by degeneration and necrosis of striated and cardiac muscles (Fowler 1986). Capture myopathy may be fatal and may not develop until many days after capture and handling.

4.7.1.4 *MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM SEDATION OR ANESTHESIA*

Diazepam (valium) is the drug used for field sedation of Hawaiian monk seals, and midazolam may also be used for sedation in some cases (see Appendix D). Gas anesthesia (*e.g.*, isoflurane) has also been successfully used in clinical settings, for example, surgeries to remove embedded fish hooks from seals. However, these latter cases involve stranding response and are covered under the Marine Mammal Health and Stranding Response Program's permit and PEIS

(NMFS 2009c) and not by this PEIS. Thus, this discussion is limited to risks associated with diazepam and midazolam sedation. These include:

- Miscalculation of dosage could lead to overdose and consequently death;
- Administration of IV diazepam could cause pain, stress, and damage to the extradural vein or surrounding tissue;
- Administration of IM midazolam could cause pain, stress, and damage to surrounding tissue; and
- Possible side effects include bradycardia (slowed heart rate), respiratory depression, tremor, confusion, blurred vision, nausea, vomiting, depressed gag reflex, lethargy, and ataxia (inability to coordinate muscle activity during voluntary movement) (NMFS 2005a).

4.7.1.5 *MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM BIOMEDICAL SAMPLING, MARKING, ATTACHMENT OF TELEMETRY INSTRUMENTS, DE-WORMING, ADMINISTERING ANTIBIOTICS AND OTHER DRUGS, DISENTANGLEMENT AND OTHER RESEARCH AND ENHANCEMENT PROCEDURES*

Numerous research and enhancement procedures involve the handling of animals, including collection of various tissues as biomedical samples, weighing, measuring, attaching flipper tags, applying pelage (fur) bleach marks, attaching various telemetry (*e.g.*, satellite or GPS tracking) devices, and administering de-worming medications. In addition to the following risks associated with these procedures, all of the handled animals are exposed to the risks of researcher disturbance and capture/restraint presented above.

- Blood collection can cause pain, stress, damage to the extradural vein or surrounding tissue, and potentially infection;
- Biopsy punches for skin and blubber samples can cause pain and stress, and produce a small wound that has the potential for infection;
- Swab sampling of orifices could cause pain or irritation. Fecal sampling with a fecal loop could also cause pain and irritation; additionally, perforation of the rectum is a possibility. In female seals, accidental insertion of a fecal loop into the vagina could result in discomfort or possibly introduction of pathogens;
- Flipper tags involve creating a small hole in the flipper, through which plastic tags are threaded. This can cause temporary pain, stress, and possibility of infection. The tag might tear out over time, causing additional wounding to the flipper;
- Use of hair bleach to temporarily mark the pelage of Hawaiian monk seals can awaken the seal, causing a disturbance response. Bleach could cause irritation to areas it might come into contact with (eyes, nose or skin surfaces);

- Attachment of instruments to the fur with epoxy can cause irritation and in some cases minor skin wounds at the margins of the attachment area. The hydrodynamic drag created by the instrument might hinder swimming performance and result in increased energetic costs of swimming and diving, potentially affecting foraging efficiency;
- Administration of de-worming and other medications (*e.g.*, antibiotics and emergency response drugs) can occur by various routes, each with some potential risk (see Appendix D). Injections (intra-muscular or subcutaneous) can cause pain, stress, swelling, and the risk of infection at the injection site. Oral intubation of drugs also can cause pain and stress, and carries the risk of introducing fluids into the trachea and lungs, which may lead to pneumonia. Topical application of medication has a potential to disturb or stress seals if they awaken during the application; additional information on potential effects of drug administration is presented in Appendix D;
- It is possible that de-worming a seal that has a sufficiently heavy parasite burden could result in a bolus of dead worms causing an intestinal blockage and death; and
- During disentanglement of seals caught in marine debris, removal of debris from severe wounds or from seals which have become very compromised by their entanglement, can pose a risk of causing excessive bleeding and other complications, potentially leading to death.

4.7.1.6 MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM TRANSLOCATION

A number of enhancement activities involve translocation of Hawaiian monk seals. The seals involved include nursing pups that have been abandoned or separated from their mothers, weaned pups, juveniles and adult males. The details of translocations are presented in Chapter 2 and Appendix F (Two-Stage Translocation: A Proposal for Endangered Hawaiian Monk Seals). The procedures associated with these actions vary with the logistics of each case and to some degree, the age of the animals involved. However, all translocations will entail some portion or all of the following elements:

- Capture;
- Restraint;
- Holding in a cage or other enclosure;
- Transport via small boat, automobile, ship or aircraft;
- Sedation;
- De-worming;
- Health and disease screening (*i.e.*, biomedical sampling);
- Pre-release quarantine;
- Attachment of telemetry devices; and

- Release at a destination site.

Risks of many of these procedures have been identified in the foregoing sections and are applicable to translocation to the extent that they occur as part of a translocation action. The following is a list of risks specific to procedures involved only in translocation:

- Temporary holding and transport may cause stress, leading to any number of related ailments, including immuno-suppression, and potentially death;
- Some monk seals in captivity have developed eye problems that make them non-viable for release into the wild;
- Seals could be harmed if an accident occurs during transport;
- Seals released in a new area may encounter risks that they were unaccustomed to in their previous location (*e.g.*, increased shark predation or competition for prey, increased human disturbance, and potential harm by humans);
- Seals released in a new area may forage less efficiently, either because the new site has less available prey, or because the seal is unfamiliar with the novel foraging landscape;
- Seals may be exposed to new diseases either through contact with other seals being translocated at the same time, or through contact with seals at the release location; and
- Translocated seals themselves may pose a risk to other seals if they carry communicable disease.

4.7.1.7 MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM BEHAVIORAL MODIFICATION

Research to determine the safest and most effective methods for modifying undesirable behavior of seals that, for example, become habituated to humans in the MHI, will potentially involve a number of techniques. These would include methods such as capture, restraint, sedation, biomedical sampling, instrumentation, translocation, and temporary holding. Seals may also be hazed using visual, audible and tactile means. They may be guided or have their movements impeded by temporary barriers. Some of these actions have already been described and would entail the same risks identified above. Risks of actions unique to behavioral modification include:

- Hazing and use of barriers to movement may cause stress;
- Tactile means might involve momentary, minor pain or discomfort, though the techniques would not involve any type of intentional infliction of injury;
- Visual and audible hazing could cause stress; and
- In cases where the objective of behavioral modification is to move seals away from a specific area where they are, for example, interacting with

people, achieving this objective could also displace the seal from resources (*i.e.*, foraging or resting areas) that are important for maintenance and growth.

Behavioral modification of aggressive male Hawaiian monk seals that harm other seals could involve experimental use of gonadotropin-releasing hormone (GnRH) agonist (*e.g.*, decapeptyl or deslorelin), to lower testosterone levels and, ideally, aggressive behavior. Decapeptyl has been used safely with no ill effects in HMS (Atkinson *et al.* 1993; Atkinson *et al.* 1998). The effects of deslorelin have proven safe in other mammals (Bertschinger *et al.* 2001; Trigg *et al.* 2006). The drugs would be given via injection after capture and restraint, and would therefore entail the same risks described above for these procedures. Potential harm or injury that could result from treatment with these drugs include:

- An initial relatively brief rise in testosterone levels prior to their suppression (as shown in other mammals injected with GnRH agonists). During this period there is a risk that male seals could exhibit elevated levels of aggression, posing a risk of harm to other seals;
- Treatment might cause the subjects to be attacked or harmed by other males;
- If effective in reducing testosterone, subject males would be temporarily "chemically castrated," such that they potentially have lower reproductive success; and
- GnRH agonists may have side effects.

4.7.1.8 *MECHANISMS OF INJURY TO HAWAIIAN MONK SEALS FROM VACCINATION*

Vaccines currently used for prevention of viral diseases in domestic animals can be divided into three types: those based on a dead inactivated virus; those using live attenuated virus; and vaccines consisting of recombinant viruses. Recombinant viruses use a vector virus that does not typically infect the target host but expresses antigen from the pathogen of interest, stimulating an immune response against it (Griffin and Oldstone 2009). Vaccines using a dead virus are considered the safest as the virus cannot replicate in the host or cause disease; however, this lack of replication often means that the immune response generated following vaccination is short lived and may not be protective. Live vaccines typically generate the most effective immune response, but present the risk (when used in species other than the one for which the vaccine was developed) of the virus replicating in the host and either causing disease in the vaccinated animal, or being shed in secretions and becoming infective to other contacted animals. Numerous carnivores, especially mustelids (weasel family) and procyonids (*e.g.*, raccoons), have died in zoological collections following vaccination with live canine distemper virus (CDV) vaccine (Deem *et al.* 2000). To overcome this risk of live vaccine use, recombinant vaccines to CDV are now used extensively in zoological collections (Bronson *et al.* 2007).

Vaccines currently being considered for Hawaiian monk seal include a recombinant canary pox (Purevax, Meriel) vaccine against morbillivius and an inactivated West Nile Virus (WNV) (Innovator, Fort Dodge). The canary pox vaccine has been safely used on a wide range of non-domestic carnivores including pinnipeds. It has not been associated with live virus shedding and is likely to stimulate higher immunity than a dead vaccine. The canary pox is also commercially available in the U.S. and is recommended by the American Association of Zoo Veterinarians for use in non-domestic carnivores. The Fort Dodge WNV vaccine has been used to date on Hawaiian monk seals in captivity in San Antonio, Texas, with no adverse reactions observed (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005).

Vaccines would most likely be administered to Hawaiian monk seals through injections which could involve capture and restraint. Vaccination would thus entail the risk associated with disturbance, injection and potentially capture/restraint. Other specific risks of vaccination may include an immune response, which can rarely result in a local reaction at the site of injection characterized by heat and swelling that resolves in 5-7 days, or febrile response (*i.e.*, fever).

4.7.1.9 NUMBER OF HAWAIIAN MONK SEALS AFFECTED BY RESEARCH AND ENHANCEMENT UNDER EACH ALTERNATIVE

Section 2.5 describes the different research and enhancement "take" activities that may occur under the various alternatives. Permits must specify the number of seals that could potentially be affected by research and enhancement take activities. Thus, each alternative may involve different numbers of animals.

The take numbers indicate the maximum number of animals that may be affected by each take category under each alternative and are presented in Appendix H (Take Tables).

When applying for MMPA/ESA marine mammal research and enhancement permits, applicants request the maximum number of takes that they believe might potentially occur during their permitted activities. Exceeding these take levels would amount to a permit violation. In the case of the Hawaiian monk seal, NMFS historically has not reached the total level of takes authorized for research and enhancement. Nevertheless, these maximum levels will be analyzed here. The numbers of takes for different research and enhancement activities under the following alternatives are presented in Appendix H and support the analysis of the alternatives presented herein.

- Alternative 1 (Status Quo) is based on the current Hawaiian monk seal research and enhancement permit (10137). Permit No. 10137 expires in June 2014 and Alternative 1 assumes that the same levels of take would be authorized in the future with no changes.

- Alternative 2 (No Action) assumes that no further research and enhancement permits would be authorized once the current permit (10137) expires in 2014;
- Alternative 3 (Limited Translocation, Preferred Alternative) includes a suite of additional research and enhancement activities with their associated number of takes, as well as some additional takes for existing (Status Quo) actions; and
- Alternative 4 (Enhanced Implementation) has identical take levels as Alternative 3, but is distinguished by the added potential to translocate weaned pups from the NWHI to the MHI and subsequently return them to the NWHI when they are 2-3 years old.

Implementation of any alternative will depend on the availability of sufficient funding, which is not guaranteed. Alternatives 3 and 4 would likely require a substantial increase in future funding levels compared to the current funding available for implementing Status Quo (Alternative 1). However, for the purposes of this analysis, it is assumed that sufficient funding would be secured to fully implement each alternative.

4.7.1.10 ASSESSMENT OF MORTALITY OF HAWAIIAN MONK SEALS DUE TO RESEARCH AND ENHANCEMENT

Analysis of mortality effects associated with research and enhancement activities will be primarily based on up to three sources of lethal takes presented in Appendix H (Take Tables). These include:

- Euthanizing moribund seals and adult male removals. These involve humanely euthanizing seals deemed by an attending veterinarian as highly likely to die (*e.g.*, due to injury or illness) and either lethal removal or permanent captivity of adult male seals that have harmed or killed other seals. Because permanent captivity is equivalent to mortality from the perspective of the wild populations, captivity is treated as a mortality in the analysis of alternatives;
- Unintentional mortality (research). This includes any unintentional deaths of seals that may occur as a result of research; and
- Unintentional mortality (enhancement). This includes any unintentional deaths of seals that may occur as a result of enhancement activities.

These sources of mortality are considered to be entirely observable. NMFS has a long history of evaluating the potential effects of research and enhancement on Hawaiian monk seals as evidenced by numerous published reports and papers showing that Hawaiian monk seals subjected to specific research and enhancement activities do not subsequently exhibit higher mortality than seals not subjected to the activities (Baker and Johanos 2002; Littnan *et al.* 2004; Baker *et al.* 2011*b*). Moreover, these studies have often sought to detect sub-lethal effects (for example, on behavior, movement, body condition, etc.) of research and

enhancement activities, but have failed to find evidence of any such deleterious effects. Based on these publications, coupled with the fact that most Hawaiian monk seals are uniquely identifiable and closely monitored, it is assumed that there are no unobserved mortalities associated with research and enhancement activities.

Thus, NMFS concludes that the unintentional or intentional (in the case of moribund seals or aggressive adult male seals) mortalities that are observed as an immediate result of research or enhancement constitute the totality of mortality associated with these activities. It is important to note that this is not a claim that research and enhancement have no associated mortality; rather it asserts that such mortality will be entirely observable and documentable.

4.7.1.11 RESEARCH AND ENHANCEMENT ACTIVITIES THAT INVOLVE TAKE OF HAWAIIAN MONK SEALS

Below is a discussion of each type of activity involving take that is proposed under various alternatives and the evidence supporting the above conclusion.

Tagging – Since the early 1980s, nearly all Hawaiian monk seals have been captured, restrained and tagged with plastic flipper tags as soon as possible after weaning. To ensure that this practice did not have negative effects, Henderson and Johanos (1988) conducted a study at Lisianski Island to compare the early survival, behavior and movements of tagged and untagged weaned pups. They found no differences in any of these metrics. For most Hawaiian monk seals, this initial tagging at weaning is the only time in their lives they are handled by humans. However, some seals may be captured, restrained and retagged at an older age if they have lost, worn or broken flipper tags. Baker and Johanos (2002) compared the survival, migration and condition of 437 seals during the year subsequent to retagging to an equal number of matched controls with pre-existing tags. It was important to choose control seals that were already tagged so that probability of resighting would not be biased between the two groups. No differences in survival, migration or condition were found between the retagged and control groups.

Bleach Marking – Seals are marked with hair dye, providing marks that last until the seal's next molt. While no directed study of the effects of bleach marking has been conducted on Hawaiian monk seals, it is reasonable to assume that since the more intensive activity of capture, restraint and tagging has no detectable negative effect, bleach marking is even less likely to cause mortality. Most seals do not even awaken during bleaching so that there is no disturbance effect. Field staff is instructed not to place bleach in areas where the seal could sweep it with their flippers into their eyes, nose or mouth. Further, despite many thousands of bleach markings of monk seals, no negative effect of this procedure other than minor disturbance has ever been observed (NMFS PIFSC Annual Permit Reports for Permits No. 10137 and 848-1695-). Bleach marking aids in detection of a seal's identity from a greater distance than would be possible with

flipper tags alone, thereby reducing the necessary approach distance and consequently the chances of disturbance.

Health Screening and Foraging Studies – Although these two activities have distinct goals and involve different procedures, in practice they quite often occur simultaneously and are therefore discussed together here. For example, almost every time a seal is captured to attach a telemetry instrument (to study foraging behavior) a health screening is conducted at the same time. Baker and Johanos (2002) evaluated the same metrics (survival, migration and condition) of seals that were instrumented and/or health screened compared to matched controls and found no difference. The number of cases of health screening was small (N = 19), however the sample for foraging instrumentation was much larger (N=93) and many in this latter group were also health screened, lending confidence to the conclusion that neither procedure had negative effects.

Further Littnan *et al.* (2004) evaluated a suite of diving and foraging-related parameters of juvenile Hawaiian monk seals fitted with the largest type of foraging instrument used in this species, a seal-mounted video camera (*i.e.,* "Crittercam"). The foraging behavior parameters of seven seals were compared while they had both the Crittercam and a much smaller dive recorder attached versus a period when they carried the dive recorder alone. No statistically significant differences were detected in the seals' behavior during the two periods.

De-worming – Although treatment for gastrointestinal parasites has long been a somewhat routine procedure for captive monk seals and other pinnipeds brought into captivity for rehabilitation, there has been relatively little experience with field treatment of free-ranging seals for parasites to reduce worm burden and improve body condition and survival. However, such a study was implemented at Laysan Island in 2009-2010 (Gobush *et al.* 2011). A pilot trial using orally administered de-wormers proved unsuccessful in that it was too difficult to administer a reliable dose orally in field conditions. Subsequently, an injectable medication trial was conducted. This involved 43 juvenile seals that were captured, weighed, measured, feces sampled and either given an intra-muscular injection of the anti-helmintic (Praziquantel), or served as controls three times on an 8-16 week interval.

The effect of treatment on survivorship, egg presence and gain in mass was evaluated. Survivorship of the subset of the three cohorts included in the study was 100% for the 2007 and 2008 cohorts, and 85.2% for the 2009 cohorts. There was no difference in survival of the treatment and control seals. Nearly all collected fecal samples had cestode eggs; there were no significant differences in egg presence between control and treated seals. Percent mass change differed with season and by age. Mass gain was greatest in the period from March to May. Percent mass gain was significantly greater for treated than control seals during March to May, but not during December to March or over the entire treatment period (December to May). The above study was designed to both

evaluate potential beneficial effects of de-worming and also detect any potential negative effects. The fact that there was no difference in survival and a suggestion of higher growth rates in treated seals during a portion of the study indicates that there was no negative effect on survival or condition.

The following describes additional observations relevant to potential negative de-worming effects (Permit No. 10137, *Hawaiian Monk Seal Deworming Project: Year One Summary*). Typically, seals entered the water within minutes of being released from treatment with no indication of adverse effects of capture or treatment. However, adverse conditions for two seals treated during the course of the study were observed. One seal displayed signs of respiratory distress and another developed an abscess at the injection site. The respiratory distress case was reviewed by veterinarians and it was deemed unlikely that this symptom could be attributed to de-worming.

The seal with the abscess was captured, the abscess lanced and flushed. The wound healed and the seal survived and gained a large amount of mass by the next capture. Three other seals developed minor swellings near their injection sites within days of treatment; these swellings subsided on their own within 1-3 weeks. One seal that had a swelling was re-injected at the next treatment period and did not develop another swelling.

As a precaution against further swellings, protocols for cleaning the injection site were reviewed and standardized, improved restraining techniques were implemented, and the Praziquantel dose was split into two injections for half of the treated seals to test whether reducing the injected volume might mitigate swelling. The dose was divided between two bilateral intramuscular injections, each with a volume of 5 milliliters (ml) or less for five treated seals in August. The maximum injection volume for the split dose group was 3.7ml for an 85 kilogram (kg) seal, and for the single dose group it was 6.2ml for a 71kg seal. Subsequently, no injection site swellings occurred in any of the seals treated.

Due to apparently weak efficacy, lack of compelling benefits and the minor risk of potential negative effects (abscess at injection) of Praziquantel injection, the de-worming study was suspended (Permit No. 10137, *Hawaiian monk seal Deworming Project: Year One Summary*). Ongoing and future studies will consider other routes of drug administration or other drugs. For example, in 2011 and 2012, a topical dewormer that could be applied without waking seals was tested on monk seals and the results are currently being analyzed. In such cases as above, researchers will be closely monitoring individuals to detect both negative and positive effects, and in cases of the former (as with the abscess described above) be prepared to mitigate negative effects. Thus, it is very unlikely that any mortalities or injuries associated with future de-wormer studies will go undetected.

Treatment with Antibiotics and Other Drugs – Appendix D provides a list of the drugs currently used or proposed to be used in Hawaiian monk seals,

possible adverse effects including any observed in Hawaiian monk seals, and the pharmacokinetics of each drug (*i.e.*, how the drug is absorbed, distributed, the rate of action and duration of effect, chemical changes in the body, and effects and routes of excretion of metabolites).

All of the drugs included have been used on Hawaiian monk seals with no severe adverse reactions observed that would preclude future use (Appendix D). Drugs are only used if prescribed by an attending veterinarian, and the purpose of using drugs in Hawaiian monk seals is to benefit the seals. For example, sedatives are given to reduce stress during certain handling events. Emergency drugs are administered if a seal has an adverse reaction during handling and needs supportive care. Long-acting antibiotics are given to seals with wounds (*e.g.*, abscesses from adult male injuries) to prevent or treat infection.

In addition to the drugs listed in Appendix D, supportive fluids such as electrolytes, dextrose, and sodium bicarbonate may be administered at the discretion of the attending veterinarian in response to adverse reactions to capture, handling, and drug administrations. New drugs may become available or other drugs may be prescribed for use in Hawaiian monk seals by the attending veterinarian. Information on such new drugs would be provided by PIFSC to the OPR Permits Division and may be incorporated into the protocols if indicated by the attending veterinarian. Possible adverse effects of any new drugs would be weighed against the benefits of using the drugs for each case. Also, if any severe adverse reactions are reported in Hawaiian monk seals, the drugs would be discontinued or dosages modified per recommendation by the attending veterinarian.

Translocation – Baker *et al.* (2011b) summarized and analyzed an extensive history of experience involving translocation of 247 Hawaiian monk seals to achieve a variety of objectives, including mitigating shark predation and male seal aggression, reducing human-seal interactions, and taking advantage of favorable foraging habitats to improve survival. A total of three mortalities (two adult male seals and one weaned pup) occurred during either capture or temporary captivity for translocation. While cause of death could not be determined in any of these cases, it is conservatively assumed that the deaths were attributable to the translocation action.

For all cases with data available to analyze, survival and dispersal behavior of translocated seals was statistically indistinguishable from comparable seals native to the release sites. This study indicates that, like other research and enhancement activities, mortalities associated with translocation are observable and quantifiable. However, as noted above, because two-stage translocation has some novel and yet untested aspects, negative and positive impacts of this activity will be assessed using simulation modeling as described in the Quantitative Approach section below and in Appendix M (Description of Monk Seal Stochastic Simulation Model).

Adult male removal – Aggressive adult male Hawaiian monk seals may be removed from their subpopulation either via translocation to another subpopulation, permanent captivity, or by lethal removal (euthanasia). As noted above, captivity will be treated the same as mortality for evaluation of impacts on populations. Baker *et al.* (2011b) found that aggressive males translocated from Laysan Island to the MHI in 1994 had high survival rates commensurate with those of native-born adults. However, while data were very sparse, it seems that post-release survival of seals taken to Johnston Atoll was likely poor. In the future, translocations to Johnston Atoll are possible but unlikely; and, if they should occur, the fate of those translocatees would be closely monitored. Any that died or disappeared after release at Johnston Atoll would be considered mortalities in the context of the permit.

Disentanglement and De-hooking – When Hawaiian monk seals are entangled in marine debris or are observed with an embedded fishing hook, they may be captured to remove the offending items. In some cases, debris is cut away from seals while they are asleep and no disturbance occurs. Marine debris and hooking are known sources of serious injury and mortality. As such, the risks associated with disentanglement/dehooking are weighed against the risks of leaving the debris or hooks in place. Over 300 Hawaiian monk seals have been observed entangled in marine debris and 75 have been observed with embedded hooks from 1989-2010 (Carretta *et al.* 2013). Many of these animals have been captured and disentangled or dehooked and none have subsequently died from causes attributable to this enhancement activity.

Over 300 Hawaiian monk seals have been observed entangled in marine debris and 75 have been observed with embedded hooks (Carretta et al. 2013).

Behavioral modification – As described above, behavioral modification research will involve a variety of techniques that entail some risk of injury or mortality. Though experience to date with these techniques is limited to a few seals hazed or subjected to temporary barriers to movement, there have been no injuries or mortalities as a result. Further, any seals that are subject to behavioral modification in the MHI in the future will be monitored very closely to determine the efficacy of the treatments as well as to detect any adverse effects on the seal. It is therefore very unlikely that any mortality associated with behavioral modification would go undetected.

Chemical behavior modification of adult males through the use of GnRH agonists has been the subject of some experimentation in captivity and the wild in the past (Atkinson *et al.* 1993; Atkinson *et al.* 1998). While the efficacy of this approach to mitigate aggressive male behavior is undetermined, there were no deaths associated with the administration procedures or from effects of the drug itself. Testosterone reducing drugs would be tested on seals in captivity prior to use in wild seals. As with other behavior modification research, study subjects in

the future would be closely monitored so that any resulting adverse reactions or mortalities could be detected and quantified.

Vaccination –To date, there have been no vaccination programs for wild pinnipeds, though some captive seals, including Hawaiian monk seals, have been vaccinated against morbillivirus and WNV (Vaccination Research and Response Plan). Under Alternatives 3 and 4, vaccine research would occur and potentially vaccination would be used for enhancement as needed. These research and enhancement projects would potentially involve either inactivated dead virus or recombinant virus vaccines.

No adverse reactions have been reported following use of the recombinant canary pox vaccine in marine mammals to date (Steller sea lions, sea otters [Jessup et al. 2009], harbor seals [Quinley *et al.* 2013], and one captive Hawaiian monk seal). The only data on vaccination of pinnipeds against WNV are from SeaWorld, San Antonio, where captive Hawaiian monk seals have been vaccinated with an inactivated WNV vaccine from Fort Dodge following an outbreak of WNV in the park and the loss of one monk seal to WNV infection. The vaccinated seals have sero-converted following vaccination with no adverse reactions (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005).

Any future vaccination programs with monk seals would proceed cautiously, testing safety and sero-conversion on surrogate species and on captive monk seals prior to use in the wild. Careful monitoring would ensure that any resulting mortalities would be detected.

Disturbance – In this section, we consider mortality due to disturbance alone (that is, seals that are disturbed by research and enhancement but not captured or handled in any way). This may occur in two ways. First, seals may be disturbed during monitoring activities (aerial, vessel or land-based) where they are approached for identification, photographic documentation, etc. Second, seals may be incidentally disturbed when they are present near other seals that are approached for monitoring, capture, handling or any other research or enhancement activity. In either case, there is no indication that the level of disturbance proposed in any of the alternatives would be likely to cause any mortality.

As noted above, prolonged, repeated and intensive harassment and disturbance (not associated with research or enhancement) likely contributed to habitat avoidance and decline in monk seal populations in the past. However, as described above, the intensity and frequency of disturbances related to past Hawaiian monk seal research and enhancement has been very low. Records on how seals react when they alert to a researcher's presence showed that during 2012, only 1.4% of seals sighted raised their head, 0.15% of seals moved away <2 body lengths, and 0.36% of seals went into the water, demonstrating a very low

level of disturbance resulting from permitted activities (2012 Annual Report for Permit No. 10137).

The proposed alternatives allow for at most 5 disturbances per seal in any given year, though the average for any seal will be far less. More importantly, because all disturbances are recorded, it is even less likely that should such a disturbance-related mortality occur it would go undetected. The primary potential mechanisms for disturbance-related mortality in Hawaiian monk seals would be avoidance of habitat critical for survival, or stress-induced mortality.

While there have been no studies specifically quantifying and evaluating the potential impacts of disturbance on Hawaiian monk seals, it stands to reason that disturbance alone would elicit far less impact than much more intensive activities such as capture, restraint, tagging, health screening, instrumentation, etc. The fact that these activities have been shown not to change survival, migration or body condition compared to seals that did not undergo such procedures (Baker and Johanos 2002), is compelling evidence that the low levels of disturbance proposed in the alternatives would be even less likely to induce harm. It is further worth noting that no harm or mortality due to simply disturbing a Hawaiian monk seal during research or enhancement has been documented in over 30 years (Permit No. 10137, *Hawaiian monk seal Deworming Project: Year One Summary*).

4.7.1.12 *SEPARATION OF POSITIVE AND NEGATIVE EFFECTS IN SUBSEQUENT ANALYSIS*

To compare effects of various alternatives, it is important to explicitly identify both negative effects (such as mortalities) from positive effects, or benefits (such as lives saved) to Hawaiian monk seals. The overall balance of these opposing effects leads to conclusions about the relative merits of each alternative. In order to distinguish and explicitly present negative and positive effects, the following approach is applied in the subsequent alternatives analyses.

All ***negative*** effects are analyzed in sections entitled:

- "Direct and Indirect Mortality Due to Research and Enhancement", and
- "Direct and Indirect Reproductive Effects Due to Research and Enhancement"

All ***positive*** effects are analyzed in sections entitled:

- "Contributions to Conservation Objectives"

In this way the positive and negative effects are readily identifiable in their respective sections.

4.7.1.13 *QUANTITATIVE APPROACH TO ANALYZE THE EFFECTS OF THE LETHAL TAKE OF HAWAIIAN MONK SEALS*

The monk seal simulation model (Appendix M) was used to assess the population level effects of the lethal take levels allowed in the alternatives. In general terms, a simulation model combines all of the important data for a population and, starting with the current population size and composition, projects the population forward to predict what the probable future state will be under various scenarios. Details of the model structure are provided in Appendix M with additional details available in Harting (2002).

For these simulations, each of the seven subpopulations was initialized at its current status (age/sex composition) and projected forward for 10 years, using the recent estimates for the vital rates (survival and reproduction) at each subpopulation. To better represent how the population behaves in the real world, simulated vital rates varied year-to-year according to historically observed variability. In the projections, seals were allowed to move among subpopulations in accordance with the movement rates observed in the wild.

As stipulated in the descriptions of the alternatives, the takes due to unintentional mortality from research can apply to any age or sex class. This means that the consequences of the mortality to the welfare of the population can vary depending on exactly which individuals are lost. In general, the loss of females is of much greater consequence to the population than is the loss of males because the population forfeits not just that individual female but also any pups she was likely to produce in the future. Further, females at or near prime reproductive age are especially important to the population because they comprise the age class likely to produce the most pups and thereby promote future population growth (refer to the discussion of age-specific reproductive value, Section 4.4). For these reasons, an exceptionally high-impact simulation scenario was used to represent the allowable take in each alternative, in which all of the take mortality was applied to females with high age-specific reproductive value (age 4 years). The maximum number of seals removed and the number allowed each year conformed to the provisions specified in the take tables (Appendix H). For example, to simulate the four unintentional takes during research allowed under Alternative 1, two females were removed during the first year of the simulation and two additional females were removed in the following year.

As with the research-related takes, the allowable take for the loss of weaned pups and juveniles during enhancement activities (Alternatives 3-4) can apply to either sex. As with the research take, a hypothetical exceptionally high-impact scenario was specified by assuming that all of this mortality would apply to females.

Because the simulated takes might occur at any subpopulation, the outcome was evaluated in terms of the effects on abundance and realized growth rate (from

first to last year of the simulations) for the total population (that is, all subpopulations combined).

4.7.1.14 *ASSESSMENT OF REPRODUCTIVE EFFECTS DUE TO RESEARCH AND ENHANCEMENT ON HAWAIIAN MONK SEALS*

Even if research and enhancement activities do not lead to mortality, it is possible that the activities could reduce the probability that seals produce viable offspring. Thus, effects on individual and population-level reproduction are possible from research and enhancement activities. This element of the direct and indirect effects analysis discusses the ways in which the scope of research and enhancement activities represented by each alternative may affect reproductive success.

The potential mechanisms for effects on reproductive success could happen to either gender; however, effects on females are naturally far more plausible and of greater concern. If research and enhancement activities were to impact the ability of some male seals to reproduce (*i.e.*, compete for or encounter mates, produce viable sperm or through any other mechanism), it is unlikely to translate into population level effects. The monk seal mating system is not well known but is probably promiscuous (Stirling 1983). Multiple male seals seek access to mate with females in estrous, such that if one or more males were unavailable due to some reproductive harm, other males would almost certainly ensure that any available female would be mated. For this reason, the remainder of this discussion focuses on reproductive effects on females. Possible mechanisms for reproductive effects on females include:

- Injury to the reproductive organs or damage to hormonal regulation that leads to temporary or permanent sterility.
- Physiological responses to stress that cause reproductive failure at any stage (ovulation, fertilization of ova, embryonic implantation, embryonic or fetal development).
- Changes in maternal behavior that reduces feeding of pups, consequently reducing their growth and survival rates.
- Delayed sexual maturation due to slow growth or poor health.

As noted in Chapter 2, NMFS has a long-standing conservative approach to disturbance or capture of adult female seals. For example, no adult female is captured that appears to be pregnant or is otherwise thought likely to be well into a pregnancy even if it is not visually apparent. The only exception is for a life-threatening situation such as a severe entanglement. Also, great efforts are made to minimize the disturbance of mother-pup pairs. Because of these precautionary policies, the risks to reproductive females are minimized, but at the same time risk-averse procedures complicate any analysis to evaluate whether any effects are occurring. For example, in the Baker and Johanos (2002) study on effects of research handling, reproductive effects could not be

evaluated. Because pregnant females were actively avoided in the study, there were no control seals to compare subsequent reproduction of the adult females that were handled (*i.e.*, the adult female treatment group was biased).

There has never been a reported or documented case where research or enhancement related disturbance has caused a female to abandon a pup.

Despite the complications with quantitative evaluation of reproductive effects based on actual research and enhancement activities in the past, it is possible to qualitatively infer the likelihood of such effects. For example, many of the hypothetical mechanisms for reproductive effects are mediated through reduced growth or body condition of female seals. Avoiding handling pregnant females reduces this risk. Also, the lack of any indication that actions such as tagging, health screening, instrumentation, and de-worming have had any negative effects on growth or body condition (Baker and Johanos 2002; Gobush *et al.* 2011), suggests that growth-related effects on reproduction are highly unlikely. Likewise, the strict avoidance of disturbance to mother-pup pairs and the prohibition on capturing either a mother or her offspring during the period between birth and weaning, means that effects on the nursing process are also very unlikely.

There has never been a reported or documented case where research or enhancement related disturbance has caused a female to abandon a pup.

It is difficult to evaluate the remaining mechanisms: stress-related reproductive failure or damage to reproductive organs. Again, by avoiding handling pregnant female seals (or those who could be pregnant) the potential for stress-related effects is minimized. Goebel *et al.* (2003) evaluated the birth rates of female Antarctic fur seals the year following capture, restraint, anesthesia, and post-canine tooth extraction (for age determination) to a control group of females that was not captured. There were no differences detected in birth rates of these two groups. The procedures these fur seals were subjected to were arguably far more intense than any procedure proposed for Hawaiian monk seals. While one cannot assume that results from another species are applicable to Hawaiian monk seals, this information is encouraging. We cannot rule out that handling could damage reproductive organs. On the other hand, if organ damage of any kind did occur, one would expect vital organs important to survival would be as likely, or more likely, to be involved than specific reproductive organs. The lack of any detectable effects on survival described in the preceding sections suggests that vital organ damage, and by inference, reproductive organ damage, is unlikely.

In summary, directly evaluating reproductive effects is far more complex than is the case for effects on survival. While we cannot rule out the potential for reproductive effects of proposed research and enhancement activities, several lines of evidence, including years of monitoring data for Hawaiian monk seals, suggest that this is a minor concern for Hawaiian monk seals.

4.7.1.15 *ASSESSMENT OF BENEFICIAL CONTRIBUTIONS TOWARD CONSERVATION OBJECTIVES FOR HAWAIIAN MONK SEALS*

This element of the direct and indirect effects analysis discusses how well the scope of research and enhancement represented under each alternative would promote recovery and conservation of the species. The evaluation of the alternatives will be conducted with reference to the 2007 Recovery Plan for the Hawaiian Monk Seal (NMFS 2007, hereafter referred to as the Recovery Plan) (see Section 3.3.1.8). The goal of the Recovery Plan is to promote the recovery of the Hawaiian monk seal to the point that it could be down-listed from "endangered" to "threatened" and ultimately to the point that it could be removed from the list of threatened and endangered species under the ESA. The Recovery Plan focuses on factors impeding recovery of the population and the actions necessary to promote recovery. The following is an excerpt from the Executive Summary of the Recovery Plan:

RECOVERY STRATEGY: While recommendations within this report are many and detailed, there are four key actions required to alter the trajectory of the Hawaiian monk seal population and to move the species towards recovery:

1. Improve the survivorship of females, particularly juveniles, in sub-populations of the NWHI. To do this requires the following:

- *maintaining and enhancing existing protection and conservation of habitat and prey base;*
- *targeting research to better understand the factors that result in poor juvenile survival;*
- *intervening where appropriate to ensure higher survival of juvenile and adult females;*
- *continuing actions to protect females from individual and multiple male aggression and to prevent excessive shark predation;*
- *and continuing actions to remove marine debris and reduce mortality of seals due to entanglement.*

2. Maintain the extensive field presence during the breeding season in the NWHI. Field presence is critical not just to the monitoring and research efforts, but also to carry out the active management and conservation of Hawaiian monk seal subpopulations in these areas.

3. Ensure the continued natural growth of the Hawaiian monk seal in the MHI by reducing threats including interactions with recreational fisheries, disturbance of mother-pup pairs, disturbance of hauled out seals, and exposure to human and domestic animal diseases. This should be accomplished with coordination of all federal, state, local and non-government parties, volunteer networks, and increased outreach and education in order to develop a culture of co-existence between humans and seals in the MHI.

4. Reduce the probability of the introduction of infectious diseases into the Hawaiian monk seal population.

The various alternatives will be qualitatively analyzed with reference to how well they address the Recovery Plan's Recovery Strategy.

4.7.1.16 *METHODOLOGY USED TO EVALUATE TWO-STAGE TRANSLOCATION EFFECTS ON HAWAIIAN MONK SEALS*

The option to conduct two-stage translocation to enhance juvenile survival is included in Alternatives 3 and 4. The conservation benefits of two-stage translocation are evaluated independently from the effects of other activities. The methods used for this evaluation rely on simulation modeling and are described in detail in Appendix F (Two-Stage Translocation: A Proposal for Enhancement of the Endangered Hawaiian Monk Seal). Key aspects of the methodology are summarized below and in Appendix F. Because this is a new type of intervention, there are limited existing data with which to formulate predictions about its expected benefits or risks. In such cases, it is often beneficial to employ simulation modeling to provide quantitative analysis of the expected outcomes.

For this evaluation, the monk seal stochastic simulation model (Appendix M) was used to compare the expected outcomes from a representative set of translocation scenarios as permitted under each alternative. In practice, the specific two-stage translocation plan to be undertaken in a given year will be determined according to the most recent data available for each subpopulation in accordance with the decision framework described in Appendix F and summarized in Chapter 5. Results from preceding translocation efforts, logistics to accomplish the translocation, funding, and other considerations will be important factors in that determination. Based on that assessment, the translocation plan implemented in a given year might involve either single or multiple donor and nursery sites, provided that the site selection is consistent with the provisions of the operative alternative (no translocations of weaned pups from the NWHI to the MHI are allowed under Alternative 3). Further, the number of seals collected and translocated to each site can vary and will be determined following the provisions of the decision framework (Appendix F).

The allowance for flexibility in site selection and number of handled seals means that no single simulation scenario can fully represent all of the possible combinations and outcomes that might be undertaken pursuant to the translocation strategy. The simulation scenarios used for this evaluation are hypothetical and were selected to illustrate the salient aspects of the two-stage translocation concept as permitted under each alternative. In practice, prior to initiating an action, additional simulations and ancillary analyses will be undertaken to inform NMFS about the relative benefits that might accrue from various translocation scenarios under consideration in a given year.

For all simulation scenarios presented here, French Frigate Shoals was chosen to represent the "donor" site because this site has consistently had the poorest juvenile survival of any site (recent years' survivorship to age 3 and age 4 is 0.137 and 0.123, respectively). The simulations modeled the collection of 10 female

pups annually for 5 years at French Frigate Shoals, with subsequent release at the nursery site. Simulations were run with and without a first-year survival decrement ("nursery site decrement") for translocatees as compared to survival of the native born seals at the release site. This decrement was primarily intended to represent a survival penalty that might result from smaller weaning girth as compared to native born seals at the nursery site.

The survival decrement, or penalty, represents a proportionate reduction in the survival rate for the translocated seals relative to other, non-managed seals of the same age at the nursery or return site. For example, if the survival rate for age 1 seals is normally 0.60 and the survival decrement is 0.90, the translocated seals will have a survival rate = 0.54 (0.90 * 0.60). As described in Appendix F, a decrement value of 0.90 (10% survival penalty) was used in those simulations that included the decrement. For the next two simulation years subsequent to the first year after release, translocated seals shared the same survival rate as native-born seals.

For all of the simulated translocations described here, seals were returned to their birth site at age 3 years. At this second stage of the simulated translocations, another survival decrement ("return decrement") was optionally applied to represent differential survival relative to non-translocated seals left at the original site. This decrement was primarily intended to represent the survival penalty that might result from translocated seals being unfamiliar with their new environment. As with the previous "nursery site survival decrement", the "return decrement" applied only to the first year after release. In the simulations that included this decrement, the value was set to 0.71 (29% survival penalty relative to non-treatment seals) to indicate the worst performance expected from the second stage of the translocation. The derivation of this value is described in Appendix F.

The metrics used to evaluate the outcome of the translocation simulations were:

- Mean final abundance (N) at the original donor site;
- Population reproductive value (V_{pop});
- Number of mature females (Nf_{mature});
- Realized growth rate ($\lambda_{realized}$) for the donor subpopulation from year 1 to year 10 of the simulation;
- Survivorship of the translocated seals (l_x to age 4); and
- Intrinsic growth rate (λ_{trans})[1] for the lifetable representing the translocated seals.

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[1] There are some subtleties associated with computing λ_{trans}, which make this a somewhat conservative value. First, it is assumed that the observed reproductive schedule for the translocated seals will match the estimated rates for the non-translocated French Frigate Shoals, which grew up at that subpopulation. However, if as

All results are compared to results of a baseline simulation scenario of the same duration in which no translocation occurred. The baseline scenario projected that in 10 years, the mean number of monk seals in the total population would be 898.##

4.7.1.17 *DIRECT AND INDIRECT EFFECTS ON HAWAIIAN MONK SEALS OF ALTERNATIVE 1 – STATUS QUO*

Direct and Indirect Mortality Due to Research and Enhancement on Hawaiian Monk Seals (Alternative 1, Status Quo)

Alternative 1 allows for the following lethal takes for both research and enhancement combined (see Table 4.7-3 and Appendix H Alternative 1 Take Table):

- Adult male removal: 10 males can be removed from the population over a five-year period. These seals can be taken for permanent captive care or by euthanasia, and may be removed in one or multiple years.
- Unintentional mortality: Four seals may be unintentionally killed over a five-year period, with no more than two seals taken per year. These seals can be of any size and of either sex. As noted previously, to model an exceptionally high-impact scenario, it is assumed that all these mortalities involve 4-year-old female seals. Note that in Alternative 1, these lethal takes could result either from research or enhancement activities, or both.
- Humane euthanasia: 10 moribund or seriously injured seals may be euthanized. These takes are not simulated in the model. By definition, this would involve seals that would definitely have died without euthanasia, so that there would be no additional mortality attributable to research or enhancement associated with this activity.

In the 10-year projection of Alternative 1 (Status Quo), the simulated loss of four 4-year old females reduced the total abundance from 898 seals (Baseline: scenario 1 of Table 4.7-3) to 889 seals (scenario 2). That difference (9 fewer seals) is attributable both to the lost female seals and the offspring they were likely to produce during the 10-year projection. The additional loss of 10 males over 5

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expected, the translocated seals returned to French Frigate Shoals are in better condition than the non-translocated seals, their reproductive patterns may be closer to the nursery sites, (Laysan Island or the MHI) which have more favorable reproductive curves (see Figure 3 of Appendix F, Translocation Paper). Further, the lifetable from which λ_{trans} is calculated contains a pre-weaning survival value (0.77) equal to that observed at French Frigate Shoals in recent years. In fact, translocated seals would be selected *after* weaning, so that their actual pre-weaning survival value would be 1.0, which if used instead, would yield higher estimates of λ_{trans}. However, because these seals' survival to weaning was not attributable to the two-stage translocation, using a pre-weaning survival value of 1.0 might suggest the translocation would yield more favorable results than is actually the case. Using either value (1.0 or 0.77) is imperfect, but the latter was chosen as it more conservatively characterized the benefits to conservation.

years (scenario 3) reduced the mean abundance by an additional 3 seals. This reduction is less than the number of males removed because the losses were randomly allocated to individual males present in the subpopulation and many of those males were older individuals likely to die sometime within the 10-year projection. These losses reduced the realized population growth rate ($\lambda_{realized}$) from 0.985 to 0.983, when both types of loss (unintentional mortality and male removals) were incorporated into the simulations.

Conclusions for Mortality Effects on Hawaiian Monk Seals (Alternative 1, Status Quo)

Under the exceptionally high-impact scenario modeled, Alternative 1 could result in a reduction of total abundance of 9 seals, representing a 1% decline compared to baseline projections without these takes. This can also be viewed as a reduction in realized growth rate of 0.002. While possible, it is unlikely that all the lethal takes due to research or enhancement would occur, or that they would all involve female seals at peak reproductive value. Thus, the research and enhancement impacts will likely be less than those simulated above.

These very small changes in the population may not be detectable compared to baseline values, so the magnitude and intensity of mortality effects would be minor. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would also be minor. The frequency of allowable lethal takes is expected to be low given that they could at most average 0.8 unintentional deaths per year, and would occur with moderate (over a 5–year permit cycle) duration, such that the duration and frequency would be minor. Overall, Alternative 1 would likely result in minor adverse effects on mortality, especially when considered with positive benefits of enhancement actions that directly or indirectly improve survival as described below.

Direct and Indirect Reproductive Effects of Research and Enhancement on Hawaiian Monk Seals (Alternative 1, Status Quo)

As described above, it is difficult to reliably quantify the degree, if any, of negative reproductive effects from research and enhancement activities. To assess a more severe case than would occur by random chance, the simulations assumed that all lethal takes involved females with high reproductive value and also accounted for the loss of the offspring they would have produced, had they not been killed. Mortality effects were all determined to be minor, thus we would assume reproductive effects on the same number of females would be even less consequential.

If reproductive effects extended to a larger number of female seals, they could result in greater impacts but it is unlikely they would be detectable. Thus, mechanisms for possible adverse reproductive effects as a result of research or enhancement exist, but are likely indistinguishable from other natural stresses, so that their magnitude and intensity would be minor. Any such effects would not

be measurable, so that their geographic extent/biological level and duration and frequency would be negligible. Overall, as described more in detail in Section 4.7.1.14 (Assessment of Reproductive Effects Due to Research and Enhancement), the direct and indirect effects from research and enhancement would likely result in negligible reproductive effects given the applicable precautionary measures (no adult female is captured that appears to be pregnant or is otherwise thought likely to be well into a pregnancy even if it is not visually apparent).

Contribution to Conservation Objectives for Hawaiian Monk Seals (Alternative 1, Status Quo)

Alternative 1 represents the Status Quo, representative of current research and enhancement activities under the existing permit. Close monitoring of Hawaiian monk seals over decades of research and enhancement activities included under Alternative 1, with the exception of the more recent addition of de-worming research and small-scale translocations of weaned pups within the NWHI, have demonstrated that procedures used do not result in major adverse effects on this species. In fact, potential effects on mortality and reproduction due to Alternative 1 research and enhancement are considered either minor or negligible.

Despite the fact that Alternative 1 does address many of the Recovery Plan objectives (see Section 3.3.1.8) to varying degrees, Status Quo efforts have not reversed the decline. Field research monitoring in the NWHI would continue to fulfill Recovery Plan objectives to monitor that portion of the population. Juvenile survival of females would potentially be improved by continued de-worming (if determined effective), current levels of translocations of nursing and weaned pups, disentanglement/de-hooking, and removal of aggressive males under Alternative 1. Continued growth of the MHI population would be supported by de-hooking and disentangling seals, and by translocations of weaned pups from areas where they may be at risk. However, mitigation of disease risk and reduction of unmanageable human-seal interactions would be very limited under Alternative 1 measures.

Conclusions for Conservation Objectives for Hawaiian Monk Seals (Alternative 1, Status Quo)

Alternative 1 would, to some degree, address many of the objectives of the Recovery Plan, though not at a level that would be expected to result in maximum potential effects on recovery. For this reason, the magnitude and intensity of Alternative 1 in meeting conservation objectives would be moderate. Research and enhancement activities would occur throughout the species range such that the geographic extent/biological level would be major. The effects of implementing Alternative 1 would be somewhat periodic in that many enhancement activities are reactive and can only be conducted when opportunities arise (such as disentangling seals). Yet, such interventions that do occur may have long-term effects. Thus, the duration and frequency of

conservation contributions would be moderate. Given the past track record of the Status Quo activities, and these considerations described, Alternative 1 would result in a moderate beneficial contribution to conservation objectives.

4.7.1.18 *DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)*

Direct and Indirect Mortality Due to Research and Enhancement on Hawaiian Monk Seals (Alternative 2, No Action)

Under Alternative 2, existing levels of research and enhancement could continue until the current permit expires in 2014. As of Spring 2013, there have been no unintentional research or enhancement mortalities during the current 5-yr permit cycle, and one adult male has been brought into captivity (none was lethally removed). Assuming the risk of these mortalities is constant over time, mortality for the remainder of the current permit cycle through 2014 is not likely to result in the total number of allowed mortalities or adult males that could be removed (10 takes per year as authorized in the current Permit 10137). Because Alternative 1 mortality effects were all judged to be minor, and mortalities under Alternative 2 would be fewer given that after the permit expires in 2014, no additional research or enhancement would occur on wild seals. Thus, it stands to reason that there would be minor adverse effects on mortality under Alternative 2 until expiration of the permit in 2014 and negligible effects thereafter due to no research or enhancement.

Direct and Indirect Reproductive Effects of Research and Enhancement on Hawaiian Monk Seals (Alternative 2, No Action)

As described under Alternative 1, mechanisms for possible adverse reproductive effects as a result of research or enhancement exist, but are likely indistinguishable from other natural stresses. Alternative 2 reproductive effects would also be negligible once the existing permit expires in 2014.

Contribution to Conservation Objectives for Hawaiian Monk Seals (Alternative 2, No Action)

The difference between Alternative 2 and Alternative 1 in terms of conservation is that under Alternative 2 any positive contributions would cease after 2014. Some conservation actions, such as education/outreach, etc. could continue and some enhancement (*i.e.*, entanglement/de-hooking) could be accomplished but only under the separate permit for the Marine Mammal Health and Stranding Response Program (see Section 1.9.3) and not as part of this research and enhancement program. Given that most entangled monk seals are encountered in the NWHI during research field camps the majority of disentanglements are done under the Pacific Islands Fisheries Science Center (PIFSC) research and enhancement permit. Under Alternative 2, those field camps would cease after 2014, so there would be no opportunity to disentangle these seals. With the exception of those activities that could be accomplished without permits or

under the auspices of stranding response, none of the objectives of the Recovery Plan would be obtained. There would be no field research to monitor populations and detect problems, and no interventions such as de-worming, translocation, etc. to improve juvenile survival.

Conclusions for Conservation Objectives for Hawaiian Monk Seals (Alternative 2, No Action)

Considering that almost all research and enhancement would cease after 2014, the Alternative 2 would not address many of the Recovery Plan objectives, therefore the contribution of this alternative to conservation of the species would be negligible in the long term. Because access to NWHI monk seals would practically cease after 2014, the geographic extent/biological level would be negligible because only scat and spew samples could be collected from vacant beaches, and seals could only be observed and photographed at great distances. The duration and frequency of meeting conservation objectives would be short-term, ending in 2014. Lack of future research and enhancement permits would result in major adverse contributions to conservation given the benefits of continued research and enhancement activities would cease and higher mortality could result from the lack of disentanglement or translocation of pups from harmful situations.

4.7.1.19 *DIRECT AND INDIRECT EFFECTS ON HAWAIIAN MONK SEALS OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

There are two notable differences between Alternative 3 and Alternative 1 (Status Quo). While, Alternative 3 includes the same activities as Alternative 1, the number of takes allowed is greater for certain activities (*e.g.*, two-stage translocation). In addition, new activities such as expanded deworming efforts and vaccinations are included in Alternative 3. These differences are described more fully in the following sections in order to provide context for the effects analysis for Alternative 3. Appendix H, Alternative 3 Take Table provides the numbers of animals proposed to be taken under this alternative (see also Table 4.7-3).

Increased Takes of Hawaiian Monk Seals For Ongoing Activities Under Alternative 3

For some activities, the number of takes that may occur under Alternative 3 exceeds that allowed under Alternative 1, because of a recognition that new or expanded enhancement activities (*e.g.*, two-stage translocation, de-worming, behavioral modification) will require additional monitoring in order to evaluate the efficacy of these activities. Thus, for example, the number of monitoring takes was increased at most locations (except French Frigate Shoals where the steep decline in population has reduced the number of seals likely to be available for monitoring).

For sites in the MHI and Nihoa, the numbers of seals taken by monitoring, tagging and marking were all increased relative to status quo. This recognizes both the need for more monitoring at these historically under-sampled sites and the fact that these populations are expected to be increasing naturally (*i.e.*, independently of any NMFS action). Therefore, more takes would be required to monitor larger numbers of seals. Likewise, the increased number of weaned pups that may be translocated for risk alleviation (*i.e.*, to move them away from harm) is in anticipation of the growing MHI population and the probability that more pups will be weaned in high risk areas in the foreseeable future.

Health screening and foraging studies (instrumentation) are also higher in Alternative 3 in order to support activities such as translocation and the associated health screening and tracking after their release to monitor outcomes. De-worming takes are also higher under Alternative 3, which would allow for broader application of this potential enhancement tool, should research determine it is effective. Total allowable adult male removals (via euthanasia, placement in captivity, or translocation) were also increased from 10 over 5 years to 20 annually (although the number that could be lethally removed remained at 10 for a 5-yr period). This is in response to recent signs of increasing multiple male aggression at Laysan Island. When the current research and enhancement permit was granted (the basis for Alternative 1), adult male removals were primarily designed to deal with single male aggression. Should there be an increase in multiple male aggression, Alternative 3 allows for the flexibility to translocate sufficient numbers of aggressive males in any year to mitigate this source of mortality on juveniles or females.

Despite the fact that numbers of animals potentially involved in research activities under Alternative 3 increased relative to Alternative 1, the number of unintentional research mortalities remains the same. This is because in the past, Status Quo levels of research and enhancement have not led to the allowable number of lethal takes. It is anticipated that the addition of some research and enhancement activities will not lead to more than the allowed level of takes under Alternative 1.

Increased Takes of Hawaiian Monk Seals for New Activities Under Alternative 3

New research and enhancement activities in Alternative 3 include:

- Two-stage translocation (described in detail in Appendix F). This does not include any translocation of weaned pups born in the NWHI to the MHI.
- Translocations of juvenile seals for research to determine survival of juvenile seals post-translocation.
- Behavioral modification of seals in the MHI.
- Chemical (*e.g.*, GnHR agonist) behavioral modification of aggressive males as an alternative to translocation, permanent captivity or euthanasia.

- Vaccination research and implementation to mitigate infectious disease.
- Unintentional mortality due to enhancement. Recognizing that the increased enhancement efforts listed above entail increased risk as well as increased benefits, additional enhancement-only-related mortalities would be allowed under Alternative 3.

Direct and Indirect Mortality Due to Research and Enhancement of Hawaiian Monk Seals (Alternative 3, Preferred Alternative)

Excluding authorization for the humane euthanasia of up to 10 moribund or severely injured seals, Alternative 3 allows for three other types of lethal take of monk seals:

1. **Adult male removal**: Up to 20 males can be removed from the population over a 5-year period. These seals can be taken into permanent captive care or by euthanasia (no more than 10 by euthanasia over the 5-year period), and may be removed in one or multiple years. While this alternative caps the lethal removals at 10 over 5 years, many more could hypothetically be taken into permanent captivity. However, in reality it has proven extremely difficult to identify a captive facility with space and resources to take any adult male monk seals. Therefore the simulated scenario allows for a rather liberal 10 to be taken into permanent captivity in addition to 10 lethal removals, for a total of 20.

2. **Unintentional mortality due to research**: A maximum of 4 seals may be taken in 5 years, with no more than 2 seals taken per year. These seals can be of any size and of either sex. This level of lethal take for research only is equal to that allowed for both research and enhancement under Alternative 1. Because there are separate allowances specifically for enhancement-related mortality under Alternative 3 (see below), the 4 research mortalities allowed could be viewed as an increase over Alternative 1. This is justified in the following way. Research-related mortalities have been rare. For example, during the past 4 complete years of permitted research, there has been 1 unintentional mortality, for an average of 0.25 per year. Under Alternative 3, there may be 4 mortalities in 5 years (an average of 0.8 per year). However, mortalities occur in whole numbers only, not fractions, and the proposed takes (4) is already a small whole number.
   Thus, while it is unlikely that this level of takes will occur, it is certainly within the realm of reason that 4 lethal accidents could occur over a 5-year period of research. Moreover, Alternative 3 involves increased research takes in various categories. Many of these takes entail capture, restraint and sometimes sedation, which are the types

of activities that present higher risk of unintentional mortality. Specifically, over 5 years, Alternative 3 allows an additional 320 flipper taggings, 150 health screenings, and 30 juvenile monk seal research translocations over and above that allowed under Alternative 1. This additional risk exposure justifies maintaining the requested level of unintentional research mortality.

3. **Unintentional mortality during enhancement activities**: This lethal take is further subdivided into three groups:

    a. Weaned pup (either sex): Up to 4 pups over 5 years, with no more than 2 in one year

    b. Juveniles/subadults (either sex): Up to 8 seals over 5 years, with no more than 4 in one year

    c. Adult Males: Up to 4 males over 5 years, with no more than 2 in one year.

Alternative 3 entails a dramatic increase in enhancement efforts in comparison to Alternative 1. New or expanded enhancement activities included in Alternative 3, which might result in increased takes include:

- Weaned Pups
    - Increased deworming
    - Increased translocation for risk alleviation
    - First stage of two-stage translocation
    - Behavioral modification
    - Vaccination
- Juveniles
    - Increased deworming
    - Second stage of two-stage translocation
    - Behavioral modification
    - Vaccination
- Adult males
    - Doubling potential number of removals in response to increased multiple-male aggression.
    - Initiation of chemical behavior modification

Compounding the risk of simply increasing the number of animals involved in enhancement is that for some of the proposed activities, the inherent risks are not well known. Whereas a large number of weaned pup translocations have been conducted and the level of risk involved is quite low (Baker *et al.* 2011b), far fewer cases of juvenile translocations have occurred. The general sense, however, is that juvenile seals are at greater risk of stress and mortality when being held captive. In a 2006 captive care program at Midway Atoll, 6 weaned pups and 1 juvenile seal were held in shoreline pens to be fattened up. All the pups gained

weight and were released in good body condition, while the single juvenile died of complications related to stress a few weeks after being brought into captivity (Baker and Littnan 2008). Because juveniles seem subject to greater risk in captivity, the number of allowed lethal juvenile takes in Alternative 3 (8 in 5 years) is higher than that for weaned pups (4 in 5 years), notwithstanding the fact that more weaned pups are likely to be involved in enhancement activities.

Compared to translocation, other enhancement activities with young seals (deworming, behavioral modification, vaccination) are thought to present lower risk. However, these are either entirely new or only rarely tested activities, so that their true risks remain uncertain and difficult to quantify pending initial trials.

A final risk magnifier that is reflected in the number of proposed unintentional mortalities is that some activities, most notably two-stage translocation, involve "grouped risk" whereby several animals will be captured, transported, held in quarantine and released together. In statistical language, by grouping seals in this way, the risk of unintentional mortality becomes "non-independent". That is, if some rare but lethal event should occur (disease outbreak, boating or vehicle accident, etc.), there is greater likelihood of losing multiple seals at one time.

Combining all of these types of take, under Alternatives 3, the total number of seals that could be removed from the population over a 5-year period consists of 24 males (20 removals and 4 unintentional mortality), and 16 additional unintentional mortalities of either sex (including 4 weaned pups, 8 juveniles, and 4 seals of any age/sex).

The simulated loss due to unintentional mortality, in which all of the mortality not specifically designated as males was assumed to apply to females (juvenile females were assumed to be age 3 yr), reduced the mean total population abundance from 898 seals to 874 seals (2.7% reduction; scenarios 1 and 4 in Table 4.7-3). The additional removal of 20 aggressive males (scenario 5) reduced the mean abundance to 864 seals (3.8% reduction). The realized growth rate decreased from 0.985 to 0.981 when all of the allowable takes were included in the simulations.

Conclusions for Mortality Effects on Hawaiian Monk Seals (Alternative 3, Preferred Alternative)

Under the exceptionally high-impact scenario modeled, Alternative 3 could result in a reduction of total abundance of 34 seals, representing a 3.8% decline compared to baseline projections without these takes. This can also be viewed as a reduction in $\lambda_{realized}$ of 0.004.

While possible, it is unlikely that all the lethal takes would occur, nor is it likely that all those not specified as males would turn out to be female seals.

The expected small changes in the population would likely amount to an equivocal change in population status, so that the magnitude and intensity of

mortality effects would be *moderate*. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would be minor. The allowable lethal takes are moderate frequency (no more than a few per year would be likely) and would occur with moderate duration (according to the 5-year permit cycle), such that the duration and frequency would be moderate. The majority of the potential lethal takes of female seals under Alternative 3 are associated with enhancement activities. These activities will focus on seals that are already at elevated risk of natural mortality and enhancement activities are expected to achieve benefits in improved survival (presented below) The overall adverse direct and indirect effects of research and enhancement on mortality would be minor to moderate adverse.

Direct and Indirect Reproductive Effects of Research and Enhancement on Hawaiian Monk Seals (Alternative 3, Preferred Alternative)

Reproductive effects of Alternative 3 are based on the same assumptions as described for Alternative 1, such that Alternative 3 reproductive effects would be negligible as in Alternative 1.

Contribution to Conservation Objectives for Hawaiian Monk Seals (Alternative 3, Preferred Alternative)

All of the contributions to conservation that would occur under Alternative 1 would also be realized under Alternative 3. However, the suite of additional enhancement activities available under Alternative 3, while they may entail some additional unintended mortalities, are, in aggregate, expected to reap far more benefits. For example, the expansion of de-worming, if effective, would improve juvenile survival and condition. While additional removals of aggressive males would reduce the number of adult males in the future, this would only occur if adult females or young animals were being harmed and killed by these males. In such a case, there is no question that removing aggressive males would yield far greater population benefit by saving female seals relative to the loss of a small number of males (Johanos *et al.* 2010). Moreover, to the extent that chemical treatment of aggressive male behavior proves feasible, this could also result in improved female survival.

Behavior modification research is intended to develop tools that would allow seals in the MHI that have developed undesirable behaviors to remain in the wild population. This would likely prevent the need to either translocate such seals to areas where their survival may be impaired (NWHI) or to bring them into captivity. Any additional seal that remains wild in the MHI addresses the Recovery Plan objective of fostering MHI population growth. Vaccination research, should it lead to a tool for mitigating the introduction or spread of infectious disease, also directly addresses a Recovery Plan objective.

Illustrative simulations to evaluate conservation benefits of two-stage translocation under the constraints of Alternative 3 are as follows. Alternative 3

allows for two-stage translocation to occur among sites within the NWHI, or among sites within the MHI. Seals can also be translocated from the MHI to the NWHI, but no facilitated movements from the NWHI to the MHI are allowed under this alternative (that is, no two-stage translocation from the NWHI to the MHI is permitted). For this alternative, the monk seal model was used to simulate the two-stage translocation of 10 pups per year, collected at French Frigate Shoals and released at Laysan Island (chosen because the most recent data indicate this site has the most consistently favorable juvenile survival among the six main NWHI subpopulations). All surviving seals were returned to French Frigate Shoals at age 3 years. This pattern was repeated for the first 5 years of each simulation.

In the simulated translocations, the translocated seals were returned to their natal site at age 3 years, and therefore the effects of the translocations at the nursery site (Laysan Island) were ephemeral (in other words, they did not cause a direct, long-term change in the local population at the nursery site because they were moved back to French Frigate Shoals). As expected, final abundance at Laysan Island was approximately the same with or without the translocations (171 seals), but the mean population trajectory was elevated while the project was underway (years 1-8) as compared to the baseline trajectory.

At French Frigate Shoals, the mean abundance at the end of the 10-year projection increased from 93 seals (baseline scenario) to 96-101 seals as a result of the temporary translocation of seals to Laysan Island. The highest value (101 seals) resulted from imposing no survival decrements following either stage of the translocation. Similarly, V_{pop} in year 10 increased from 165 newborn equivalents to 203 newborn equivalents with the translocation and no survival decrements. The basis for the V_{pop} increase is evident in the number of mature females present at French Frigate Shoals: 26 with no translocation, versus a maximum of 33 mature females with translocation. With no survival decrements, survivorship to age 4 yr (l_4) of the translocatees increased from 0.123 (baseline) to 0.226 with translocation and no decrements, thereby increasing the intrinsic growth rate of the lifetable describing the demography of the translocated seals ($\boldsymbol{\lambda}_{trans}$) from 0.916 to 0.952.

Table 4.7-1 represents results of simulated translocations from French Frigate Shoals to Laysan Island (10 female pups per year for five consecutive years). Result columns are: N = mean final abundance at French Frigate Shoals (5% and 95% tails in parentheses); V_{pop} = population reproductive value in year 10 of the ten year simulation (5% and 95% tails in parentheses); Nf_{mature} = mean final number of mature females (age 5-20 yrs); l_4 = survivorship of translocated seals to age 4 yrs; and $\boldsymbol{\lambda}_{trans}$ = intrinsic growth rate of modified life table applicable only to the translocated seals.

Table 4.7-1 Results of Simulated Translocations from French Frigate Shoals to Laysan Island

Scenario	Survival Decrements*	N	V_{pop}	Nf_{mature}	l_4	λ_{trans}
Baseline	NA	93 (61,131)	165 (100, 244)	26	0.123	0.916
No decrements	1.00, 1.00	101 (67,141)	203 (124, 299)	33	0.226	0.952
Nursery decrement only	0.90, 1.00	99 (67, 138)	198 (120, 291)	32	0.205	0.944
Return decrement only	1.00, 0.71	97 (66, 135)	187 (115, 275)	30	0.161	0.932
Both decrements	0.90, 0.71	96 (65, 133)	181 (112, 274)	29	0.145	0.926

* Survival decrements for first year after initial release at nursery site, and first year after return to natal site. Tabulated values give proportion of mean survival rate as compared to resident (non-treatment) seals on site.

Conclusions for Conservation Objectives for Hawaiian Monk Seals (Alternative 3, Preferred Alternative)

Alternative 3 would, to the highest degree considered feasible, address all of the objectives of the Recovery Plan. Under Alternative 3 (Preferred), weaned pups may be taken from areas of lower survival to areas of higher survival (1) within the NWHI, (2) within the MHI, or (3) from the MHI to NWHI, with the option of returning the seals to their birth location or nearest appropriate site at age 2 years and older. This alternative excludes moving weaned pups born in the NWHI to the MHI.

Maximum potential benefits might not be realized through the two-stage translocation proposed under Alternative 3 because weaned pups could not be moved from areas of current low survival in the NWHI to higher survival in the MHI. This limits the potential effectiveness of the translocation process given current demographic rates. If future conditions are such that translocations from the NWHI to MHI would be even more beneficial than they may be currently, the inflexibility to conduct such translocations would reduce potential conservation benefits of Alternative 3 further. However, implementing two-stage translocations from the NWHI to the MHI would be infeasible at this time. NWHI pups, if brought to the MHI, could become involved in fishery and other human interactions, just as has occurred among some seals born in the MHI. Capacity and techniques for monitoring translocated seals, and intervening to prevent and mitigate such interactions, must be further developed before this action can be conducted without risking failure as measured both in terms of seal survival and public attitudes toward monk seal conservation.

The effects of implementing Alternative 3 would be quite immediate in that many enhancement activities could begin right away. Because this Alternative offers a variety of ways to conduct enhancement at any one time, the benefits are more likely to be long-term (because in any year it is likely that some suite of enhancement tools could be implemented), making the duration and frequency of conservation contributions *major*. Overall, there would likely be a *major* beneficial contribution of Alternative 3 towards conservation objectives.

Given that Status Quo (Alternative 1) efforts have failed to reverse the decline, more ambitious measures as represented in Alternatives 3 and 4 have been developed. Relative to Status Quo, the contribution to conservation through Alternative 3 measures would be moderate in magnitude and intensity. The activities would occur throughout the species range such that the geographic extent/biological level would be major. Alternative 3 provides a variety of ways to conduct enhancement at any one time and the benefits are more likely to be long-term (because in any year it is likely that some suite of enhancement tools could be implemented) therefore considered *major* in terms of duration and frequency. Overall, the contribution of beneficial effects towards conservation objectives under Alternative 3 would be *major*.

4.7.1.20 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Direct and Indirect Mortality of Hawaiian Monk Seals Due to Research and Enhancement (Alternative 4, Enhanced Implementation)

Alternatives 3 and 4 are quite similar except for the approach to two-stage translocation. Under Alternative 4, NMFS would be permitted to move weaned pups born in the NWHI to the MHI. Since the level of allowable lethal takes are the same for Alternatives 3 and 4, the expected small changes in the population would likely amount to an equivocal change in population status, so that the magnitude and intensity of mortality effects would be moderate. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would be minor. The allowable lethal takes are moderate frequency (no more than a few per year being likely) and would occur with moderate duration (5 year permit cycle), such that the duration and frequency would be moderate. As discussed under Alternatives 1 and 3, the levels of take specified in the alternatives present the maximum number possible and likely would not be reached under any alternative, including Alternative 4. Therefore, the overall direct and indirect effects of mortality would likely be minor to moderate adverse under Alternative 4, considering this represents the exceptionally high-impact simulation scenario and risks must be balanced with the potential gains from the contribution towards conservation objectives summarized below.

Direct and Indirect Reproductive Effects of Research and Enhancement on Hawaiian Monk Seals (Alternative 4, Enhanced Implementation)

The same logic applied in analysis of Alternatives 1 and 3 reproductive effects, would also apply to Alternative 4. Thus, Alternative 4 reproductive effects would be negligible as in the other alternatives.

Contribution to Conservation Objectives for Hawaiian Monk Seals (Alternative 4, Enhanced Implementation)

The distinction between Alternatives 3 and 4 becomes apparent when considering the potential benefits to conservation of two-stage translocation. Under Alternative 4, while many of the benefits described under Alternative 3 would be the same, there would be potential to yield greater results given the additional option of moving seals from the NWHI to the MHI as discussed here.

Given recent survival rates, the potential benefits associated with two-stage translocation of weaned pups from French Frigate Shoals to the MHI, an option which is unique to Alternative 4, are greater than those likely to result from a within-NWHI translocation (Alternative 3). The mean final abundance at French Frigate Shoals increased from 93 seals (baseline) to 104-112 seals with translocation. Similarly, the number of mature females increased from 26 at the end of the ten year baseline projection, to 36-43 with translocation, giving an increase in V_{pop} from 165 newborn equivalents (baseline) to 221-263 newborn equivalents. Survivorship to age 4 yr (l_4) for the translocatees increased from 0.123 to 0.434 with translocation and no survival decrements, giving λ_{trans} = 0.991 for the lifetable associated with the translocated seals.

Table 4.7-2. Results of simulated translocations from French Frigate Shoals to MHI (10 female pups per year for five consecutive years). Result columns are: N = mean final abundance at French Frigate Shoals (5% and 95% tails in parentheses); V_{pop} = population reproductive value in year 10 of the ten year simulation (5% and 95% tails in parentheses); Nf_{mature} = mean final number of mature females (age 5-20 yrs); l_{x-4} = survivorship of translocated seals to age 4 yrs; and λ_{trans} = intrinsic growth rate of modified life table applicable only to the translocated seals (see Table 4.7-2).

Table 4.7-2 Results of Simulated Translocations form French Frigate Shoals to MHI (10 Female Pups per Year for 5 Consecutive Years)

Scenario	Survival Decrements*	N	V_{pop}	Nf_{mature}	l_4	λ_{trans}
Baseline	NA	93 (61,131)	165 (100, 244)	26	0.123	0.916
No decrements	1.00, 1.00	112 (78, 151)	263 (169, 375)	43	0.434	0.991
Nursery decrement only	0.90, 1.00	111 (77, 151)	252 (162, 360)	41	0.391	0.985
Return decrement only	1.00, 0.71	105 (71, 144)	228 (144, 326)	37	0.310	0.969
Both decrements	0.90, 0.71	104 (71, 143)	221 (138, 325)	36	0.279	0.964

Note: Survival decrements for first year after initial release at nursery site, and first year after return to natal site. Tabulated values give proportion of mean survival rate as compared to resident (non-treatment) seals on site.

Conclusions for Conservation Objectives for Hawaiian Monk Seals (Alternative 4, Enhanced Implementation)

Alternative 4 would, to the highest potential degree, address all of the objectives of the Recovery Plan. The option to conduct two-stage translocation using the MHI as a temporary nursery site, would allow the maximal potential benefits, given current demographics, to be achieved. Also, the flexibility to adapt to potential future conditions that might make translocations from the NWHI to MHI even more beneficial, would allow NMFS to adapt strategies to a greater range of future scenarios. These considerations make the magnitude and intensity of Alternative 4 conservation benefits *major*. The activities would occur throughout the species range such that the geographic extent/biological level would be *major*.

As discussed above, implementing two-stage translocations from the NWHI to the MHI would be infeasible at this time. NWHI pups, if brought to the MHI, could become involved in fishery and other human interactions, just as has occurred among some seals born in the MHI. Capacity and techniques for monitoring translocated seals, and intervening to prevent and mitigate such interactions, must be further developed before this action can be conducted without risking failure as measured both in terms of seal survival and public attitudes toward monk seal conservation.

The effects of implementing Alternative 4 would, like Alternative 3, be quite immediate in that many enhancement activities could begin right away. Because this Alternative offers a variety of ways to conduct enhancement at any one time, the benefits are more likely to be long-term (because in any year it is likely that some suite of enhancement tools could be implemented), making the duration and frequency of conservation contributions *major*. Overall, there would likely be a *major* beneficial contribution of Alternative 4 towards conservation objectives. Again, the only difference between Alternative 4 and Alternative 3 is the provision for two-stage translocation of weaned pups from the NWHI to the MHI. Because that action has been deemed infeasible for the present and next several years, Alternative 4 would be equivalent to Alternative 3 in practical terms for at least several years.

Table 4.7-3 Simulation results for lethal takes for Alternatives 1 and Alternatives 3/4 (allowable lethal take is equivalent for Alternatives 3 and 4). Main cell entry is the mean value (over 500 simulations), with the 5% and 95% tails from the projections in parentheses. Details of number and types of take and simulation design are provided in the text.

Table 4.7-3 Simulation Results for Lethal Takes for Alternatives 1, 3, and 4

Scenario	Description	Total abundance	Realized growth rate
1	Baseline (no takes)	898 (773,1025)	0.985 (0.971, 0.998)
2	Alt. 1 Status Quo (unintentional mortality only)	889 (766,1019)	0.984 (0.970, 0.998)
3	Alt. 1 Status Quo (unintentional mortality and male removals)	887 (770,1014)	0.983 (0.970, 0.997)
4	Alt. 3-4 (unintentional mortality only)	874 (757,996)	0.982 (0.969, 0.996)
5	Alt. 3-4 (unintentional mortality and male removals)	864 (749,985)	0.981 (0.968, 0.994)

4.7.1.21 CUMULATIVE EFFECTS OF ALTERNATIVES ON HAWAIIAN MONK SEALS

Summary of Direct and Indirect Effects of the Alternatives on Hawaiian Monk Seals

Direct and indirect mortality and reproductive effects of research and enhancement activities may result from disturbance, capture, and handling. The alternatives vary by the levels of take permissible for research and enhancement and were evaluated in terms of the amount of mortality and reproductive effects that would occur under a given scope of research (Sections 4.7.1.15 through 4.7.1.18 and Appendix H, Take Tables). Table 4.7-4 summarizes the direct and indirect effects of the alternatives on monk seals.

Table 4.7-4 Summary of Direct and Indirect Effects of the Alternatives on Hawaiian Monk Seals

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Mortality	Minor adverse	Negligible	Minor to moderate adverse	Minor to moderate adverse
Reproduction	Negligible	Negligible	Negligible	Negligible
Contribution to Conservation Objectives	Moderate Beneficial	Major adverse	Major beneficial	Major beneficial

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Hawaiian Monk Seals

As described in detail in Section 3.3.1.3, Hawaiian monk seals are the most endangered pinniped species in U.S. waters and the second most endangered pinniped in the world. Hawaiian monk seals were listed as endangered in 1976 (41 FR 51611; November 23, 1976) due to a significant decline of over 70% since 1958 based on 2010 population estimates. The most recent published estimate of total abundance is 1,125 seals, declining at approximately 4.5% per year (Carretta *et al.* 2013). Table 4.7-5 presents past, present and future actions and events that may contribute to cumulative effects (beneficial and adverse) to the Hawaiian monk seal population.

Table 4.7-5 Hawaiian Monk Seal Cumulative Actions and Events

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, volcano, earthquake, hurricane	• Prey availability • Changes in habitat	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of entanglement and affects habitat suitability for molting, resting, and pupping areas	-
Climate change		• Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012).	-
Shark predation	• Mortality • Injury	• 1997 – 2006: 170 monk seal pups impacted by sharks at FFS (injured, confirmed and inferred deaths) • 2007 – 2012: 30 deaths due to shark predation at FFS	-
Male monk seal aggression		• 1980s and 1990s, injuries and deaths of female monk seals caused by multiple male aggression attacks inhibited population recovery at Laysan Island. Targeted translocations of adult males reduced this effect but this threat remains and is not unique to Laysan Island. Single male aggression toward pups remains a concern.	-
Disease	• Mortality • Reproduction	• Diseases such as morbillivirus could be devastating to monk seal survival or reproduction (see Section 3.3.1)	-
Scientific Research			
Research and enhancement permits issued since 2000 (HMS only)	• Education • Disturbance • Mortality • Injury	• 1982 – 1994: 23 seals died during rehabilitation. • 2003-2012: 2 mortalities due to research activities • While mortality has occurred, overall benefits of research and enhancement are beneficial for long term seal survival. • PIFSC - Permit 10137 HMS Research and Enhancement; MMHSRP - Permit 932-1905 ESA Species Emergency Response; Waikiki Aquarium – Permit 15453; Sea World – Permit 16124; Terrie Williams, Long Marine Laboratory – Permit 13602; Sea Life Park, Hawaii – Permit 17429; research on captive animals improves understanding of species for better management of wild populations and enhancement activities educate the public about the species' status	+
Cetacean research	• Disturbance	• Disturbance (*i.e.*, Level B harassment) due to interaction with vessels could occur but would be temporary and not result in injury or mortality.	-
Commercial Activities			

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Commercial Fisheries	• Mortality • Injury • Disturbance • Prey availability	• 1913 – 2002: fishing for trevally and amberjack. • 1930 – 2009: bottomfish fishery in NWHI. No current fisheries operating in NWHI • 1940s: Honolulu-based vessels fished lobsters, reef fish, inshore species, and turtles. • 1946: fishing companies used FFS as base for planes exporting scad and other species. • 1950s – 1991: longline for tuna (foreign fleet ended 1976; domestic fleet ended 1991). • 1970 – 1999: Hawaiian spiny lobster, Scaly slipper lobster. 11 million landed • 1965 – 1980: foreign vessels used tangle nets to harvest precious coral; Taiwanese vessels illegally poached 100 tons near Gardner Pinnacles and Lay • 1994, 2006, 2007 and 2010: 4 seals confirmed dead in nearshore gillnets • 1989 – 2010: 75 seals observed with embedded fish hooks in MHI • Hawaii State managed MHI nearshore fisheries a serious concern for seal injury and mortality seal-fishery interactions (NMFS 2012) • Past documentation of interactions between monk seals and Hawaii-based domestic pelagic longline fishery (NMFS 2002); although this fishery targets swordfish and tunas and does not compete with monk seals for prey (NMFS 2012).	-
Removal of marine debris from high entanglement zones	• Injury • Mortality	• 1982-2011: 323 entangled seals, 8 of which confirmed dead • 1994, 2006, 2007: Three seals found dead in gillnets (non-recreational) • 1995: seal found dead with hook lodged in its esophagus. • 1989-2009: 64 seals observed with embedded hooks in MHI • 2011: 9 seals observed hooked • 2012: 14 seals observed hooked (3 dead) • 2013: 3 deaths due to hookings or poor body condition (brought in under MMHSRP permit)	+
Entanglement of Hawaiian monk seals in marine debris or fishing gear			-
Inter-Island Transmission Cable	• Disturbance	• Disturbance (*i.e.*, Level B harassment such as noise) may occur during cable laying activities. • Long-term effects not anticipated as construction-related disturbance due to noise or human presence would be temporary and not result in injury or mortality.	-
Boat tours (*i.e.*, wildlife watching, snorkeling, parasailing, catamaran tours, etc.)		• Disturbance (*i.e.*, Level B harassment such as noise) may occur during tour activities.	-
Residential & Commercial construction (beach, near shore)	• Disturbance • Habitat degradation	• Disturbance (*i.e.*, Level B harassment due to noise) may occur during construction activities as well as once permanent coastal structures are in place (*i.e.*, increased exposure to humans). • Habitat may be permanently altered by coastal infrastructure.	-
Military Activities			

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**

Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS)	• Disturbance	• "Potential effects are expected to Level B harassment. Effects to impact rates of recruitment or survival on the associated marine mammal species and stocks not anticipated."
		• "Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) is minimal to negligible." The following permits are for different Navy vessels (US Navy 2012).
		  • File No. 18702: Level B harassment of 9 Hawaiian monk seals during training, testing, and military operations of LFA sonar in Hawaii North mission area; 4 monk seals in Hawaii South mission area.
		  • File No. 18703: Level B harassment of 9 Hawaiian monk seals during training, testing, and military operations of LFA sonar in Hawaii North mission area; 4 monk seals in Hawaii South mission area.
		  • File No. 18704: Level B harassment of 9 Hawaiian monk seals during training, testing, and military operations of LFA sonar in Hawaii North mission area; 4 monk seals in Hawaii South mission area.
		  • File No. 18705: Level B harassment of 9 Hawaiian monk seals during training, testing, and military operations of LFA sonar in Hawaii North mission area; 4 monk seals in Hawaii South mission area (Cody personal communication 2013)
			-

Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai`i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])		• Permit 15806 NMFS Incidental Harassment Authorization: Level B harassment not to exceed 110 monk seals annually. Expires January 5, 2014. • Permit 17860 NMFS Incidental Harassment Authorization: Level B harassment not to exceed 1 monk seals annually.	-
Permit 17860 US Navy Acoustic Technology Experiments			
Joint High Speed Vessel		• 2013: second trial of vessel; speed over 40 knots • Planned for use to get warfighters and equipment into combat as needed • Risk of collision leading to serious injury or mortality • Disturbance due to underwater noise	-
Other Activities			

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Monk seal harvest for meat, skins and shark bait	• Disturbance • Mortality • Injury	• Hunted to near extinction.	-
Introduction of invasive species or disease	• Competition for habitat or prey • Parasites • Indirect mortality	• Introduction to Laysan Island: rabbits, rats, common sandbur (*Cenchrus echinatus*) (weed) that inhibits regeneration of the primary nest substrate (Eragrostis variabilis) for Laysan finches (Morin and Conant 1998). • Insect and arachnids species (*e.g.*, beetles, weevils, grasshoppers, bees, wasps, spiders and ants), reptiles (*e.g.*, snakes, lizards) and mammals (*e.g.*, mice, rats, dogs, cats) could introduce disease or parasites to seals. • Mammals in particular may increase the risk of diseases such as morbillivirus. • Invasive fish species introduced through ballast water may cause changes in prey dynamics.	-
Removal of marine debris from high entanglement zones Entanglement of Hawaiian monk seals in marine debris or fishing gear	• Injury • Mortality	• 1982-2011: 323 entangled seals, 8 of which confirmed dead • 1994, 2006, 2007: Three seals found dead in gillnets (non-recreational) • 1995: seal found dead with hook lodged in its esophagus. • 1989-2009: 64 seals observed with embedded hooks in MHI • 2011: 9 seals observed hooked • 2012: 14 seals observed hooked (3 dead) • 2013: 3 deaths due to hookings or poor body condition (brought in under MMHSRP permit)	+ -
MMHSRP and other NMFS permits to disentangle, dehook and relocate seals away from harmful situations		• 2005 – 2012: 136 monk seals rescued, rehabilitated or assisted (Personal communication, Look 2013). • 1982 to 1994: 23 seals died during rehabilitation though it is likely these seals would have died from injuries regardless of intervention. • Two seals died in captivity when captured for translocation to mitigate male aggression.	+
Intentional shooting, maiming, injury or other harm	• Disturbance • Mortality • Injury	• 2009: 3 seals (including a pregnant female) shot and killed in MHI (Baker et al. 2010). • 2010 - 2012: 1 juvenile female seal and 4 adult seals were found dead due to multiple skull fractures caused by blunt force trauma on Kauai and Molokai.	-
Habitat protection , loss mitigation and restoration	• Habitat protection	• 1986: critical habitat 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 & 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). • 1988: critical habitat expanded to include Maro Reef and waters previously designated areas out to 20 fathoms (36.6 m) (53 FR 18988; May 26, 1988).	+

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural resource and species education and outreach	• Education	• 2009-2010: 10,000 people reached through partnerships with 30+ businesses, 50+ school presentations, 100+ schools • Promotes public understanding of monk seals and their habitat – increasing support for their survival	+
Hawaiian Monk Seal Rehabilitation Facility at Natural Energy Laboratory of Hawai`i Authority	• Survival • Reproduction	• 2.6-acre property at Keahole Point, Hawai`i for monk seal rehabilitation • Consists of a holding facility with two in-ground, custom-built fiberglass pools and two smaller in-ground pools designed specifically for monk seals.	+
Development and Maintenance			
Building islands using dredge and fill	• Contaminants • Habitat degradation • Disturbance • Injury • Stranding • Entanglement in debris	• Accumulation of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in tissues through nursing or through diet. • Studies link contaminant exposure and detrimental health effects such as reproductive impairment, immune dysfunction, and cancer in several pinniped species (northern fur seals: Beckmen et al. 2003, harbor seals: De Swart et al. 1994; California sea lions: Ylitalo et al. 2005a; and DeLong et al. 1973). • Coastal projects, bridges, roads and other infrastructure likely have changed the quality and quantity of monk seal critical habitat.	-
LORAN station (NWHI)			-
Coastal Infrastructure and Development			-
Wai`anae Wastewater Treatment Plan Modification	• Contaminants • Water Quality	• Improvements in water treatment would likely decrease the level of contaminants and biological waste entering coastal waters.	+
Wailupe Stream Flood Control			
Advanced Wastewater Treatment Upgrade			
Waimanalo Treatment and Disposal System			
Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie			
Legislation			

Hawaiian Monk Seal Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Hawai'i Environmental Policy Act (HRS 343)	• General species and habitat protection	• Protection of Hawaiian natural resources through public disclosure process and government reviewed impact evaluation	+
Hawai'i Act 165	• Survival	• June 2010: Legislature passed Act 165 to increase penalties for taking (includes harassing or killing) a monk seal. Class C felony (up to 5 years imprisonment). Someone convicted under this law could face a fine of up to $50,000.	+

Hawaiian Monk Seal Cumulative Effects Conclusion

Cumulative Hawaiian Monk Seal Mortality

Table 4.7-6 summarizes cumulative take, including mortality, of Hawaiian monk seals for cumulative actions and events that can currently be quantified. The primary contributors to adverse cumulative effects on Hawaiian monk seal mortality include entanglement, predation, male seal aggression, infectious diseases, starvation (food limitation), habitat loss, fishery interactions, and other human interactions such as intentional killing.

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Table 4.7-6 Hawaiian Monk Seal Take (Including Mortality) Due to Cumulative Actions and Events

Type of Effect		PEIS Research and Enhancement Alternatives							Cumulative Actions & Events
		Alternative 1 Status Quo (annual seals permitted)	Alternative 2 No Action (annual seals permitted)	Alternative 3 Limited Translocation (annual seals permitted)	Alternative 4 Enhanced Implementation (annual seals permitted)	Past Actions			Reasonably Foreseeable Future Actions & Events External to Research & Enhancement
						2012 Permit Report	2003 - 2012 Permit Reports (total)	Activities External to Research & Enhancement	
Number of Seal "Takes[1]"	tagging	Up to 456	0 after 2014	Same as Alternative 1, more as needed[2]	Same as Alternative 1, more as needed[2]	118	1,560		
	Monitoring (aerial-, vessel- or land-based)	1,440				421	5,227		
	retagging	Up to 100				18	157		
	bleaching	Up to 1315				453	5,374		
	epidemiology	Up to 100	0 after 2014	Same as Alternative 1, more as needed[2]	Same as Alternative 1, more as needed[2]	8	120		
	necropsies	As warranted				7	NA		
	deworming	Up to 200				48	NA		
	incidental harassment during research and enhancement	Up to 200	0 after 2014	> 200 as needed[2]	> 200 as needed[2]	7			US Navy Incidental harassment Permit 15806: 121 seals annually; US Navy Permit 17806 Incidental harassment (Level B) not to exceed 1 seal annually.
Mortality		Up to 10 males lethally removed over 5-year period.	0 after 2014	Same as Alternative 1	Same as Alternative 1	1	1	1997 – 2006: 170 seal pups injured or confirmed dead by sharks 2007-2012: 30 deaths due to shark predation 1982-2004: 23 deaths during research and enhancement 8 deaths since 2009 due to confirmed or suspected intentional killings 1982-2011: 8 entanglement deaths 1995, 2012, 2013: 3 deaths due to hookings; 2013: 1 death undetermined (poor body condition)	Unknown
Injury								1982-2011: 323 entangled seals	Unknown

Type of Effect		PEIS Research and Enhancement Alternatives							Cumulative Actions & Events
		Alternative 1 Status Quo (annual seals permitted)	Alternative 2 No Action (annual seals permitted)	Alternative 3 Limited Translocation (annual seals permitted)	Alternative 4 Enhanced Implementation (annual seals permitted)	Past Actions			Reasonably Foreseeable Future Actions & Events External to Research & Enhancement
						2012 Permit Report	2003 - 2012 Permit Reports (total)	Activities External to Research & Enhancement	
Contribution Towards Conservation Objectives	disentanglement and dehooking	As warranted (likely not to exceed 25/year)	0 after 2014	Research, development and implementation of methods.	Same as Alternative 3	6	117	2005 - 2012: 136 seals rescued, rehabilitated or assisted (MMHSRP Permit)	Continued outreach and education initiatives to foster public understanding for protection and conservation of Hawaiian monk seals
	translocation	Up to 71	0 after 2014	Same as Alternative 1, Up to 20 weaned pups annually (or total of 200 over 10-year period) only within NWHI or from MHI to NWHI	Same as Alternative 1, Up to 20 weaned pups annually (or total of 200 over 10-year period) anywhere within the Hawaiian Archepelago	13	239		
	mitigation of disease	Up to 30	0 after 2014	Same as Alternative 1 Research, development and implementation of methods	Same as Alternative 3				
	management of human-seal interactions	Not Authorized	No behavior modification to reduce human/seal interactions	Research, development and implementation of methods.	Same as Alternative 3				
	Supplemental Feeding	Not Authorized	Not Authorized	Supplement monk seal diet using feeding stations in NWHI locations where seals are released after being cared for in captivity.	Same as Alternative 3				

[1] - Personal Communication, Look 2012 and 2013.

[2] - For examples of the number of seal takes proposed on an 'as needed' basis under Alternatives 3 and 4, please refer to Appendix H.

In the long term, once the current permit expires in 2014, Alternative 2 (No Action) would contribute no mortalities. While direct mortality of research and enhancement would no longer be possible, indirect mortality associated with the cessation of beneficial activities such as moving seals away from harmful situations, could contribute to an adverse cumulative effect on seal survival.

Alternative 1 (Status Quo), assuming the maximum allowed mortality impact, would result in an estimated 11 fewer seals in the population at the end of 10 years. Compared to the number of mortalities caused by predation and starvation (6-11 pups per year eaten by sharks at French Frigate Shoals alone) combined with mortalities resulting from but not limited to entanglement, intentional lethal killings by humans and potential diseases in the future, the contribution of Alternative 1 to cumulative adverse effects from mortality would be minor and would therefore be unlikely to cause the population to decline. In addition, Alternative 1 would result in moderate benefits to survival through enhancement activities intended to promote survival.

Alternatives 3 (Limited Translocation, Preferred) and 4 (Enhanced Implementation), assuming the maximum allowed mortality impact, would result in an estimated 34 fewer seals in the population at the end of 10 years. This level of mortality would result in a minor adverse contribution to cumulative effects of mortality considering other causes of mortality shown in Tables 4.8-5 and 4.8-6. Importantly, other actions proposed under Alternatives 3 and 4 such as two-stage translocation to improve survival, protection against disease, removal of seals from harmful situations, and behavior modification to minimize interactions with fisheries would result in major beneficial contributions to recovery and promote better survival of the species.

Cumulative Reproductive Effects for Hawaiian Monk Seals

Disturbance from research and enhancement activities would likely result in negligible effects on reproduction as discussed in Sections 4.7.1.17 – 4.7.1.20. Other human disturbance such as recreation and coastal development may cause physical responses and physiological effects in monk seals as described in detail in Section 4.7.1. The intensity of response to a particular stress or disturbance and the ultimate effect on individual animals depends on many factors, including the nutritional and reproductive status of the animal at the time of the stress or disturbance.

Outward observable indications are that Hawaiian monk seals do not usually exhibit strong disturbance responses, and the consequences of other stressors can be difficult to attribute to reproductive effects alone. However, it is currently not possible to rule out that there may be unobserved deleterious effects on reproduction.

Many seals have become extremely habituated to people and choose to rest on beaches with hundreds of humans in proximity. Still, Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people. This suggests that beach habitat selection of MHI monk seals may be influenced by human disturbance.

Actions and events likely to contribute to disturbance of seals (see Table 4.7-5) include commercial activities such as coastal development, tourism, research (other than seal-specific), military activities, and fisheries interactions. The combination of these actions with proposed research and enhancement alternatives may cause stress to the seals. While it is difficult to determine whether the cumulative effects of disturbance from these activities result in impacts to reproduction, the contribution of the alternatives would be negligible.

Cumulative Contribution to Conservation Objectives for Hawaiian Monk Seals

Section 3.3.1.3 and the 2007 Recovery Plan (NMFS 2007) describe numerous factors that influence the population dynamics of Hawaiian monk seals and many types of management actions that are likely to be necessary to promote the recovery of the population. The proposed alternatives were evaluated against the conservation objectives outlined by the Recovery Plan and, in essence, Alternatives 3 and 4 provide the most benefit to the species by providing major beneficial contributions to conservation while Alternative 2 would likely result in major adverse effects to conservation because research and enhancement actions would stop in 2014. Alternative 1 provides some conservation benefits however, the limitations described in Section 4.7.1.15 result in only moderate contribution to overall cumulative effects to conservation objectives.

Other factors contributing beneficially to conservation of the species include the MMHSRP (Permit 932-1905) responsible for disentanglement, dehooking and moving seals away from other harmful situations. The proposed Hawaiian Monk Seal Rehabilitation Facility at Natural Energy Laboratory of Hawai‘i at Keahole Point would also benefit the species through rehabilitation. Information from scientific research and benefits of enhancement activities on monk seals play a crucial role in making informed decisions about these regulations and management actions with the overall purpose of recovering the species.

4.7.2 *MARINE WATER QUALITY*

As described in Section 3.2.7, Marine Water Quality, the overall quality of Hawai‘i ’s coastal waters, based on the Water Quality Index, is 78% rated Good, 18% fair and 4% poor (EPA 2008).

Marine waters surrounding Hawai‘i are classified as either Class AA or Class A, based on protection of water quality (HAR Chapter 11-54). The open coastal waters around the NWHI are classified as Class AA waters (HAR Section 11-54-6[b][2][A][ix] and [x] from the shoreline to a depth of 183 meters or 600 feet). The

objective of Class AA waters is that they remain as nearly as possible in their natural pristine state, while Class A waters are maintained for multiple uses, with lower water quality standards applied to them.

Research and enhancement activities that could cause impacts to marine water quality in the near shore regions include spills and leaks of fuels and contaminants during vessel and small boat operations; introduction of biohazards from the use of drugs such as antibiotics, de-wormers, and vaccination research; introduction of heavy metals and other contaminates from external instruments deployed on animals; and effluent from maintenance of seals in shore-based temporary pens.

4.7.2.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVES ON MARINE WATER QUALITY

Status Quo (Alternative 1) activities would have none to negligible adverse impacts on nearshore marine water quality. Researchers using small boats and large vessels would be required to follow protocols for boat operations and refueling prior to receiving approval to conduct the work under a Monument permit (PMNM-2011-001 presented in Appendix L). In the NWHI, boat emissions are controlled by the Monument proclamation and management requirements; and researchers are required to follow these requirements. Researchers would also follow these protocols for operations in the MHI.

In addition to permit conditions, there are several Monument Best Management Practices (BMP) that are designed to avoid, minimize or mitigate potential impacts to water quality (see Appendix L). Monument Permit PMNM-2011-001 specifies measures to minimize impacts on water quality due to boating:

- Tenders and small vessels mush be equipped with engines that meet EPA emissions requirements;
- Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or nearshore waters; and
- Special Conditions and Rules for Small Boat Operations are required at Tern Island (Monument BMP #013), which mandate specific notification and operator training.

Under the Status Quo, small boats (less than 20 ft) used by NMFS researchers conducting Hawaiian monk seal research and enhancement activities include: Boston whalers, ridged hull Zodiacs, Zodiac and Achilles inflatables and personal watercraft. These small boats can be launched from larger ships to access the islands and conduct research or can be used for access between research locations. All small boats and the larger research vessels used by NMFS such as the NOAA R/V Oscar Elton Sette (224 ft), the R/V Searcher (97 ft), and the M/V Kahana (160 ft), would be required to follow all permit requirements, provisions, and BMPs to protect water quality when working in the Monument

and MHI. Thus, impacts to water quality from boat operations would be negligible.

For seals that are maintained in temporary pens in the NWHI, any seal effluent would not be expected to be substantially higher than that which naturally occurs in nearshore waters, as determined in previous NEPA documents (NMFS 2009b). The construction of temporary shoreline or land-based pens to hold seals temporarily (up to 2 weeks) for translocations would not be expected to impact water quality. A limited number of animals would be held at any given time, so feces and urine would not concentrate more than would from a natural aggregate of seals. Wastes would be diluted from currents and scats would be removed from the dry section of the pen before they could enter the water column (NMFS 2009b).

For the same reasons, the use of drugs in Hawaiian monk seals in the wild (*e.g.*, deworming medications, antibiotics) would likely result in diffuse, dilute and ephemeral environmental dispersal of the drugs, such that impacts on water quality and any non-target organisms in the water are expected to be extremely low (NMFS 2009b; NMFS 2010a).

External instruments deployed on monk seals for foraging and monitoring studies are sealed by plastic polymer resin. Therefore, no leakage of metals or other materials from batteries would occur in the water column or on haulout areas if researchers are not able to retrieve the instruments and they fall off when an animal molts.

Alternative 2 (No Action) would result in no additional effects on marine water quality once the current permit expires in 2014 as no research and enhancement activities for Hawaiian monk seal would be permitted.

Despite the additional activities and expanded scope and methods under Alternative 3, would still result in a negligible potential to impact water quality due to the use of small boats. Considering the strict guidelines described above for Alternative 1, which would also be in place under Alternative 3, the potential adverse effects of Alternative 3 on water quality would be negligible. Alternatives 3 (and 4) include the use of long acting antibiotics to treat abscesses and the initiation of vaccination studies, potentially on free-ranging Hawaiian monk seals. It is not likely that the antibiotics or viruses that would be shed due to vaccination would be encountered in high enough concentrations to affect water quality.

Alternative 4 may result in slightly greater use of boats due to potential increases in the number of translocations; however, the additional boats and research vessels to translocate weaned pups between NHWI and MHI would still not result in anything but negligible impacts to water quality particularly considering the controls and mitigation measures already in place.

4.7.2.2 *CUMULATIVE EFFECTS OF ALTERNATIVES ON MARINE WATER QUALITY*

Given that all of the Alternatives would result in negligible affects to marine water quality, no cumulative impacts are anticipated.

4.7.3 SEA TURTLES

This section addresses potential direct, indirect and cumulative effects of the alternatives on sea turtles in the NWHI and MHI. In general, there are two potential types of effects on sea turtles that could result from the alternatives:

- Disturbance of individual sea turtles in the nearshore environment; or
- Disturbance of individual sea turtles on beaches during nesting.

Based on these types of potential effects, Table 4.4-2 in Section 4.4.2 summarizes the criteria used to evaluate impacts of the alternatives on sea turtles. As indicated in the table, the geographic extent, magnitude, frequency, and intensity are used to evaluate the level of potential effects on sea turtles. While sonic tags (which would transmit signals up to 69 kHz) may also be used during research and enhancement activities, sea turtles have a hearing range from approximately 100 to 1000 Hz (Bartol *et al.* 1999; Ridgway *et al.* 1969), and also would not be affected by the sonic tag transmissions. Therefore, effects of sonic tags are not further evaluated here.

The alternatives could result in direct effects on individual sea turtles through vessels in the nearshore environment, or through human activity on beaches during ground surveys or other research and enhancement beach activities. Activities related to field camps (Section 3.3.1.9) may also disturb turtles. Adherence to the BMPs for Monument (Appendix L) would minimize potential adverse effects on turtles. These special conditions for field camps and research activities in the Monument are in place to ensure preservation of the NWHI native ecosystem, including turtles (PMNM 2008a).

Indirect effects on sea turtles could result from disturbance, and are evaluated here in terms of how potential indirect effects might ultimately impact turtle reproduction. Such effects would only occur if an alternative affects the monk seal population in the NWHI and MHI, and then the Hawaiian monk seal population, in turn, affects the sea turtle population. Even if the Hawaiian monk seal population increased substantially, it is unlikely that any seal interactions with sea turtles would result in population-level effects, as neither species is a major predator or competitor with the other. Therefore, effects discussed below focus on the potential for direct effects.

The research and enhancement could affect sea turtles if activities resulted in measurable effects including:

- Breeding and nesting success; and
- Disturbance of sea turtles.

The following discussion analyzes the potential for the alternatives to affect sea turtles through these two pathways.

4.7.3.1 *BREEDING AND NESTING SUCCESS OF SEA TURTLES*

Green sea turtles that are asleep and basking on the beach are generally unaware of unobtrusive human presence such as observing seals. However, some activities, such as small boat transits and landings, capturing a seal, and other research activities may waken basking turtles, causing them to flee into the water. To the extent that the research and enhancement activities in the NWHI or MHI could result in increased human presence near nesting beaches due to ground surveys, specimen collection, or other activities, up to 200 sea turtles nesting on beaches could be incidentally harassed annually. This disturbance could alter their breeding and nesting activities. The extent of these effects would depend on whether humans were present during nesting or breeding season, the proximity of activities to nesting areas, as well as the duration of the activity. Although green sea turtles nest throughout the Hawaiian Archipelago, over 90% nest at French Frigate Shoals in the NWHI (NOAA 1998). Thus, by minimizing human activities during green turtle nesting in specific areas such as French Frigate Shoals, potential effects could be avoided (NMFS 2009b; USFWS 2009c).

The USFWS requires BMPs are followed to minimize and avoid the unintentional disturbance of basking and/or nesting green sea turtles while conducting research or camping on various islands (USFWS 2009c). These measures include the following:

- Walking is prohibited on all beaches, from dusk to dawn, where adult turtles rest;
- All field camps will use maximum light control (shading, minimum wattage, etc.); and
- All field camps must avoid disorienting hatchling turtles.

4.7.3.2 *MORTALITY EFFECTS ON SEA TURTLES*

Sea turtles could be killed if vessels used during research and enhancement activities collided with individual sea turtles. To date, no collisions with sea turtles during Hawaiian monk seal research and enhancement activities have been documented. Additionally, if monk seal researchers encountered basking turtles on beaches, and the turtles subsequently moved away from their basking site, this could result in turtles entering the water making them more vulnerable to predation or collisions however this effects is difficult to document or measure. The threat of boat strikes would be minimized by operating small boats at a moderate speed while watching for objects in the water, including turtles. While the consequences of vessel collisions are high (*i.e.,* resulting in serious injury or mortality), the likelihood of this occurring is low (NMFS 2009b).

Researchers may enhance habitat for sea turtles when they remove marine debris during field activities. Marine debris affects turtles via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on sea turtles.

4.7.3.3 *DIRECT AND INDIRECT EFFECTS ON SEA TURTLES OF ALTERNATIVE 1 – STATUS QUO*

Negligible effects on sea turtles would be expected to occur under the Status Quo Alternative. Disruption of breeding and nesting activities or disturbance of individual turtles would not likely result in adverse effects on individuals or the population thus these effects would be negligible. Minor, short-term disturbance during nesting and breeding activities could occur, but with the implementation of BMPs required by Monument permits, these effects would be minimized to a negligible level. Similarly, the likelihood of collisions with vessels during research and enhancement are low due to Monument BMPs and associated mitigation measures described in Appendix L. Impacts to turtles are expected to be temporary disturbances, and no harm or mortality is anticipated (NMFS 2009b). Thus, mortality effects on turtles are considered negligible under Alternative 1.

4.7.3.4 *DIRECT AND INDIRECT EFFECTS ON SEA TURTLES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)*

Similar to Alternative 1, negligible effects on sea turtles would be expected to occur under Alternative 2. Though not likely, disruption of breeding and nesting or disturbance of individual turtles could occur as a result of research and enhancement activities on wild monk seals only until 2014. Once the current permit expires in 2014, no research or enhancement would occur that could result in disturbance.

4.7.3.5 *DIRECT AND INDIRECT EFFECTS ON SEA TURTLES OF ALTERNATIVE 3 (LIMITED TRANSLOCATION; PREFERRED ALTERNATIVE) AND ALTERNATIVE 4 (ENHANCED IMPLEMENTATION)*

Alternatives 3 and 4 do not differ in their potential effects on turtles thus they are described together here. Alternatives 3 and 4 could result in minor disruption of breeding and nesting activities on beaches due to human presence due to the potential for increased activity in the Hawaiian Islands.

Alternatives 3 and 4 would increase the level of ground, boat, and aerial Hawaiian monk seal surveys and beach activities; however, restrictions and mitigation measures for all new activities would be required by the MMPA, ESA, and NMFS to minimize disturbances from research and enhancement activities. In addition, requirements of the Monument and protocols established by the

USFWS would be in place to minimize adverse impacts of research activities (Appendix L, PMNM 2011-001; USFWS 2009c; USFWS 2014).

Minor short-term decreases in sea turtle survival and/or productivity could potentially result from disturbance of nesting and breeding, but with the implementation of procedures required by NMFS, these potential reproductive effects would be minimized to a negligible level.

Alternatives 3 and 4 could result in a small number of individual sea turtles being disturbed by vessels given the increase in activities such as translocation, but this effect would be expected to be very infrequent and of low magnitude, and would thus be negligible.

4.7.3.6 CUMULATIVE EFFECTS OF ALTERNATIVES ON SEA TURTLES

Sea turtles in the NWHI and MHI, including leatherback, loggerhead, olive ridley, hawksbill, and green sea turtles, are all listed as threatened or endangered under the federal ESA. Sea turtle populations have declined due to incidental take in fishing operations, direct harvest of turtles, entanglement in marine debris, ocean pollution, and disease (*e.g.*, fibropapillomatosis). While the green sea turtle population remains under stress due to these threats, the population is increasing (Section 3.3.2).

Direct and indirect mortality and reproductive effects of research and enhancement activities may result from disturbance or collision with vessels. Table 4.7-7 summarizes the direct and indirect effects of the alternatives on sea turtles.

Table 4.7-7 Summary of Direct and Indirect Effects of the Alternatives on Sea Turtles

	Alternative 1 Status Quo	**Alternative 2 No Action; No Permit After 2014**	**Alternative 3 Limited Translocation (Preferred Alternative)**	**Alternative 4 Enhanced Implementation**
Mortality	Negligible	Negligible	Negligible	Negligible
Reproduction	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Sea Turtles

Past, present and reasonably foreseeable future actions that may affect sea turtle survival or reproduction are summarized in Table 4.7-8.

Table 4.7-8 Effects of Past, Present and Reasonably Foreseeable Future Actions on Sea Turtles

Hawaiian Sea Turtle Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris	• Changes to habitat • Injury or mortality • Changes in prey due to ecosystem shift	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris, entanglement and affects habitat suitability for resting, and nesting areas	-
Climate Change		• Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish prey populations are affected by these changes and can be both beneficial and adverse.	- /+
Introduction of Invasive species or disease		• Insect and arachnids species (*e.g.*, beetles, weevils, grasshoppers, bees, wasps, spiders and ants), reptiles (*e.g.*, snakes, lizards) and mammals (*e.g.*, mice, rats, dogs, cats) could introduce disease or parasites to turtles. • Mammals in particular may increase the risk of diseases such as morbillivirus. • Invasive fish species introduced through ballast water may cause changes in prey dynamics.	-

Hawaiian Sea Turtle Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Scientific Research			
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) (6 missions)	• Education • Disturbance • Injury or mortality	• Direct effects on individual sea turtles through human activity and research; beach disturbance; collisions with vessels. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to fish prey and turtles. • Up to 200 sea turtles nesting on beaches could be incidentally harassed annually. • Marine debris affects turtles via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). • While mortality is possible, overall benefits of research and enhancement are beneficial for long term species survival.	**-/+**
Permit 10137 PIFSC Hawaiian Monk Seal Research and Enhancement			
Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island			
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems			
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge			
Permit 14097 NMFS Southwest Fisheries Science Center (SWFSC) pinniped, cetacean and sea turtle studies (Harass)			
Permit 14381 Sampling sea turtle bycatch in Hawaiian Longline Fisheries (Handle / Release)			
Permit 15685 Ocean capture research of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles in the Hawaiian Islands (Capture/Handle/Release)			
Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas			

Hawaiian Sea Turtle Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Commercial Activities			
Whale watching (Tour boats)	• Disturbance • Injury or mortality	• Potential for collisions between surface vessels and sea turtles. • Noise and movement of vessels can temporarily displace sensitive species in the offshore area, such as the sea turtles. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to sea turtles.	-
Military Activities			
Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai`i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Disturbance • Injury or mortality	• Possible TTS, injury, masking, harassment, contamination, collision, entanglement, and detonation impacts to sea turtles due to military training activities. • Airborne sound from low-flying helicopters or airplanes may be heard by sea turtles while at the surface or underwater. Responses by turtles could include hasty dives or turns, or decreased foraging (Soto et al., 2006). • Degradation or destruction of feeding habitat by underwater detonations and training activities. • Land-based training exercises may displace nesting or resting sea turtles, may damage nests. • Degradation or destruction of feeding habitat by underwater detonations and training activities. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to sea turtles.	-
Permit 17860 Acoustic Technology Experiments			
Joint High Speed Vessel			
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS); NOAA Incidental Harassment Permits 18702 - 18705			

Hawaiian Sea Turtle Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Other Activities			
Guano mining	• Mortality and Reproductive effects	• Direct disturbance to breeding and resting individuals during activities.	-
Feather poaching			
Turtle harvest		• 18th – 19th Centuries: Unregulated take of meat, eggs for consumption and shark bait. Direct disturbance to breeding and resting individuals during activities.	
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Disturbance • Mortality and Reproductive effects • Reduction in marine debris	• There are NO regulations as to when activities may occur, there are no stipulations with regards to protection of nesting or resting habitat.	-/+
Removal of marine debris from high entanglement zones	• Injury or mortality	• Researchers may enhance habitat for sea turtles when they remove marine debris during field activities. Marine debris affects turtles via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on sea turtles. • Federal regulations authorize Federal and state employees to aid stranded endangered (50 CFR 222.310) and threatened (50 CFR 223.206) sea turtles.	+
MMHSRP and other NMFS permits and authorizations to disentangle, dehook and relocate seals away from harmful situations; also includes activities for other marine mammals including: stranding networks; rehabilitation; responses/investigations of mortality events; biomonitoring; tissue/serum banking; and analytical quality assurance.			
Fishery Ecosystem Plan for the Hawai`i Archipelago			
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions	• Habitat protection	• Sea Turtles may benefit from Habitat designations; feeding areas, breeding and resting areas.	+
Habitat protection , loss mitigation and restoration			
Natural resource and species education and outreach	• Education	• 2009-2010: 10,000 people reached through partnerships with 30+ businesses, 50+ school presentations, 100+ schools	+
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Disturbance • Injury or mortality	• Sea turtles may benefit from protection measures reducing disturbance and mortality due to ship collisions.	+

Hawaiian Sea Turtle Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Development and Maintenance			
Building islands using dredge and fill Inter-Island Transmission Cable LORAN station (NWHI) Residential & Commercial construction (beach, near shore)	• Contaminants • Habitat degradation • Disturbance • Injury • Stranding • Entanglement in debris	• Accumulation of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in tissues through diet. • Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller et al. 2010). • Coastal projects, bridges, roads and other infrastructure likely have changed the quality and quantity of habitat. • Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to turtles may occur while laying the cable, including entanglement and mortality.	-
Wai`anae Wastewater Treatment Plan Modification Wailupe Stream Flood Control Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Contaminants • Water quality improvements	• Improvements in water treatment would likely decrease the level of contaminants and biological waste entering coastal waters.	+
Legislation			
Hawai'i Environmental Policy Act (HRS 343)	• General species and habitat protection	• Protection of Hawaiian natural resources through public disclosure process and government reviewed impact evaluation	+

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Cumulative Effects Conclusion for Sea Turtles

Turtles encounter orders of magnitude more people and boats in the MHI from non-Hawaiian monk seal related activities than under any of the proposed Alternatives. While green sea turtles are the turtle species most likely to overlap with Hawaiian monk seals, the contribution of the proposed research and enhancement activities are not likely to result in anything but negligible cumulative effects given the mitigation measures implemented during research and enhancement. In addition, the removal of marine debris by monk seal researchers would likely be beneficial for sea turtles.

4.7.4 CETACEANS

This section addresses potential direct, indirect and cumulative effects of the alternatives on cetaceans in the NWHI and MHI. As discussed in Section 3.3.3, humpback whales, spinner dolphins, bottlenose dolphins and false killer whales are the cetacean species most likely to be present in nearshore areas where Hawaiian monk seals and activities associated with the alternatives would occur. The impact discussion therefore focuses on potential effects of the alternatives on these species.

In general, there are two potential types of mechanisms for effects that could result from the alternatives:

- Disturbance due to vessel activities, aerial surveys or beach activities; or
- Collisions with vessels.

Table 4.4.3 in Section 4.4.2 summarizes the criteria used to evaluate effects of the alternatives on cetaceans. As indicated in the table, the geographic extent, magnitude, frequency, and intensity are used to evaluate the level of potential effects.

The alternatives could result in direct and indirect reproductive effects on spinner dolphins or bottlenose dolphins as a result of disturbance due to vessel or aircraft activity during surveys or transport Hawaiian monk seals. However, the disturbance that could occur would likely be short-term and not result in lasting effects on these species.

Spinner dolphins and bottlenose dolphins may alter their behavior in response to a small boat transiting within lagoons where research and enhancement activities may occur. The level of disturbance is temporary and dolphins typically approach researchers, versus showing avoidance behaviors. This disturbance is not likely to result in adverse effects on reproduction.

As summarized in the 2009 EA for NMFS Permit 10137 for monk seal research and enhancement, abundance of humpback whales for the entire North Pacific Ocean is estimated to be 18,302 individuals, with over 50% of the population (approximately 10,000) estimated to winter in Hawaiian waters (Calambokidis *et*

al. 2008). In 2012, the main Hawaiian Islands insular stock of false killer whales was listed as endangered. These animals could also occur near shore where aerial and boat surveys occur. Most aerial surveys would occur during summer months when humpback whales are not present, but vessel and aerial surveys and transporting seals by air and boat could occur year-round. Takes of humpback whales and false killer whales would be avoided by implementing mitigation measures described in the analysis of alternatives below.

The potential effects of sonic tags are included in the 2009 EA for NMFS Permit 10137 for Hawaiian monk seal research and enhancement (NMFS 2009b) and are summarized here. Sonic tags used during research and enhancement would transmit signals at 69 kHz. While spinner dolphins that occur in lagoon waters of French Frigate Shoals have an estimated auditory range of 150 Hz to 160 kHz (Southall *et al.* 2007), it is not likely that the presence of these tags on pups would have a measurable impact on dolphins. Therefore, under all alternatives, the potential effects of sonic tags are considered negligible.

While it is possible that collisions with vessels used during research and enhancement could result in mortality of humpback whales or dolphins, the likelihood of this occurring is very low. Mitigation measures and BMPs implemented by NMFS such as NAO 217-103 (Management of Small Boats) and Monument permit conditions presented in Appendix L. To date, there have been no documented incidents of collision with monk seal research and enhancement vessels.

4.7.4.1 *DIRECT AND INDIRECT EFFECTS ON CETACEANS OF ALTERNATIVE 1 – STATUS QUO*

Under Status Quo, Permit No. 10137 authorizes annual harassment of 500 spinner dolphins within the lagoon waters at four NWHI sites (Midway Atoll, Pearl and Hermes Reef, Kure Atoll, and French Frigate Shoals). Harassment would occur primarily during summer months but may occur year-round (NMFS 2009b). As described above, the presence of sonic tags on pups would have a negligible effect on dolphins under all alternatives.

Negligible effects on cetaceans would be expected to occur under Alternative 1 given that the interactions with cetaceans are not likely to cause disturbance that would result in reproductive effects and collisions are not anticipated. Mitigation would be incorporated as follows:

- Aerial surveys would be conducted above shoreline areas; in the event cetaceans were encountered near shore, researchers would fly to an altitude of 1000 feet to avoid harassment (NMFS 2009b); and
- If encountered by boat, researchers would maintain a distance of 50 yards (150 feet) for cetaceans other than humpback whales, and a distance of 300 feet if a humpback whale is encountered.

These approach distances are consistent with Federal Regulation (50 CFR 224.103) to avoid take if humpback whales are encountered and NMFS guidelines to avoid harassment of other cetaceans (NMFS 2009b).

4.7.4.2 *DIRECT AND INDIRECT EFFECTS ON CETACEANS OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)*

While there is potential for short-term disturbance or low probability of collisions with vessels under Alternative 2 while the permit is still valid, negligible effects on cetaceans would be expected under the No Action Alternative given that the magnitude of potential disturbance is not likely to cause reproductive effects and collisions would be extremely rare. Research and enhancement activities on wild monk seals would discontinue after the current permit expires in 2014.

4.7.4.3 *DIRECT AND INDIRECT EFFECTS ON CETACEANS OF ALTERNATIVE 3 LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE) AND ALTERNATIVE 4 ENHANCED IMPLEMENTATION*

Alternatives 3 and 4 could result in disturbance of up to 500 individual spinner dolphins and 20 bottlenose dolphins annually; however, these incidents are expected to be short-term and not result in long-term or population level effects on reproduction. Given the stringent BMPs (see Appendix L) and other permit conditions implemented by NMFS, there would be negligible effects on reproduction due to research and enhancement activities. As stated under Alternative 1 above, the presence of sonic tags on pups would have a negligible effect on dolphins under all alternatives (NMFS 2009b).

The same procedures and mitigation would be followed in Alternative 3 (Preferred) as that described under Alternative 1 to avoid takes of humpback whales. Aerial survey altitudes would be increased if cetaceans are encountered, and boat surveys would maintain distances to cetaceans consistent with NMFS regulations and guidelines.

While collisions with survey vessels may occur, the increased level of activity under Alternatives 3 and 4 are still not expected to result in mortalities of cetaceans. Vessel activities associated with the research and enhancement would not be frequent, and it is expected that individual dolphins or whales would move away from survey vessels in their vicinity. Although individual dolphins or whales could be injured during collisions, this would be an extremely rare occurrence, and the effect on the populations of humpback whales and spinner dolphins would be negligible.

4.7.4.4 *CUMULATIVE EFFECTS OF ALTERNATIVES ON CETACEANS*

Humpback whales are listed as endangered, under the ESA and depleted under the MMPA. Spinner dolphins in Hawai`i are not listed as threatened or

endangered under the ESA, nor are any of the Hawaiian Islands stocks depleted under the MMPA. Recent Stock Assessment Reports (SAR) indicate that Central North Pacific Stock of humpback whale (which winters in Hawaii) has been increasing in the 1990s and 2000s. Estimates of the rate of increase vary, but are generally between 4 and 9% (NMFS 2009). Despite recent concerns regarding potential adverse effects on spinner dolphins due to human interaction (see Section 4.5.2), interactions with monk seal researchers are managed through the stringent Monument permit process and are relatively infrequent compared to other interactions with humans throughout the Islands.

Direct and indirect mortality and reproductive effects of research and enhancement activities may result from disturbance or collision with vessels. Table 4.7-9 summarizes the direct and indirect effects of the alternatives on cetaceans.

Table 4.7-9 Summary of Direct and Indirect Effects of the Alternatives on Cetaceans

	Alternative 1 Status Quo	**Alternative 2 No Action; No Permit After 2014**	**Alternative 3 Limited Translocation (Preferred Alternative)**	**Alternative 4 Enhanced Implementation**
Mortality	Negligible	Negligible	Negligible	Negligible
Reproduction	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Cetaceans

Past, present and reasonably foreseeable future actions that may affect cetacean survival or reproduction are summarized in Table 4.7-10.

Table 4.7-10 Effects of Past, Present and Reasonably Foreseeable Future Actions on Cetaceans

Hawaiian Cetacean Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane	• Changes to habitat • Injury or mortality • Changes in prey due to ecosystem shift	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris, entanglement and affects habitat suitability for resting, and feeding areas	-
Japanese Tohoku earthquake and tsunami debris			
Climate Change		• Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish prey populations are affected by these changes and can be both beneficial and adverse.	- /+
Introduction of Invasive species		• Invasive fish species introduced through ballast water may cause changes in prey dynamics.	-
Scientific Research			
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) (6 missions)	• Education • Disturbance • Injury or mortality	• Direct effects on individuals through vessels and aircraft in the nearshore environment; collision, disturbance. • Humpbacks could be killed if vessels used during research and enhancement activities collided with individuals • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to cetaceans. • Various cetacean research permits as listed in Table 4.5-2. . Permit 14451 Assessing distribution and abundance of marine mammals on Navy operational area; surface vessel surveys, photo identification, videography, and acoustic recording (Harass)	-
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge			- /+
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems			
Cetacean research			
Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas			-

Hawaiian Cetacean Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Commercial Activities			
Whaling	• Disturbance • Injury or mortality	• 19th Century subsistence activities. • Commercial whaling: nearly 600 whaling ships were based out of Hawaii in the mid-1800s (Bishop Museum 2013)	-
Whale and dolphin watching (Tour boats)		• Potential for collisions between surface vessels and cetaceans. • Noise and movement of vehicles can temporarily displace sensitive species in the offshore area, such as the cetaceans. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to cetaceans.	- /+
Military Activities			
Joint High Speed Vessel (JHSV)	• Disturbance • Injury or mortality	• Possible TTS, injury, masking, harassment, contamination, collision, entanglement, and detonation impacts to cetaceans due to military training activities. • Airborne sound from low-flying helicopters or airplanes may be heard by cetaceans while at the surface or underwater. Responses by cetaceans could include hasty dives or turns, or decreased foraging (Soto et al., 2006). • Degradation or destruction of feeding habitat by underwater detonations and training activities.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS); NOAA Incidental Harassment Permits 18702 - 18705			
Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])			
Permit 17860: US Navy Acoustic Technology Experiments.			
Other Activities			

Hawaiian Cetacean Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Disturbance • Mortality and Reproductive effects • Reduction in marine debris	• There are NO regulations as to when activities may occur, there are no stipulations with regards to protection of habitat or species	- /+
Removal of marine debris from high entanglement zones Fishery Ecosystem Plan for the Hawai`i Archipelago MMHSRP and other NMFS permits and authorizations to disentangle, dehook and relocate seals away from harmful situations; also includes activities for other marine mammals including: stranding networks; rehabilitation; responses/investigations of mortality events; biomonitoring; tissue/serum banking; and analytical quality assurance.	• Injury or mortality	• Researchers may enhance habitat for cetaceans when they remove marine debris during field activities. Marine debris affects cetaceans via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on cetaceans. • Response to stranded cetaceans may increase survival through rehabilitation or identify causes of mortalities.	+
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions Habitat protection , loss mitigation and restoration	• Habitat protection	• Cetaceans may benefit from Habitat designations; feeding areas, breeding and resting areas.	+
Natural resource and species education and outreach	• Education	• 2009-2010: 10,000 people reached through partnerships with 30+ businesses, 50+ school presentations, 100+ schools	+
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Disturbance • Injury or mortality	• Cetaceans will benefit from protection measures reducing disturbance and mortality due to ship collisions.	+

Hawaiian Cetacean Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Development and Maintenance			
Building islands using dredge and fill	• Contaminants • Habitat degradation • Disturbance • Injury • Stranding • Entanglement in debris	• Accumulation of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in tissues through diet. • Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller et al. 2010). • Coastal projects, bridges, roads and other infrastructure likely have changed the quality and quantity of habitat. • Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to cetaceans may occur while laying the cable, including entanglement and mortality.	-
Inter-Island Transmission Cable			
LORAN station (NWHI)			
Permit 17268 Honolulu Seawater AC (Incidental Take)	• Disturbance • Injury • Stranding	• Potential for collisions between surface vessels and cetaceans. • Noise and movement of vehicles during training can temporarily displace sensitive species in the offshore area, such as the cetaceans. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to cetaceans.	-
Wai`anae Wastewater Treatment Plan Modification	• Contaminants • Water quality improvements	• Improvements in water treatment would likely decrease the level of contaminants and biological waste entering coastal waters.	+
Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie			
Legislation			
Hawai`i Environmental Policy Act (HRS 343)	• General species and habitat protection	• Protection of Hawaiian natural resources through public disclosure process and government reviewed impact evaluation	+

Cumulative Effects Conclusion for Cetaceans

While there are several permits for research on cetaceans in the Hawaiian Islands, these authorized research activities are not expected to result in long-term negative impacts on cetacean populations and likely contribute to overall conservation of the species. There are few disturbances to spinner dolphins in the NWHI concurrent with research and enhancement activities, as a limited number of people are able to access the Monument via a permit issued by the Monument, and such permits would not authorize harassment of spinner dolphins unless a research and enhancement permit were issued. Permit No. 1007-1629-01 issued to Dr. Leszek Karczmarski, Marine Mammal Research Program, Texas A&M University, authorized research on spinner dolphins in the NWHI over a six-year period, and expired on August 31, 2007.

Future spinner dolphin management measures may result in time-area closures that would allow the species important protection from human disturbance during critical resting periods and therefore be beneficial to species survival and reproduction. Similarly, Hawaiian monk seal critical habitat designation would likely be beneficial for spinner dolphins due to overall habitat protection in bays shared by seals and dolphins.

Overall, Hawaiian monk seal research and enhancement under any of the alternatives is expected to result in a negligible contribution to cumulative effects on cetaceans. Effects are likely to be negligible due to the temporary duration of research and enhancement activities in the open ocean or nearshore environment. Also, the minimal amount of vessel and airplane activity from monk seal research and enhancement as compared to those associated with recreation, fishing, shipping and other human activities is not likely to result in anything but negligible cumulative effects on cetaceans.

4.7.5 FISH

This section addresses potential direct, indirect and cumulative effects of the alternatives on fish in the NWHI and MHI, by assessing the potential for increased predation from Hawaiian monk seals. Table 4.4.4 in Section 4.4.2 summarizes the criteria used to evaluate effects of the alternatives on fish. Potential effects on fish populations would be similar for Essential Fish Habitat, commercially harvested fish species, and nearshore fish species; thus, potential effects for these categories are discussed together.

As described in Section 3.3.1.5, Hawaiian monk seals are foraging generalists, with a wide variety of prey including several varieties of fish and multiple species of crab and lobster. There is also evidence of variation in diet among individuals, demographic groups (between juveniles and adults/sub adults) and locations (Iverson 2006); indicating that individual monk seal foraging preferences and capabilities play a role in selection of foraging habitat. In other words, diets differ considerably among individual seals.

4.7.5.1 *DIRECT AND INDIRECT EFFECTS OF ALL ALTERNATIVES ON FISH*

Given the wide variety of fish consumed by monk seals, the likelihood that seal predation on fish could cause a long-term decline in fish populations is unlikely. Therefore, none of the alternatives would result in any notable effect on fish populations as a result of monk seal predation. Nearshore activities such as vessel surveys are not likely to result in disturbance or mortality of fish and would be considered negligible under all alternatives.

Negligible effects on fish would be expected to occur under the Status Quo Alternative given that the Hawaiian monk seal population is projected to continue to decline despite research and enhancement covered under the existing permit. While this is not to say that predation on fish species by monk seals does not occur, the continuation of research and enhancement activities on seals would not result in dramatic changes in the levels of fish consumed by seals throughout the Hawaiian Islands. In fact, given the projected decline in Hawaiian monk seals under all alternatives, a potential decline in predation on fish over the next 10 years could be reasonably assumed.

The potential effects of sonic tags, which may transmit signals up to 69 kHz, are summarized in the 2010 EA for NMFS Permit 10137 for Hawaiian monk seal research and enhancement (NMFS 2009b) as summarized here. Many fish species hear outside of this frequency (A. Scholik, personal communication, March 31, 2009), with the exception of some clupeids (Popper *et al.* 2004). Only a few species of clupeids are found in Hawaiian waters (*e.g.,* the clupeid Spratelloides delicatulus is found from O`ahu to Kure), and if these fish can hear within the frequency emitted by the sonic tags it is highly unlikely that there would be any significant effects on these fish.

4.7.5.2 *DIRECT AND INDIRECT EFFECTS ON FISH OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE) AND ALTERNATIVE 4 – ENHANCED IMPLEMENTATION*

Alternatives 3 and 4 could result in a slight reduction in the decline of the numbers of Hawaiian monk seals. In other words, though the decline may slow, the population would still likely decrease (see Section 4.4.1). As described in more detail in Section 3.3.1.5, foraging competition may help explain differential survival rates of juvenile Hawaiian monk seals at various subpopulations between different habitat areas, but does not provide any indication that the monk seals would be more effective predators than other predators in the vicinity (*e.g.*, birds, sharks, large predatory fish).

Translocating a small number of juvenile monk seals (potentially 20 per year) between islands in the NWHI would not have a measurable effect on any fish species, as the number translocated would typically be small relative to the seal abundance at the recipient subpopulation and would likely represent a small segment of the large marine predator population, particularly when compared to

the numbers of predatory fish present in the NWHI (Sprague *et al.* 2013). Additionally, the predatory effect on fish resulting from the juvenile monk seals is likely to be the same whether it occurs at the original island or at the island where the juveniles are translocated. Effects of this alternative would be negligible.

It is unlikely that Hawaiian monk seals would have a predatory effect on fish populations that is measurably different than any other predatory effect of other species. Fish consumption by Hawaiian monk seals would be distributed across a wide variety of available prey species, and the effect of translocating Hawaiian monk seals (slowing their population decline) is not likely to be detectable.

4.7.5.3 CUMULATIVE EFFECTS OF ALTERNATIVES ON FISH

Fish populations have been affected by commercial fishing, ocean pollution, climate change, and habitat degradation. Direct and indirect mortality from research and enhancement activities is likely to be negligible. Table 4.7-11 summarizes the direct and indirect effects of the alternatives on fish species.

Table 4.7-11 Summary of Direct and Indirect Effects of the Alternatives on Fish

	Alternative 1 Status Quo	**Alternative 2 No Action; No Permit After 2014**	**Alternative 3 Limited Translocation (Preferred Alternative)**	**Alternative 4 Enhanced Implementation**
Mortality	Negligible	Negligible	Negligible	Negligible
Reproduction	Negligible	Negligible	Negligible	Negligible

<u>Past, Present and Future Actions and Events Contributing to Cumulative Effects on Fish</u>

Past, present, and reasonably foreseeable future actions that may affect fish survival or reproduction are summarized in Table 4.7-12.

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Table 4.7-12 Effects of Past, Present and Reasonably Foreseeable Future Actions on Fish

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane	• Changes to habitat • Injury or mortality • Changes in prey due to ecosystem shift	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris, entanglement and affects habitat suitability	-
Japanese Tohoku earthquake and tsunami debris			
Climate Change		• Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish prey populations are affected by these changes and can be both beneficial and adverse. However, future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011).	-/+
Introduction of Invasive species or disease		• Parasites have been shown to be significant stressors in many species. Reif et al. (2006). • Invasive fish species introduced through ballast water may cause changes in fish population dynamics.	-
Predation by apex predatory fish nearshore (30m depth)	• Mortality	• Apex predatory fish consume a minimum of 66,000 kg/day (146,000 lb/day) approximately 50 times more than a Hawaiian monk seal (Sprague et al. 2013).	-/+
Predation by Hawaiian monk seals nearshore (30m depth)	• Mortality	• Estimated predation by 200 monk seals in MHI is approximately 1,300 kg per day (2,900 lb per day) (Sprague et al. 2013)	-/+
Scientific Research			

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) (6 missions)	• Education • Disturbance • Injury or mortality	• Direct effects on individual fish through human activity and research. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to fish. • While mortality is possible, overall benefits of research and enhancement are beneficial for long term species survival.	**-/+**
Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island			
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge			
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems			
Incidence and Effects of Coral and Fish Disease within Shallow Water Reefs			
Tuna Tagging			
Commercial Activities			

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Commercial Fisheries (bottomfish and pelagic)	• Mortality • Injury	• 1882: Sea cucumber harvest • 1913 – 2002: fishing for trevally and amberjack. • 1930 – 2010: bottomfish fishery. Following WWII, Honolulu-based vessels had fishery for bottomfish, lobsters, reef fish, inshore species, and turtles. • 1946: fishing companies used FFS as base for planes exporting scad and other species. • 1950s – 1991: longline for tuna (foreign fleet ended 1976; domestic fleet ended 1991). • 1970 – 1999: Hawaiian spiny lobster, Scaly slipper lobster. 11 million landed • 1965 – 1980: foreign vessels used tangle nets to harvest precious coral; Taiwanese vessels illegally poached 100 tons near Gardner Pinnacles and Lay • 1948 – 1978: number of trips per year per fishermen increased and has remained about 8 trips per year between 1980 and 2004. Data suggest there are more fishermen catching fewer fish. • Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006). • 1996-2006: Increased fishing effort with number of hooks set increasing four-fold. Catch rates for apex predators such as blue shark, bigeye and albacore tunas, shortbill spearfish, and striped marlin declined from 3 to 9% per year while catch rates for mahimahi, sickle pomfret, escolar, and snake mackerel, increased by 6 to 18% per year (Polovina 2009). • 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). Decreased catch rates for large fishes has continued through at least 2011 (Polovina 2011). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013).	-

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Recreational and Subsistence Fisheries	• Mortality • Injury	• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • Limited data on subsistence harvest of fish species in Hawaii make estimating harvest levels difficult. • 2013: daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) • Widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004).	-
			-
Military Activities			
Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Disturbance • Injury or mortality	• Possible TTS, injury, contamination, collision, entanglement, and detonation impacts to fish due to military training activities. • Degradation or destruction of feeding habitat by underwater detonations and training activities.	-
Permit 17860 US Navy Acoustic Technology Experiments			
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS); NOAA Incidental Harassment Permits 18702 - 18705		• Navy's impact analysis expects effects on recruitment or survival to be negligible. • Potential for injury to fish is negligible. • Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to fish is expected to be minimal.	
Other Activities			

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Disturbance • Mortality and Reproductive effects • Reduction in marine debris	• There are NO regulations as to when activities may occur, there are no stipulations with regards to protection of nesting or feeding habitat.	**-/+**
Removal of marine debris from high entanglement zones Fishery Ecosystem Plan for the Hawai`i Archipelago	• Injury or mortality	• Researchers may enhance habitat for fish when they remove marine debris during field activities. Marine debris affects fish via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on fish.	**+**
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions Hawaiian monk seal critical habitat designation	• Habitat protection	• Fish may benefit from Habitat designations; feeding areas, breeding and resting areas.	**+**
Hawaiian Spinner Dolphin Human Interaction Protection Measures	•	• Fish populations may benefit from dolphin protection measures due to potential time-area closures in bays around the MHI; potential additional protection of habitat; added recruitment could benefit fish populations.	**+**
Natural resource and species education and outreach	• Education	• 2009-2010: 10,000 people reached through partnerships with 30+ businesses, 50+ school presentations, 100+ schools	**+**
SEIS Measures to End Bottomfish Overfishing in the Hawaiian Archipelago Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006) Final EIS Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (2005)	• Mortality • Habitat protection	• Fish may benefit from habitat protection and cessation of overharvesting.	**+**
Development and Maintenance			

Hawaiian Fish Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Building islands using dredge and fill Inter-Island Transmission Cable LORAN station (NWHI)	• Contaminants • Habitat degradation • Disturbance • Injury • Stranding • Entanglement in debris	• Accumulation of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in tissues through diet. • Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller et al. 2010). • Coastal projects, bridges, roads and other infrastructure likely have changed the quality and quantity of habitat. • Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to fish may occur while laying the cable, including entanglement and mortality.	-
Wai`anae Wastewater Treatment Plan Modification Wailupe Stream Flood Control Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Contaminants • Water quality improvements	• Improvements in water treatment would likely decrease the level of contaminants and biological waste entering coastal waters.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices also widely impact coral reef habitat. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013).	-
Legislation			
Hawai`i Environmental Policy Act (HRS 343)	• General species and habitat protection	• Protection of Hawaiian natural resources through public disclosure process and government reviewed impact evaluation	+

Cumulative Effects Conclusion for Fish

The contribution of the proposed monk seal research and enhancement activities to cumulative effects on fish are expected to be negligible. A maximum current population of 200 Hawaiian monk seals in the MHI is liberally estimated to consume approximately 1,300 kg per day (2,900 lb per day); this is an average of about 15 lb per day per seal. In comparison, Sprague et al. (2013) conservatively estimate that apex predatory fish (sharks and jacks present in just the nearshore waters out to 30 m depth in the MHI) consume a minimum 66,000 kg/day (146,000 lb/day). The estimate of commercial catch of species occurring within nearshore (up to 30 m depth) habitats (that is, after excluding mostly pelagic species that account for 95% of commercial landings), is 1,676 kg (3,969 lb) per day.

Natural environmental processes such as climate also drive long-term dynamics that affect fish populations. Variability in fish prey populations are affected by these changes and can be both beneficial and adverse. Future climate change is projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011).

Other actions including species habitat protection such as monk seal critical habitat designation and spinner dolphin protection measures could result in better recruitment of fish species in the nearshore environment around Hawaii due to potential restrictions on types of activities or time-area closures that may disrupt fish.

4.7.6 BIRDS

4.7.6.1 DIRECT AND INDIRECT EFFECTS ON BIRDS OF ALTERNATIVE 1 – STATUS QUO

Under Alternative 1, the current NMFS Research and Enhancement Permit (10137) would continue until its expiration in 2014, and subsequent permits would be issued to continue research and enhancement activities according to the scope and methods currently permitted. For a complete description of research and enhancement activities allowed under Alternative 1, please refer to Section 2.7, Alternative 1 Status Quo, and Table 2.10-1.

Seabirds

Alternative 1 would result in minor, adverse short-term effects on productivity of seabird species identified in Table 3.6-6. Seabirds that nest in proximity to areas where monk seals haul out could be disturbed by researchers' presence on beaches. Accidental crushing of eggs, chicks, or nest burrows, blockage of access to nest sites with gear, thermal stress, increased predation of chicks, and elevated

stress levels in birds are examples of impacts that are possible each time a human or humans enter a nesting seabird colony (PMNM 2008). Thermal stress could occur to eggs and/or very young chicks if adult seabirds are flushed from the nest and kept away for more than 3 minutes (PMNM 2008). In addition, if adult seabirds are flushed from nests, unattended eggs or hatchlings are more vulnerable to predation. Stress reactions (elevated heart rate, elevated levels of corticosterone, and behavioral responses) have also been documented in several species of nesting seabirds as a result of human activities in nesting colonies (PMNM 2008).

All reasonable precautions would be implemented to avoid take of seabirds incidental to research and enhancement activities and nesting seabirds on beaches would be avoided. To mitigate impacts, USFWS gives research and enhancement field researchers a briefing on appropriate mitigation to avoid take of seabirds in the NWHI (USFWS 2010a). Mitigation includes:

- Looking for nests or for adults flushing from inconspicuous nests when approaching seabird colonies;
- Not disturbing any colonies of ground-nesting sooty terns, gray-backed terns or brown noddies with chicks 2-7 days old (before scapular feathers have erupted);
- Planning activities to avoid displacing adults from eggs or chicks for longer than 3 minutes;
- Never leaving string or line anywhere in nesting colonies;
- Planning work when the fewest birds are in the area;
- Extinguishing all ship lights except for running lights or anchor lights when operating in proximity to seabird colonies;
- Traveling on marked trails to avoid subsurface nests; and
- Digging out shearwaters or petrels if nests are stepped on (PMNM 2008).

Alternative 1 would result in minor periodic, adverse short-term effects on survival of seabirds. There is limited risk that seabirds, particularly albatross that require a long straight-line ground trajectory to become airborne, could fly into fencing associated with shoreline or inland pens with resultant injury.

Temporary pens for Hawaiian monk seals were seasonally maintained by researchers at Kure Atoll, Midway Atoll, and French Frigate Shoals for ten years during summer months with no incidents of seabirds becoming entangled in the fence. However, during a three-month period in 2006, a single Laysan albatross flew into fencing associated with a temporary pen at French Frigate Shoals and was injured, but not killed (USFWS 2014).

In order to minimize hazards from shoreline pens for birds, including short tail albatross, researchers would increase monitoring on windy days and would dismantle the pen after use, which would typically not exceed two weeks for holding seals (USFWS 2014).

Airplane flight activities could also have minor adverse effects on birds due to the increased noise disturbance and potential risk for birds being hit by aircraft. Noise disturbance results in an energetic cost to the bird although the energetic cost of response may not equate to reduced survival or productivity.

The millions of seabirds in the NWHI make aircraft flights to the islands potentially hazardous to both the birds and the aircraft personnel. At Tern Island and French Frigate Shoals, the species most commonly killed during aircraft operations is the sooty tern, but occasionally wedge-tailed shearwaters, great frigate birds, and both species of albatross are also hit (PMNM 2008). Both Laysan and black-footed albatross use the runway at Midway as a soaring area on their way to feed during the day (PMNM 2008). However, bird use of the airport runways declines dramatically at night, so night flights have a greatly reduced chance of hitting birds.

Requirements of the Monument would be in place to ensure the overall effects of air strikes on birds is minimal (PMNM 2008).

Requirements of the Monument include:

- Night flights for most of the year at Midway;
- Vegetation management along the runways to modify bird flight and nesting behavior;
- Flight path advisories given to pilots; and
- Runway clearing of birds and other wildlife by personnel prior to landing and takeoffs (PMNM 2008).

As described above and in Section 3.3.1.9, field camps in the NWHI are typically supplied and staffed using vessels, rather than aircraft. While the use of aircraft may occur under special circumstances (at Midway Islands or French Frigate Shoals), this is expected to be infrequent, thereby further minimizing the potential for these effects to occur.

Alternative 1 would result in minor localized effects on habitat for seabirds, which could be short or long-term depending on the extent or type of damage to the physical environment. The NWHI or the islets off the MHI are particularly vulnerable to the introduction of invasive species. Invasive plants and introduced mammals (*e.g.*, rats) are a primary threat to nesting seabirds, both indirectly by altering the ecosystem (plants) and directly by eating eggs and chicks (mammals).

For example, the invasive plant golden crownbeard (*Verbesina encelioides*) displaces almost all native vegetation in some nesting areas at Kure, Midway, and Pearl and Hermes Atolls. This plant causes entanglement of albatross adults and chicks and increases chick mortality due to heat stress by reducing the birds' ability to use convective cooling for thermoregulation (PMNM 2008). BMPs for Monument Special Conditions for Moving between Islands and Atolls and packing for field camps would be in place to ensure preservation of the NWHI

native ecosystem, and temporary field camps are established primarily during summer months only (PMNM 2008).

Researchers may enhance habitat for birds when they remove marine debris during field activities. Marine debris affects seabirds via ingestion of anthropogenic materials (*e.g.,* plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would result in a beneficial impact for birds.

Activities to be undertaken by researchers in the MHI are not likely to have a measurable impact to the environment relative to those activities that already exist (*e.g.,* recreational boating and fishing, aerial tour operations, use of beaches by tourists), and no permanent damage to the physical environment (*e.g.,* construction) is expected. Thus, the analysis of potential effects of the research and enhancement alternatives focuses on potential effects in the NWHI.

Shorebirds

Alternative 1 is expected to have minor or negligible effects on shorebirds. The only nesting shorebird in the Hawaiian Archipelago is the endangered Hawaiian Stilt. This species breeds in the MHI and large coastal wetlands and ephemeral playas, not beaches, are important habitats for this species.

Large numbers of overwintering shorebirds occur throughout the Hawaiian Archipelago, but negligible effects on their productivity or survival are expected from research and enhancement activities associated with Alternative 1. Overwintering shorebirds may be temporarily displaced from foraging areas during research and enhancement activities on the beach (ground surveys, holding pens, etc.), but these are expected to be brief, temporary disturbances with no measurable effects on shorebirds.

Minor risk from aircraft collisions is possible, but requirements of the Monument would be in place to ensure the overall effects of air strikes on birds is minimal. Requirements of the Monument are the same as described above. As described above and in Section 3.3.1.9, field camps in the NWHI are typically supplied and staffed using vessels, rather than aircraft, and any aircraft use is expected to be infrequent, minimizing the potential for these effects to occur.

Protected Bird Species

Most nesting seabirds and commonly occurring shorebirds that occur in the Hawaiian Archipelago (Table 3.3-5) are considered Species of Greatest Conservation Need (SGCN) by the State of Hawai'i. Thus, effects from Alternative 1 on the altered survival or productivity and habitat alteration for SGCN species are identical to the effects identified for seabirds and shorebirds in the above sections.

Components of Alternative 1 with the greatest potential to affect protected Birds of Conservation Concern (BCC) (Laysan and black-footed albatross) would be

the same as those described in Section 3.3.6.1 for seabirds. Because albatross species require long runways for takeoffs, they are the protected species most likely to collide with aircraft or holding pens. However, Monument requirements for the use of aircraft and of the USFWS for holding pens would be in place to ensure the overall effects of air strikes on birds is minimal (Appendix L, PMNM 2011-001).

ESA-listed seabird and shorebirds and all bird species occurring in the NWHI include:

- Short-tailed albatross;
- Laysan duck;
- Nihoa millerbird;
- Laysan finch, Nihoa finch;
- Hawaiian petrel;
- Newell's shearwater;
- Band-rumped storm petrel (candidate species); and
- Hawaiian stilt (USFWS 2010a).

Alternative 1 is not likely to affect the Hawaiian stilt, Hawaiian petrel, Newell's shearwater, band-rumped petrel and Nihoa finch. These species occur outside of the Project Area and would rarely, if ever, come into contact with NMFS personnel, equipment or activities.

Short-tailed Albatross

Alternative 1 may have short-term, minor effects on short-tailed albatross. Short-tailed albatross nest at Midway Atoll and have attempted to nest at Kure Atoll and Laysan Island (USFWS personal communication 2011d; 2011e,f; DLNR personalcommunication 2011). Although short-tailed albatross typically nest on sloping grassy terraces further inland, the active nest at Midway Atoll is approximately 20 m from the beach where Hawaiian monk seal surveys will occur. NMFS personnel will strictly adhere to island-specific USFWS protocols for short-tailed albatross to minimize effects to this species. No holding pens will be placed in the vicinity of short-tailed albatross or their nests (USFWS 2014). Monument requirements for the use of aircraft and of the USFWS for holding pens will also be in place to ensure the overall effects of air strikes on short-tailed albatross are minimal (Appendix L, PMNM 2011-001; USFWS 2014).

Laysan Duck

Alternative 1 may have short-term minor effects on the Laysan duck. Laysan ducks use all available habitats, including the field camp at Laysan Island and coastal habitats at both Laysan Island and Midway Atoll (USFWS 2009e). It is possible that non-breeding Laysan ducks in coastal areas may be disturbed by NMFS personnel, but these are expected to be brief, temporary disturbances with no measurable effects on Laysan ducks.

Some Laysan ducks, including ducklings, selectively use the camp area for foraging and resting and may be affected by NMFS personnel conducting camp activities. NMFS personnel must be cautious in their use of pesticides and monitor the effects of water use and discharge on the island's aquifer (USFWS 2009e). Hens that nest in or near camp may lead ducklings into camp; therefore, NMFS personnel should always be aware of ducks in camp and be careful not to disturb or fragment broods (USFWS 2009e).

Laysan ducks may also inadvertently fly into or run into Hawaiian monk seal holding pens. However, this is unlikely because: 1) Laysan ducks are most active at night when Hawaiian monk seal activities are minimal (USFWS 2009e); 2) Laysan ducks are more likely to walk rather than fly (USFWS 2009e); and 3) when foraging Laysan ducks tend to freeze rather than flush when startled (USFWS 2009e). In addition, NMFS personnel would strictly adhere to USFWS requirements for holding pens to ensure the overall effects on Laysan ducks due to Hawaiian monk seal activities are minimal (Appendix L, PMNM 2011-001; USFWS 2014).

Nihoa Millerbird

Alternative 1 may have short-term, minor effects on Nihoa Millerbirds at Laysan Island. Although Millerbirds are not typically found in beach habitats where monk seal activities will occur, both NMFS and USFWS maintain field camps at Laysan Island. Unintentional disturbance of Nihoa Millerbirds is possible as NMFS personnel transit from beach areas to field camps and conduct activities around field camps. Millerbirds often stay hidden in dense vegetation when not singing, so their contact with humans is anticipated to be minimal. Monk seal research personnel will adhere to strict procedures mandated by USFWS to avoid injury or death to Laysan Finch USFWS 2009c; USFWS 2014), and these procedures protect Millerbirds as well. Campsites at Laysan Island will be inspected regularly for potential hazards to birds (USFWS 2009c; USFWS 2014).

Laysan Finch

Alternative 1 may moderately affect Laysan finches (USFWS 2009c; USFWS 2014). Both NMFS and USFWS maintain field camps at Laysan Island, and NMFS maintains field camps at Pearl and Hermes Reef (see Section 3.3.1.9). Laysan finches are tame to human presence, thereby entering these field camps in search of food and water. Unintentional mortality or serious injury of Laysan finches is possible given their high activity level and curious nature. Despite efforts to prevent mortality, finches have drowned in camp containers that filled with rainwater when researchers were away from camp, or have become trapped in camp gear. In 2010, one Laysan finch died at Laysan Island when it got into a sink bucket that was left open, and one died at Pearl and Hermes due to unknown causes. In 2011, five Laysan finches died at Pearl and Hermes during a single incident after a lid was left off a pallet tub and then accumulated rainwater. In response to these unfortunate incidences, the HMSRP has reviewed its training protocols for

staff working at Laysan Island and Pearl and Hermes, and placed a renewed emphasis on use of avoidance and minimization measures. There were no lethal takes of Laysan finches in 2012. Furthermore, the HMSRP has developed new notification procedures to ensure that the news of any lethal takes is immediately transmitted to the Director of the Pacific Islands Fisheries Science Center and USFWS. Mitigation required by the Monument and USFWS would minimize impacts to Laysan finch (PMNM 2008; USFWS 2009c; USFWS 2014).

Conclusions for Direct and Indirect Effects of Alternative 1 on Birds

Overall, Alternative 1 is expected to have minor or negligible effects on seabird and shorebird productivity, survival, and habitat. Because beaches in the Hawaiian Archipelago are not used by nesting shorebirds, they are much less likely to be affected by human disturbance. Alternative 1 would also have minor or negligible short-term adverse effects on productivity or survival of SGCN-listed seabirds and shorebirds and BCC listed albatross species. Alternative 1 may have minor, short term effects on the Laysan Duck, Nihoa Millerbird, and short-tailed albatross. Alternative 1 may have moderate adverse effects on Laysan Finch. Although possible, it is not expected that the finches would become entangled in shoreline net pens. Carcasses of any dead birds would be frozen and notification given to USFWS within 5 days. While the deaths in 2011 represented an increase over previous mortalities in a given year, this did not exceed the estimated take over the 5 year period of Permit No. 10137. The HMSRP expects not to exceed 10 unintentional mortalities of Laysan finches over a 5-year permit period.

BMPs and protocols of the Monument and USFWS would be in place to ensure preservation of the NWHI ecosystem and the resources it holds (PMNM 2008; USFWS 2009c; USFWS 2014). USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species and to minimize human effects on endangered land birds. Therefore, Alternative 1 would result in minor effects on bird productivity, survival, and habitat.

4.7.6.2 DIRECT AND INDIRECT EFFECTS ON BIRDS OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Alternative 2, the No Action Alternative, would only allow for status quo research and enhancement activities on Hawaiian monk seals to continue until the current permit (10137) expires in 2014. When the existing permit expires, all research and enhancement activities that require a permit (except under the separate MMHSRP permit) would cease. For a complete description of research and enhancement activities allowed under Alternative 2, please refer to Section 2.8, Alternative No Action, and Table 2.10-1.

Seabirds

Effects from potential disturbance, altered survival and/or productivity, and habitat alteration from Alternative 2 mirror the effects described for seabirds Alternative 1 (Status Quo) but would occur for a shorter timeframe. Hawaiian monk seal ground surveys and beach activities would cease after 2014, resulting in fewer disturbances to seabirds by monk seal research personnel, fewer chances of collisions by seabirds with airplanes and Hawaiian monk seal holding pens, fewer opportunities for the introduction of exotic species. Therefore, effects from Alternative 2 would be less likely to impact seabirds than those outlined for Alternative 1. It is possible that seabirds may be affected by monk seal research activities until 2014, and thus implementation of Alternative 2 may result in minor short-term decreases in survival or productivity in seabirds

Once the current permit expires in 2014, potential effects on birds are likely to be negligible as no research or enhancement activities would occur on wild Hawaiian monk seals under Alternative 2; however, the beneficial removal of marine debris by monk seal researchers would also cease.

Shorebirds

Effects from potential disturbance, altered survival, and habitat alteration from Alternative 2 mirror the effects described for Alternative 1 for shorebirds but would occur for a shorter timeframe. Overwintering shorebirds may be temporarily displaced from foraging areas during research and enhancement activities on the beach (ground surveys, holding pens, etc.), but these brief, temporary disturbances with no measurable effects on shorebirds would cease after 2014. Implementation of Alternative 2 is not likely to have any measurable effects on shorebird survival and is unlikely to cause adverse short or long-term localized effects on habitat.

Protected Bird Species

Effects from potential disturbance, altered survival or productivity, and habitat alteration from Alternative 2 mirror the effects described for the protected species in Alternative 1 but would occur for a shorter timeframe. Hawaiian monk seal ground surveys and beach activities would cease after 2014, resulting in fewer disturbances to protected species by monk seal research personnel, fewer chances of collisions of birds with airplanes and Hawaiian monk seal holding pens, and fewer opportunities for the introduction of exotic species.

It is possible that protected birds may be affected by research activities prior to 2014, and thus, Alternative 2 may result in minor, short-term decreases in survival and/or productivity in SGCN-listed seabirds and shorebirds. However, requirements of the Monument and protocols established by the USFWS would be in place to minimize effects to protected seabirds and shorebirds. Alternative 2 may also have minor, short term effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate effects on the Laysan Finch prior to 2014. To

mitigate effects to Laysan finch, MMRP personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species. Campsites at islands where Laysan finches occur would be inspected regularly for presence of hazards to the birds.

Conclusions for Direct and Indirect Effects of Alternative 2 on Birds

Effects from potential disturbance, altered survival and/or productivity, and habitat alteration from Alternative 2 mirror the effects described for seabirds under Alternative 1 (Status Quo) except research activities would cease to occur after 2014.

It is possible that birds may be affected by monk seal research activities prior to 2014, and thus implementation of Alternative 2 may result in minor short-term decreases in survival and/or productivity in birds. Alternative 2 may also have short term, minor effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate adverse effects on Laysan finches. However, requirements of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds. Once the current permit expires in 2014, potential effects on birds are likely to be negligible as no research or enhancement activities would occur on wild Hawaiian monk seals under Alternative 2; however, the beneficial removal of marine debris by researchers would also cease.

4.7.6.3 DIRECT AND INDIRECT EFFECTS ON BIRDS OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)

Under Alternative 3, all activities currently permitted would continue, and new permissions would be granted with expanded scope and methods. For a complete description of research and enhancement activities allowed under Alternative 3, please refer to Section 2.9, Alternative 3 Limited Translocation, and Table 2.10-1.

Seabirds

Potential effects from Alternative 3 on seabirds are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be slightly increased due to the additional ground, boat, and aerial surveys and beach activities (*e.g.,* remote camera installations, increased capturing and translocation of Hawaiian monk seals, increased use of shore pens, use of unmanned aerial flights) that may be authorized under this alternative. Increased field activities would also correlate to increased removal of marine debris for Hawaiian monk seals by researchers, which indirectly results in a beneficial impact to birds. In addition, once remote cameras are installed, fewer

Hawaiian monk seal ground surveys would be needed, thereby reducing effects on nesting seabirds overall. Restrictions and mitigation measures would be required by the USFWS and Monument to minimize disturbances caused by all new and existing monk seal research and enhancement activities. Thus, Alternative 3 is expected to have minor short-term adverse effects on seabird productivity and/or survival.

Potential effects from Alternative 3 on seabird habitat are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be slightly increased due to the additional research and camp activities that may occur under this alternative. Alternative 3 would result in minor localized effects on habitat for seabirds if fire, disease, or introduced species are spread through research or field camp activities. Habitat effects could be short or long-term depending on the extent or type of damage to the physical environment. However, BMPs would be in place by the Monument for camp protocols and to prevent the spreading of disease or introduced species (PMNM 2008).

Shorebirds

Potential effects from Alternative 3 on shorebirds are identical to the effects described for Alternative 1 (Status Quo) but their likelihood of occurrence would slightly increase due to the additional ground, boat, and aerial surveys and beach activities (*e.g.*, remote camera installations, increased capturing of Hawaiian monk seals) that may be authorized under Alternative 3. However, restrictions and mitigation measures would be required by the Monument and USFWS to minimize disturbances caused by all new research and enhancement activities. Thus, Alternative 3 is expected to have minor short-term adverse effects on shorebird survival and/or adverse short or long-term localized effects on shorebird habitats.

Protected Bird Species

Potential effects from Alternative 3 on SGCN protected seabird and shorebird species are identical to the effects described for Status Quo (Alternative 1), but their likelihood of occurrence would slightly increase due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities that may be authorized under this alternative. However, restrictions and mitigation measures for all new activities would be required by the Monument and USFWS to minimize disturbances by research and enhancement activities. Alternative 3 may thus result in minor short-term decreases in survival and/or productivity and/or adverse short or long-term localized effects on habitats. Alternative 3 may also have minor, short term effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate adverse effects on Laysan finches. To mitigate effects to Laysan finch, monk seal researchers adhere to strict procedures mandated by USFWS to avoid injury or death to this species.

Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds (USFWS 2009c; USFWS 2014).

Conclusions for Direct and Indirect Effects of Alternative 3 on Birds

Potential effects from Alternative 3 on birds are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be slightly increased due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities that may be authorized under this alternative. Implementation of Alternative 3 may result in minor short-term decreases in survival and/or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 3 may also have minor, short term effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate adverse effects on Laysan finches (USFWS 2014). However, requirements of the USFWS (USFWS 2014) and Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs (PMNM 2008) are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds.

4.7.6.4 DIRECT AND INDIRECT EFFECTS ON BIRDS OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

The Enhanced Implementation Alternative would encompass all the activities permitted under Alternative 3, with the addition of the option for temporary translocation of weaned pups from the NWHI to the MHI. For a complete description of research and enhancement activities allowed under Alternative 4, please refer to Section 2.10, Alternative 4 Enhanced Implementation, and Table 2.10-1.

Seabirds

Potential effects from Alternative 4 on seabirds are identical to the effects described under Alternative 3. Requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse effects of monk seal research and enhancement activities on nesting seabirds. Overall, Alternative 4 is expected to have minor short-term adverse effects on seabird productivity, survival, or habitat.

Shorebirds

Potential effects from Alternative 4 on shorebirds are identical to the effects described under Alternative 3. Requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse effects of research activities (Appendix L, PMNM 2011-001). Thus, Alternative 4 is expected to have minor short-term adverse effects on shorebird survival and

could result in adverse short or long-term localized effects on shorebird habitats depending on the extent or type of damage to the physical environment.

Protected Species

Potential effects from Alternative 4 on SGCN-protected seabird and shorebird species are identical to the effects described under Alternative 3. Requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse effects of MMRP activities. Overall, Alternative 4 would have minor short-term decreases in survival and/or productivity and/or adverse short or long-term localized effects on habitats for SGCN-protected seabirds and shorebirds. Alternative 4 may also have minor, short term effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate adverse effects on Laysan finches. To mitigate effects to Laysan finch, monk seal personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species. Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds (USFWS 2014).

Conclusions for Direct and Indirect Effects of Alternative 4 on Birds

Potential effects from Alternative 4 on birds are identical to the effects described in Alternative 3. Implementation of Alternative 4 may result in minor short-term decreases in survival or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 4 may also have minor, short term effects on short-tailed albatross, Laysan Duck, and Nihoa Millerbird, and moderate adverse effects on Laysan finches. However, requirements of the Monument and USFWS would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives MMRP field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds.

4.7.6.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON BIRDS

Direct and indirect mortality and reproductive effects of research and enhancement activities may result from disturbance or collision with vessels. Table 4.7-13 summarizes the direct and indirect effects of the alternatives on birds.

Table 4.7-13 Summary of Direct and Indirect Effects of the Alternatives on Birds

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Mortality	Negligible to Minor adverse (Moderate adverse for Laysan finch)	Negligible	Negligible to Minor adverse (Moderate adverse for Laysan finch)	Negligible to Minor adverse (Moderate adverse for Laysan finch)
Reproduction	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects

Past, present and reasonably foreseeable future actions that may affect bird survival or reproduction are summarized in Table 4.7-14.

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Table 4.7-14 Effects of Past, Present and Reasonably Foreseeable Future Actions on Birds

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane	• Changes to habitat • Injury or mortality • Changes in prey due to ecosystem shift	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris, entanglement and affects habitat suitability for resting, and nesting areas	-
Japanese Tohoku earthquake and tsunami debris			
Climate Change		• Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish prey populations are affected by these changes and can be both beneficial and adverse.	+/-
Introduction of invasive species or disease		• Introduction to Laysan Island: rabbits, rats, common sandbur (*Cenchrus echinatus*) (weed) that inhibits regeneration of the primary nest substrate (Eragrostis variabilis) for Laysan finches (Morin and Conant 1998). • Insect and arachnids species (*e.g.*, beetles, weevils, grasshoppers, bees, wasps, spiders and ants), reptiles (*e.g.*, snakes, lizards) and mammals (*e.g.*, mice, rats, dogs, cats) could introduce disease or parasites to birds. • Mammals in particular may increase the risk of diseases such as morbillivirus. • Invasive fish species introduced through ballast water may cause changes in prey dynamics.	-
Scientific Research			
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) (6 missions)	• Education • Disturbance • Injury or mortality	• Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) to birds.	-
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems		• Direct effects on individual birds through vessels in the nearshore environment, or through human activity on beaches during ground surveys or other research and enhancement beach activities. • While mortality has occurred, overall benefits of research and enhancement are beneficial for long term seal survival.	-/+
Long term monitoring Laysan & black footed albatross			
Monitoring of Red-footed, Brown, and Masked Boobies from Midway Atoll and French Frigate Shoals			
Military Activities			

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
US Navy Hawaii Range Complex Permit 15806 Letter of Authorization for marine mammal take: U.S. Navy Training - Hawai`i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Disturbance • Injury or mortality • Habitat destruction	• Potential effect on night-flying birds flying into lighted towers or buildings. • Downed birds near the new towers or antennas. • Noise from launches, ricocheting projectiles, mine neutralization activities and beach activities may startle / disturb nearby wildlife and cause flushing behavior in birds. • The potential ingestion of toxins, such as the small amount of propellant or simulant remaining in the spent boosters or on pieces of missile debris, by birds is possible but unlikely. Birds flying through an exhaust plume may be exposed to concentrations of hydrogen chloride that could irritate eye and respiratory membranes (Federal Aviation Administration, 1996). • The potential for main-beam (airborne) exposure thermal effects on birds exists. • Activities related to beach training exercises may also disturb habitat and nesting or resting birds. • Possible loss of individual migratory seabirds to GUNEX training in the designated impact area. • Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller et al. 2010). • Potential strike or mortality by training activities.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS); NOAA Incidental Harassment Permits 18702 - 18705		• Birds could be killed by collisions with vessels used during research and enhancement activities during night hours, *e.g.*, unshielded lights. • "Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) is minimal to negligible." (US Navy 2012)	
Permit 17860 US Navy Acoustic Technology Experiments			
Other Activities			

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Guano mining	• Injury or mortality • Reproductive effects	• Direct disturbance to breeding and resting individuals during activities.	-
Feather poaching			
Seabird harvest activities		• 1842 – 1915: Unregulated take of seabirds by consumption, egg harvest, nest loss to guano harvest, introduced species, chick mortality due to removal of adults; direct disturbance to breeding and resting individuals during activities.	
State of Hawai'i DLNR. Clearing of rivers, streams, beach areas	• Disturbance • Mortality and Reproductive effects • Reduction in marine debris	• No regulations as to when activities may occur, there are no stipulations with regards to protection of nesting or feeding habitat.	-/+
Removal of marine debris from high entanglement zones	• Injury or mortality	• Marine debris affects seabirds via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on sea birds. • Mortality in longline fisheries is a global threat to most albatross and large petrel species (Gilman 2004). Hundreds of thousands of seabirds, including tens of thousands of albatrosses, are caught annually in longline fisheries worldwide (Gilman 2004).	+
Fishery Ecosystem Plan for the Hawai'i Archipelago			
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions	• Habitat protection	• Birds may benefit from Habitat designations; feeding areas, nesting and resting areas.	+
Habitat protection , loss mitigation and restoration			
Natural resource and species education and outreach	• Education	• 2009-2010: 10,000 people reached through partnerships with 30+ businesses, 50+ school presentations, 100+ schools	+
Building islands using dredge and fill	• Contaminants • Habitat degradation • Disturbance • Injury • Stranding • Entanglement in debris	• Accumulation of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in tissues through diet. • Coastal projects, bridges, roads and other infrastructure likely have changed the quality and quantity of habitat.	-
LORAN station (NWHI)			

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Wai`anae Wastewater Treatment Plan Modification	• Contaminants • Water quality improvements	• Improvements in water treatment would likely decrease the level of contaminants and biological waste entering coastal waters.	+
Wailupe Stream Flood Control			
Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie			
Legislation			
Hawai`i Environmental Policy Act (HRS 343)	• General species and habitat protection	• Protection of Hawaiian natural resources through public disclosure process and government reviewed impact evaluation	+

Since the arrival of the first humans to the Hawaiian Archipelago, more than half of the islands' 140 native bird species have become extinct (Hawaiian invasive species.org). Today, 31 Hawaiian bird species are endangered. Past threats to birds within the Project Area include habitat loss (MHI), bird poaching, seabird bycatch from longline fisheries, invasive species, marine debris, habitat loss, and contaminants.

Current threats are outlined below.

- Mortality in longline fisheries is a global threat to most albatross and large petrel species (Gilman 2004). Hundreds of thousands of seabirds, including tens of thousands of albatrosses, are caught annually in longline fisheries worldwide (Gilman 2004).
- Invasive species spread disease, destroy habitat, and indirectly and directly kill Hawaiian birds. Rats, mongoose, ants, mosquitoes (carrying bird pox and bird malaria), cats, and the golden crownbeard have been some of the most damaging invasive species for nesting seabirds in the Hawaiian Archipelago.
- Marine debris affects seabirds via ingestion of anthropogenic materials (*e.g.,* plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). In addition, debris from the tsunami that occurred in Japan in March 2011 could have significant impacts on wildlife, including seabirds, throughout the Pacific (Ocean Conservancy 2012). Tsunami debris that goes north of the Hawaiian Islands is predicted to primarily collect in the Northern Pacific Gyre where it will mix with common debris. This mixture of debris will then turn up in the NWHI again as currents carry debris from the Gyre to the NWHI (Maximenko and Hafner 2012). Tsunami debris is thus expected to continue to litter NWHI coastlines for many years to come (Maximenko and Hafner 2012).
- Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller *et al.* 2010).
- Global climate change factors are already affecting the NWHI ecosystem and will have widespread effects. Global mean sea levels have risen an estimated 3.1 ± 0.7 mm yr-1 from 1993-2003, an amount higher than any other 10-year period since 1950 (Keller *et al.* 2010). Habitat loss from sea level rise may be devastating to seabird populations that depend on these low islands for survival (Baker *et al.* 2006, Reynolds *et al.* 2012).

Avian mortality or reduced survival/reproductive success from RFFAs is identified for wind farms, residential and commercial construction (beach, nearshore), commercial fishing, scientific research activities on land, natural events, introduction of invasive species, tourism and recreation, and marine

pollution. Particularly in the MHI, all of the mortality factors except bird poaching identified in the previous section may continue to occur within the Project Area in the future. Some of the greatest sources of human-caused bird mortality from the past include the introduction of invasive species, habitat loss, and commercial fishing. However, effects of global climate change may become the largest threat to seabirds, especially in the NWHI, in the future.

Components of climate change most likely to affect seabirds in the NWHI include sea level rise, changing storm intensity and frequency (causing erosion), sea surface temperature rise and acidification (Keller *et al.* 2010). Habitat loss from sea level rise may be devastating to seabird populations that nest at or near sea level. Models predict that sea level will continue to rise. In addition, there is the potential for further habitat degradation with the release of contaminants contained in landfills as the islands are eroded or flooded from sea level rise (Reynolds et al 2012). As sea surface temperature increases, seabird prey species may move to deeper, cooler water, thereby decreasing food availability for foraging birds, or requiring birds to fly further north in the Pacific to obtain food resources.

Cumulative Effects Conclusion for Birds

Birds, especially nesting seabirds, of the Hawaiian Archipelago are susceptible to future human-caused mortality factors. The contribution from Hawaiian monk seal research and enhancement activities, however, is considered minor or negligible on birds. Activities to be undertaken by researchers in the MHI are not likely to have a measurable impact to the environment relative to those activities that already exist (*e.g.,* recreational boating and fishing, aerial tour operations, use of beaches by tourists), and no permanent damage to the physical environment (*e.g.,* due to construction) is expected. Thus, the contribution of any alternatives to cumulative effects on birds in the MHI is considered negligible.

Because Best Management Practices and protocols in place for the NWHI minimize human disturbance to birds, the direct and indirect effects associated with Alternative 1 are minimized, and research and enhancement activities would contribute negligible to minor cumulative effects on bird species. Alternative 2 would involve even less disturbance to birds from research and enhancement activities because activities would cease in 2014, thus contributing even less to the overall cumulative effects on birds. Compared to status quo (Alternative 1) Alternatives 3 and 4 would involve additional human disturbance associated with increased research and enhancement ground activities or aerial surveys than Alternative 1. However, the magnitude, intensity and duration of these effects are still considered minor given the low likelihood of interacting with these species and the temporary nature of the disturbance. Overall, the contribution to an adverse cumulative effect from any of the alternatives is considered negligible to minor.

4.7.7 CORALS

As described in Section 3.3.7, Coral, the Hawaiian Islands contain about 6,700 square miles of coral reef habitats, consisting of both shallow water species inhabiting waters less than 98 ft (30 m) and deep water species found in waters greater than 98 ft (30 m) (NMFS 2008b). NOAA has proposed listing three species of shallow water reef building corals in Hawaii as threatened under the Endangered Species Act: *Montipora patula/verrilli*, *Montipora dilitata/flabellata/turgescens*, and *Acroproa paniculata*. All three of these species occur in the Northwestern Hawaiian Islands, and *Montipora patula/verrilli* and *Montipora dilitata/flabellata/turgescens* occur in the Main Hawaiian Islands. These species are proposed as threatened due to a number of threats, with the most significant identified as ocean warming, coral disease, and ocean acidification as a result of climate change.

4.7.7.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVES ON CORALS

Status Quo (Alternative 1) activities would have negligible adverse impacts on shallow water corals due to the strict protocols described for entering the NWHI under a Monument permit. Vessel anchors and chains have the potential to destroy corals and live rock. To mitigate this type of damage, mooring buoys are used in areas where frequent or extended anchoring is necessary. In addition, Monument regulations, codified under 40 CFR Part 404, prohibit anchoring on corals.

In order to conduct monk seal research and enhancement activities in the Monument, NMFS must obtain a permit from the Co-Trustees. The Monument permit (PMNM-2011-001 presented in Appendix L) dictates certain mitigation measures that are standard practice for NMFS when working in the area and also in the MHI. In addition to permit conditions and as described in Section 3.3.10.1 Monument Permitted Activities, there are several Monument BMPs that are designed to avoid, minimize or mitigate potential impacts (see Appendix L).

Monument Permit PMNM-2011-001 specifies measures to minimize impacts on corals due to boating:

- Anchoring of authorized vessels is allowed on non-coral substrate only, and anchors must be lowered slowly and carefully
- All vessels, engines, and anchor lines must be free of introduced species prior to entry into the monument
- Tenders and small vessels must be equipped with engines that meet EPA emissions requirements
- Specific measures are required for boat operations and diving activities to reduce or eliminate adverse effects on protected marine species (Monument BMP #004); and

- Special Conditions and Rules for Small Boat Operations are required at Tern Island (Monument BMP #013), which mandate specific notification and operator training.

Under the Status Quo, small boats (less than 20 ft) used by NMFS researchers conducting Hawaiian monk seal research and enhancement activities in areas with shallow corals include: Boston whalers, ridged hull Zodiacs, Zodiac and Achilles inflatables and personal watercraft. These small boats can be launched from larger ships to access the islands and conduct research or can be used for access between research locations. All small boats and the larger research vessels used by NMFS such as the NOAA R/V Oscar Elton Sette (224 ft), the R/V Searcher (97 ft), and the M/V Kahana (160 ft), would be required to follow all permit requirements, provisions, and BMPs to protect coral when working in the Monument. In the MHI, researchers do not anchor small boats. Thus, impacts to shallow or deep water corals under the status quo would be expected to result in negligible effects.

Alternative 2 (No Action) would result in no additional effects once the current permit expires in 2014 as no research and enhancement activities for Hawaiian monk seal would be permitted.

Alternative 3 (Preferred), which adds new activities with expanded scope and methods, has a slightly greater potential to impact shallow water corals as compared to Alternative 1 due to increased research activity and use of small boats. However, considering the strict guidelines described above for Alternative 1, which would also be in place under Alternative 3, the potential adverse effects of Alternative 3 on the corals would be negligible.

Alternative 4 will have a slightly greater potential impact than Alternative 3, again due (in part) to the additional use of small boats and possibly larger research vessels to translocate weaned pups between NHWI and MHI. However, any potential adverse effects on coral would likely be negligible due to the controls and mitigation measures already implemented by NMFS.

4.7.7.2 CUMULATIVE EFFECTS OF ALTERNATIVES ON CORALS

Considering that there would only be negligible direct and indirect effects are anticipated under any of the Alternatives, there would be no contribution of monk seal research and enhancement activities to a cumulative impact on coral species.

4.7.8 INVASIVE SPECIES

The Hawaiian Archipelago is home to many rare and endemic species of plants and animals, many of which are formally listed as endangered (under the ESA), protected (MMPA) and/or listed as a species of concern under various federal, state or international laws or agreements. Endemic species are particularly vulnerable to harm from the introduction of non-native species, for example,

through competition for resources (such as food and habitat), disease or predation.

The introduction of non-native species could have effects on plant and animal species endemic to the islands and atolls used for Hawaiian monk seal research and enhancement activities. The Hawai'i Invasive Species Council (HISC) identifies 46 high-profile invasive species/categories, of which only hull fouling species, algae and mussels, are of concern within the MHI (HISC 2010d). In the NWHI, there is special concern over the introduction and proliferation of non-native seeds, insects or other alien species such as snakes, rodents, dogs, cats and so forth, as wells as hull-fouling species (algae and mussels). Section 3.3.9 provides more detail on invasive species in the Hawaiian Archipelago relative to the proposed action and associated Project Area.

4.7.8.1 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVES ON INTRODUCTION OF INVASIVE SPECIES

Research and enhancement on Hawaiian monk seals would likely result in minor or negligible effects pertaining to introduction of invasive species for the following reasons. Any increase in activity, especially within the NWHI, does increase the potential to introduce alien species. However, access to the Monument is limited and is contingent on the express permission of the Co-Trustees through the permitting process. Strict adherence to the special permit conditions and rules for the prevention of introduction of non-native species, as described in Appendix L of the Monument Permit, PMNM 2011-001, Attachment 13 *Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment.* The Monument permit General Terms and Conditions sets out protocols and procedures to reduce the risk of the spread of non-native (invasive) species including the assurance that "…all vessels are inspected for potential introduced species prior to departing the last port before entering the Monument". In addition, NOAA Administrative Order (NAO) 216-6, Section 7.03 addresses the integration of EO 13112, Invasive Species, in the NOAA Decision-making process, requiring the agency to "…use authorities to prevent introduction of invasive species, respond to and control invasions in a cost effective and environmentally sound manner".

NMFS closely follows these precautions when conducting any research and enhancement activities in the NWHI, thus the potential for vessels or personnel to introduce non-native species would likely be minor, particularly given that field camps in the NWHI are seasonal, typically staffed between April to August. Camps are rarely re-supplied during the field season thereby further reducing the potential introduction of invasive species. Research and enhancement activities in the MHI are not likely to result in the spread of invasive species relative to numerous other activities in the region including recreation, fishing, ecotourism and general habitation of the area.

Alternative 1 (Status Quo) activities would not likely result in the spread of invasive species due to the strict protocols described for entering the NWHI under a Monument permit however the possibility still exists. Given the high population and level of ecotourism, recreation, fishing, and other human activities that have the potential to spread non-native species, the research and enhancement activities proposed would be expected to result in negligible effects as the introduction of invasive species because while it may be possible for research activities to introduce invasive species, the likelihood of this occurring is extremely low.

Alternative 2 (No Action) would result in negligible effects once the current permit expires in 2014 as no research and enhancement on wild monk seals would be permitted.

Alternative 3, which adds new activities with expanded scope and methods, has a slightly greater potential to introduce non-native species than Alternative 1 due to increased activity. Specifically, the translocation of seals from MHI to NWHI may increase the probability that alien species already established in MHI could be transferred to the Monument. However, considering the strict guidelines described above, the potential adverse effects of Alternative 3 on the spread of invasive species would be negligible because, as with Alternative 1, while it may be possible for research activities to introduce invasive species, the likelihood of this occurring is extremely low.

Alternative 4 could have only a slightly greater potential effect than Alternative 3, due to the potential increased transport between the MHI and NWHI. Still, the likelihood of cross-region transport would also be negligible because of the strict quarantines that apply and the fact that while it may be possible to introduce invasive species, the likelihood of this occurring is extremely low.

4.7.8.2 CUMULATIVE EFFECTS OF ALTERNATIVES ON INTRODUCTION OF INVASIVE SPECIES

Since none of the Alternatives would result in measurable introduction or spread of invasive species in Hawaii, no cumulative impacts on are anticipated.

4.8 Social And Economic Environment

4.8.1 COMMERCIAL FISHING

This section analyzes potential direct, indirect and cumulative effects of the alternatives on commercial fishing. The area of analysis focuses on nearshore areas surrounding the MHI. As discussed in Section 4.4.3 Impact Criteria for Socioeconomic Resources, given the restrictions on commercial fishing due to the Monument, effects of the alternatives on commercial fishing are unlikely in the NWHI. Therefore, this analysis focuses on the MHI.

Best available data for analyzing impacts of fisheries

The analysis of the effects of alternatives on fishing relies heavily upon a recently published report (Sprague et al. 2013). This publication evaluates nearshore fish biomass, monk seal biomass, monk seal consumption of fish, fishery landings and degree of overlap between monk seal prey selection and species targeted by fishers in the MHI. The analysis is primarily focused on shallow (up to 30 m depth) coral reef habitat. Sprague et al. (2013) used the best available data to estimate a reasonable mean or range for parameters such as biomass and consumption rates. In cases where there was considerable doubt or uncertainty, and hence a broad range of plausible values, the authors erred on the side of *over*-estimating the potential monk seal impacts (*e.g.*, population size or consumption rate), while *under*-estimating the available resources and human impacts (*e.g.*, available biomass or fishery landings). This approach ensures that conclusions represent a maximum estimate of potential monk seal impacts. This is particularly useful for the PEIS analysis in that it provides a worst-case scenario for impacts.

As mentioned above, analysis of potential impacts of alternatives on fishing was limited to nearshore areas. Monk seals forage almost entirely on the ocean floor in waters 200 m or shallower. However, information for estimating biomass of fishes potentially consumed by seals exists only for waters <30 m deep. As such, for this impact analysis, total estimated prey consumption of seals (foraging at all depths) is compared to fish biomass in waters < 30 m, which comprises only about 12% of the total habitat in which seals feed. As such, the estimated proportion of fish consumed by monk seals is greatly overestimated. For this and several other reasons explained in Sprague et al. (2013), conclusions about the impacts of seals on fisheries are exaggerated. It is also worth noting that some 95% of fishery landings in Hawaii are pelagic fishes and monk seals are not known to consume any of the fish species targeted by pelagic fisheries.

Details of the analysis can be found in Sprague et al. (2013), but the basic approach was to estimate and compare the following:

- Biomass of fish (at various levels of the food web- apex predatory fish, secondary consumers, herbivores, planktivore) in nearshore hard-bottom coral reef habitat to a depth of 30 m
- Biomass of monk seals in the MHI
- Rate at which monk seals of various age groups consume prey
- Rate at which apex predatory fish consume prey
- Commercial and recreational fishery

A liberal estimate of the total prey biomass consumed by an assumed population of 200 monk seals in the MHI is a maximum of 1,300 kg per day (2,900 lb per day); this is an average of about 15 lb per day per seal. In comparison, Sprague et al. (2013) conservatively estimate that apex predatory fish…consume a minimum of 66,000 kg/day (146,000 lb/day). Thus, these apex predatory fish consume at least 50 times more fish than the entire population of monk seals in the MHI.

landings
- Relative overlap between families of fish found in monk seal diet and caught in fisheries

Examples of how Sprague et al. (2013) systematically overestimated absolute and relative potential impacts of seals on fisheries include, but are not limited to:

- Available fish biomass estimate did not account for several areas, in particular, Penguin Bank, a submerged former shield volcano off the west end of Moloka'i (depth generally ranging from 40-100 m) that is frequently used by monk seals for foraging
- Monk seals are known to forage in depths beyond 30 m. The analysis considered only hard bottom coral reef out to 30 m depth, representing just 12% of the area over which monk seals may forage. The estimate of prey biomass is therefore much smaller than is actually available in the monk seal's MHI foraging range.
- The estimates of biomass density only measured fin fish density, although monk seals and other apex predatory fish are known to also consume invertebrates, and invertebrate biomass may be many times that of fin fishes.
- Values for monk seal prey consumption were inflated in several ways to account for uncertainty
- Using current methods, monk seal diet is only determined to the taxonomic level of family, rather than to species. So, while Sprague et al. (2013) report that both fishermen and monk seals may target certain *families* of fishes, it is possible that the actual *species* consumed by each within those families may not overlap. Furthermore, even when fisheries and monk seals consume the same species, there may be differences in the size of the prey, the area, and the depth over which those species are taken.

Effects of Alternatives on commercial fishing

Effects on commercial fishing could be anticipated if an action were to result in a change in profits for the commercial fishermen. A change in profits could not only affect fishermen's well-being and quality of life, but could have a larger effect on the economy of the area. Given that profit is a function of revenue and cost, profits for fishermen could decrease or increase if the cost associated with fishing increases or decreases and/or the revenue derived decreases or increases, respectively. Potential effects on costs associated with fishing are considered in terms of lost or damaged fish, lost or damaged gear, and lost fishing time and fuel costs (if vessels relocate to other fishing areas) due to the alternatives. This analysis addresses potential changes in revenues for commercial fishermen as a consequence of the alternatives. The indicator used to assess this change is the potential variation in commercial catch, both in terms of quantity and value, due to the alternatives, as presented in Table 4.4-6 in Section 4.4.3 Impact Criteria for Socioeconomic Resources.

The alternatives are not anticipated to result in any direct effects on commercial fishing. However, depending on the extent to which Hawaiian monk seals may prey on and reduce the population of certain fish species that are commercially viable, indirect effects on commercial fishing may be possible if an alternative results in a change in the MHI Hawaiian monk seal population, and that change in population, in turn, affects either cost to the commercial fishery or affects revenue through the level of commercial catch. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators or competitors of those species. These possible effects on commercial fishing revenues and costs are examined below.

Among commercial fisheries in Hawaii, the pelagic fishery is the largest and most valuable, accounting for about 95% of commercial landings with 26.6 million pounds of pelagic fish caught commercially in 2010 (WPacFin 2011). Monk seals are benthic (bottom) foragers and there is no evidence that they eat the species targeted by pelagic fisheries (see Section 3.3.1.5). Thus, it appears that there is no potential for monk seals to impact 95% of commercial fishery landings.

Sprague et al. (2013) report the following. Hawaiian monk seals are liberally estimated to consume 4% of body mass (adults), 6% (sub-adults), and 8% (juveniles) per day. A liberal estimate of the total biomass of prey consumed by a maximum current population of 200 monk seals in the MHI is approximately 1,300 kg per day (2,900 lb per day); this is an average of about 15 lb per day per seal. In comparison, Sprague et al. (2013) conservatively estimate that apex predatory fish (sharks and jacks present in just the nearshore waters out to 30 m depth in the MHI) consume a minimum 66,000 kg/day (146,000 lb/day). Thus, near-shore predatory fish alone consume at least 50 times more fish than does the entire assumed population of MHI monk seals.

Commercial fishery landings from 2003-2009 were reported by Sprague et al. (2013) and are reproduced here in Table 4.8-1 (adapted from DLNR commercial catch reports). A conservative estimate of commercial catch of species occurring within nearshore (up to 30 m depth) habitats (that is, after excluding mostly pelagic species that account for 95% of commercial landings), is 1,676 kg (3,969 lb) per day.

Total minimum estimated biomass of reef fish in the shallow water coral reef habitats of the MHI is 16,600,000 kg (36,600,000 lb) (Sprague et al. 2013). Thus, the daily consumption of the entire MHI monk seal population amounts to a *maximum* of 0.009% of the estimated available prey biomass. Because assumptions erred on the side of overestimating monk seal impacts, the true value is likely considerably even smaller.

Finally, Sprague et al. (2013) report that only 27% of reported commercial fishery landings (by weight, excluding pelagic species) are in the same fish families also found in monk seal diet. Or conversely, 73% of commercial nearshore landings

are from families of fish not eaten by monk seals and therefore not likely to be impacted by any increase in monk seal consumption. When pelagic commercial species are included, landings in fish families also eaten by monk seals only accounted for 1.3% of the total commercial catch.

For alternatives that are anticipated to result in an increase in Hawaiian monk seal population in the MHI, either through translocation or because of the long-term success of the enhancement actions, additional fish consumption by seals may occur. However, as noted above, only about 27% of the commercial nearshore landings are from the same families of fish eaten by Hawaiian monk seals. Further, a commercially viable fish that a monk seal may eat would not necessarily be available to fishermen. For example, those fish may instead be eaten by predatory fish (which, as noted above, conservatively consume at least 50 times more fish than the entire monk seal population). Seabirds and other marine mammals also may take such commercially targeted prey. Further, Hawaiian monk seals forage over a much wider range of areas than accounted for in the Sprague et al. (2013) analysis. Given these considerations, the percentage of commercial catch that might be consumed by seals present in the MHI due to research and enhancement activities would be even smaller than indicated by the above calculations.

Table 4.8-1. Commercial fishery landings reported to the State of Hawai'i DLNR from 2003 to 2009. All are sea landings reported in pounds (lbs). Families marked as "excluded" were not included in the analysis of biomass consumption relative to monk seals.

Family	Common Name	2003	2004	2005	2006	2007	2008	2009	Annual Average (lbs)	Daily Average (lbs)	Daily Average (kg)
Acanthuridae	Surgeonfishes	102,703	88,448	90,018	71,984	76,637	81,094	41,095	78,854	216	98
Albulidae	Bonefish	3,057	2,002	3,344	5,175	9,822	11,308	8,531	6,177	17	8
Balistidae	Triggerfishes	62	113	61	8	236	812	2,015	472	1	1
Carangidae	Akule/opelu	847,465	1,002,718	887,225	867,448	1,094,462	620,770	617,268	848,194	2,324	1,054
Carangidae	Jacks/ulua	82,304	84,383	58,442	39,480	70,828	61,079	58,347	64,980	178	81
Cephalopod	Octopods & squid	25,864	23,108	20,956	20,434	18,290	31,305	34,335	24,899	68	31
Crustacean	Crabs, lobsters, prawn	40,138	26,159	150,892	36,589	52,190	57,557	155,842	74,195	203	92
Elopidae	Ladyfish tarpon	823	430	581	1,106	1,407	408	1,642	914	3	1
Holocentridae	Squirrelfishes & soldierfishes	34,548	29,629	35,367	24,041	36,049	59,171	52,508	38,759	106	48
Kuhliidae	Flagtail	2,995	1,893	2,250	1,266	1,670	4,182	4,180	2,634	7	3
Kyphosidae	Sea chub	19,503	19,349	19,639	35,616	26,773	21,597	14,479	22,422	61	28
Labridae	Wrasses	6,532	6,094	3,761	4,965	4,611	6,026	7,645	5,662	16	7

Family	Common Name	2003	2004	2005	2006	2007	2008	2009	Annual Average (lbs)	Daily Average (lbs)	Daily Average (kg)
Lutjanidae	Snappers	1,789	3,387	1,851	2,381	2,645	3,460	4,223	2,819	8	4
Monacanthidae	Filefishes	906	3,590	407	741	595	454	0	956	3	1
Mugilidae	Mullet	9,239	8,171	7,785	8,369	11,329	9,740	8,560	9,028	25	11
Mullidae	Goatfishes	62,201	68,994	39,703	40,348	35,499	38,055	54,193	48,428	133	60
Muraenidae	Moray eels	59	124	85	101	250	483	1,864	424	1	1
Pomacentridae	Damselfishes	908	1,745	2,131	2,085	1,240	1,867	1,882	1,694	5	2
Priacanthidae	Bigeyes	3,209	14,117	5,541	2,987	4,842	3,843	2,752	5,327	15	7
Scaridae	Parrotfishes	35,506	32,049	32,573	30,387	40,094	44,806	50,475	37,984	104	47
Scorpaenidae	Scorpionfishes	3,348	2,972	3,279	2,713	2,303	2,053	3,641	2,901	8	4
Serranidae	Groupers, basslets, & anthias	49,052	44,292	48,214	31,443	29,203	23,226	25,742	35,882	98	45
Sphyraenidae	Barracuda	2,929	2,973	1,787	1,619	1,467	3,925	1,591	2,327	6	3
-	Misc. inshore fishes (incl. moi, mu, awa)	6,872	7,644	5,906	5,895	11,751	15,325	16,746	10,020	27	12
Subtotal		1,342,012	1,474,384	1,421,798	1,237,181	1,534,193	1,102,546	1,169,556	1,325,953	3,633	1,648

Family	**Common Name**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Annual Average (lbs)**	**Daily Average (lbs)**	**Daily Average (kg)**
EXCLUDED											
Family	Common Name										
Istiophoridae & Xiphiidae	Billfishes & swordfishes	3,029,870	2,294,177	4,655,440	4,038,122	5,470,247	6,406,085	5,967,862	4,551,686	12,470	5,656
Scombridae	Tunas	14,055,058	13,315,002	14,596,986	12,618,034	18,660,259	18,908,288	15,229,305	15,340,419	42,029	19,064
-	Corals	0	0	0	0	3,775	0	0	539	1	1
Lutjanidae, Serranidae, Berycidae, Carangidae	Deep bottomfishes	585,235	642,258	523,538	477,503	508,708	509,027	473,573	531,406	1,456	660
-	Misc. pelagic fishes	4,107,385	4,633,532	4,405,774	4,269,982	4,711,822	4,847,981	5,231,456	4,601,133	12,606	5,718
-	Other animals (*e.g.*, sea cucumber, limpet)	11,730	8,441	7,231	10,246	7,499	10,517	22,649	11,188	31	14
-	Seaweeds and limu	13,304	16,906	10,184	5,102	5,741	9,900	10,402	10,220	28	13
-	Sharks	203,253	142,289	193,450	177,205	370,349	337,043	297,078	245,810	673	305
-	Unclassified or misc	10,058	12,267	15,605	57,603	5,821	17,216	5,129	17,671	48	22
Subtotal		22,015,893	21,064,872	24,408,208	21,653,797	29,744,221	31,046,057	27,237,454	25,310,072	69,343	31,453
TOTAL		**23,357,905**	**22,539,256**	**25,830,006**	**22,890,978**	**31,278,414**	**32,148,603**	**28,407,010**	**26,636,025**	**72,975**	**33,101**

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If an alternative results in a change in the Hawaiian monk seal population in the MHI, indirect effects on commercial fishing may also include changes in costs due to the nature and number of interactions between fisheries and seals. Costs from such interactions can arise from: 1) damaged catch from depredation (*i.e.*, seals eating fish off fishing lines or hooks) by Hawaiian monk seals; 2) increased loss or damage of fishing equipment such as hooks; and 3) actions taken by commercial fishing to reduce interactions and harm to Hawaiian monk seals. For example, efforts to reduce interactions can result in increased fuel costs if fishermen relocate to avoid monk seals. In addition, if a fisherman brings gear aboard and stops fishing efforts to avoid a seal interaction, fishing time could be reduced (with potential associated reductions in catch).

The data available on the above interactions types between commercial fishing and Hawaiian monk seals are limited to NOAA observer reports from the NWHI and the MHI, as well as published studies from the 1990s in the NWHI. The NOAA bottomfish observer reports from the MHI from 2003 to 2005 did not record any interactions between Hawaiian monk seals and commercial fishing vessels (NOAA Fisheries Service, Pacific Islands Regional Office, Observer Program, Hawaii Bottomfish Quarterly and Annual Status Reports, 2003, 2004, 2005; accessed online at: http://www.fpir.noaa.gov/OBS/obs_hi_bf_rprts.html). Similarly, NOAA longline observer reports from 1994 to 2011 did not record any interactions between Hawaiian monk seals and commercial fishermen (Nitta and Henderson, 1993).

However, bottomfish observer reports from the NWHI in the early 1990s indicate that bottomfish-monk seal interactions occurred, on average, at a rate of one interaction per 34.4 hours fishing, with no recordings of damaged fish from interactions (Hale and Coon 1993, Nitta and Henderson 1993). A study of commercial bottomfish fishing in the NWHI did present evidence of damaged fish by Hawaiian monk seals. This study reported that the mean incident rate for fish damaged by NWHI monk seals was 0.45 damaged fish per 1,000 landed fish, or less than 0.05% of catch (Kobayashi and Kawamoto 1995). The study also estimated that NWHI monk seals may have stolen approximately 12.15 fish per 1,000 landed fish, with estimated gear costs for each fish lost of approximately $7.50 (in 2012 dollars).

While the data from the NWHI indicate that Hawaiian monk seals did interact with commercial bottomfish fishing in the 1990s, there are no observer data in the MHI documenting such interactions. The Hawaiian monk seal population in the NWHI during the 1990s was much larger than the current MHI seal population. That difference, and the lack of data on interactions in the MHI, suggest interactions between commercial fishing vessels and monk seals in the MHI resulting in costs to the fishery are likely rare.

4.8.1.1 *DIRECT AND INDIRECT EFFECTS ON COMMERCIAL FISHERIES OF ALTERNATIVE 1 – STATUS QUO*

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.6 Alternatives Carried Forward for Analysis.

Alternative 1 is not anticipated to have any direct effects on commercial catch in the MHI. Under Alternative 1 (and all other alternatives), the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011*a*) independent of actions taken by NMFS. While this natural growth may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal.

As discussed above, effects on commercial fishing could stem from changes in the quantity of fish, value of commercial catch, and costs to the fishery related to commercial fishing/Hawaiian monk seal interaction.

Indirect effects of Alternative 1 on commercial fishing could be possible if there were marked changes in the availability of commercially fished species and, consequently, the quantity of commercial catch, due to an increase in the Hawaiian monk seal population. Furthermore, commercial fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 1 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the nearshore MHI, and
- Only a fraction (27%) of that consumption potentially overlaps with commercially fished species, and
- Apex predatory fish likely consume over 50 times more prey than the entire monk seal population

Given those findings, any marginal increase in Hawaiian monk seal population due to Alternative 1 activities are anticipated to have negligible effects on commercial fishing.

Conclusion for Direct and Indirect Effects on Commercial Fisheries from Alternative 1 (Status Quo)

None of the research and enhancement activities permitted under Alternative 1 would directly affect commercial fishing in MHI. Therefore, direct effects are likely to be negligible. Given the small relative consumption rate of the entire Hawaiian monk seal population, the limited overlap between prey consumed by seals and species targeted by commercial fisheries, and the lack of data on interactions with the commercial fishing industry in the MHI, under Status Quo (Alternative 1) a marginal increase in the growth rate of the Hawaiian monk seal population that is already naturally increasing in the MHI is likely to result in negligible indirect adverse effects on commercial fishing.

4.8.1.2 DIRECT AND INDIRECT EFFECTS ON COMMERCIAL FISHERIES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

Alternative 2 is not anticipated to have any direct effects on commercial fishing in the MHI. As noted above, demographic data suggest that the Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on commercial fishing under Alternative 2 would not likely occur.

Indirect effects of Alternative 2 on commercial fishing could be possible if there were marked changes in the availability of commercially fished species and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. Furthermore, commercial fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

Because most monk seal research and enhancement activities would cease after 2014 under Alternative 2, any increases to the monk seal population due to Alternative 2 would be even smaller than under Alternative 1. Thus, for all the reasons presented in the analysis of Alternative 1 above, the effects of Alternative 2 are anticipated to be negligible.

Conclusion for Direct and Indirect Effects on Commercial Fisheries from Alternative 2 (No Action)

Alternative 2 is not anticipated to either directly or indirectly affect commercial fishing in MHI. The overall effects of Alternative 2 are expected to be negligible.

4.8.1.3 *DIRECT AND INDIRECT EFFECTS ON COMMERCIAL FISHERIES OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities. Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP) (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal increases in the MHI monk seal population if seals with undesirable behaviors are able to remain in the wild. This would be expected to involve only very few seals. Importantly, behavioral modification is in part intended to reduce habitual seal interactions with fishing operations. If this effort succeeds, then Alternative 3 may *reduce* potential effects on fishing by minimizing interactions. Alternative 3 is not anticipated to have any direct effects on commercial fishing in the MHI.

> *Importantly, behavioral modification is in part intended to reduce habitual seal interactions with fishing operations. If this effort succeeds, then Alternative 3 may reduce potential effects on fishing by minimizing interactions.*

Indirect effects of Alternative 3 on commercial fishing could be possible if there were marked changes in the availability of commercially fished species and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. Furthermore, commercial fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 3 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the nearshore MHI, and

- Only a fraction (27%) of that consumption potentially overlaps with commercially fished species, and
- Apex predatory fish likely consume over 50 times more prey than the entire monk seal population

While Alternative 3 activities may marginally increase the Hawaiian monk seal population, behavioral modification activities may succeed in reducing seal interactions with fisheries. Given the findings of Sprague et al. (2013) coupled with the potential reduction in seal/fishery interactions, any marginal increase in the seal population due to Alternative 3 activities are anticipated to have negligible effects on commercial fishing.

Conclusion for Direct and Indirect Effects on Commercial Fisheries from Alternative 3 (Preferred Alternative)

None of the research and enhancement activities permitted under Alternative 3 would directly affect commercial fishing in MHI. Therefore, direct effects are likely to be negligible to none. A marginal increase in the MHI Hawaiian monk seal population growth rate due to Alternative 3, especially coupled with potentially reduced seal/fishery interactions due to behavioral modification, is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.8.1.4 DIRECT AND INDIRECT EFFECTS ON COMMERCIAL FISHERIES OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that the benefit of Alternative 4 would primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth that is naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 2 or 3 years of age. Alternative 4 is not anticipated to result in any direct effects on commercial fishing in the MHI.

Indirect effects of Alternative 4 on commercial fishing could be possible if there were marked changes in the availability of commercially fished species and, consequently, the quantity of commercial catch, due to increased Hawaiian

monk seal population. Furthermore, commercial fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

Under this alternative, a maximum of 20 weaned pups per year could be translocated to the MHI from NWHI for the five-year permit period. Each group of monk seals would be returned to the NWHI once they reached 2 or 3 years of age. The maximum number of additional seals that would be present in a single year is 60 seals if it is assumed that:

- the maximum allowed number of juvenile monk seals per year (20) are translocated for at least 3 consecutive years;
- all of these are translocated from the NWHI to the MHI and not vice versa; and
- there is no mortality of translocated seals for three years;

While it is important to consider this scenario in order to understand what might happen if all of these seals survived, that would be very unlikely. A more realistic estimate of the maximum number of translocated monk seals in the MHI is derived by applying the survival rates of native-born MHI monk seals to translocated seals. Retaining the first two assumptions in the preceding bullets, this results in a projected maximum number of 51 additional seals. Again, while this analysis acknowledges that an additional 60 seals in these years would be unlikely, it uses this number (60) in order to present the greatest potential impact scenario for the purposes of evaluating potential effects on commercial fish in the MHI under Alternative 4.

Based upon the liberal consumption rates in Sprague et al. (2013) juvenile monk seals eat approximately 5 kg (11 lb) of prey per day. Therefore, the additional 60 juvenile monk seals that could potentially occur temporarily in the MHI under Alternative 4 would consume at most 60 x 5 = 300 kg (662 lb) of prey per day. This represents at most 0.0018% of the estimated standing biomass of reef fish in the nearshore habitats of the MHI. Furthermore, apex fish predators are estimated to consume at least 220 times as much as would these 60 potential juvenile monk seals. Interactions between the translocated seals and commercial fisheries could increase under Alternative 4, although as noted above, documentation of such interactions is lacking and they are likely to be very rare. However, as under Alternative 3, behavioral modification activities under Alternative 4, if successful, could mitigate fishery interactions with both translocated and seals native to the MHI. Given the exceedingly small potential increase in prey consumption, only part of which would potentially overlap with commercially targeted species, and the potentially marginal increase in fishery interactions (though mitigated by behavioral modification), overall Alternative 4 activities are anticipated to have negligible effects on commercial fishing.

Conclusion for Direct and Indirect Effects on Commercial Fisheries from Alternative 4 (Enhanced Implementation)

None of the research and enhancement activities permitted under Alternative 4 would directly affect commercial fishing in the MHI. Therefore, direct effects are likely to be negligible. A temporary and only marginal Hawaiian monk seal population increase within the MHI due to Alternative 4, combined with the implementation of behavioral modification tools, is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.8.1.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON COMMERCIAL FISHERIES

This section presents the cumulative effects on commercial fishing in the context of past actions and the RFFAs listed in Tables 4.5-1 and 4.5-2 respectively.

Summary of Direct and Indirect Effects on Commercial Fisheries

The alternatives are not anticipated to result in any *direct* effects on commercial fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. However, *indirect* effects on commercial fishing may be possible if an alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the commercial catch because Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are commercially viable. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators or competitors of those species.

Indirect effects on commercial fishing may be possible if an alternative results in a change in the Hawaiian monk seal population in the MHI, which, in turn, results in an increase in the number of seal-commercial fisheries interactions. However, the analysis suggests that the indirect effects of the alternatives on commercial fishing are likely to be negligible due to the marginal increase in the monk seal population expected, and implementation of behavioral management tools.

Direct and indirect effects of monk seal research and enhancement activities on commercial fisheries are evaluated in terms of potential increases or decreases in commercial catch. Table 4.8-2 summarizes the direct and indirect effects of the alternatives on commercial fisheries.

Table 4.8-2 Summary of Direct and Indirect Effects of the Alternatives on Commercial Fisheries

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Commercial Fisheries	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Commercial Fisheries

Past, present and reasonably foreseeable future actions that may affect commercial fisheries are summarized in Table 4.8-3.

Table 4.8-3 Effects of Past, Present and Reasonably Foreseeable Future Actions on Commercial Fisheries

Commercial Fisheries Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris	• Changes to fish habitat • Injury or mortality to fish • Changes in prey due to ecosystem shift • Changes in fish age class recruitment	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris by fish and affects habitat suitability.	-
Climate Change		• Subtropical Pacific ecosystem changes evident although modest relative to changes from increased fishing effort. However, future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011). • Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish populations are affected by these changes and can be both beneficial and adverse.	+/-
Introduction of Invasive species		• Parasites have been shown to be significant stressors in many species. Reif et al. (2006). • Invasive fish species introduced through ballast water may cause changes in fish population dynamics.	-
Predation by apex predatory fish nearshore (30m depth)	• Mortality of fish	• Apex predatory fish consume a minimum of 66,000 kg/day (146,000 lb/day) approximately 50 times more than a Hawaiian monk seal (Sprague et al. 2013).	-/+
Predation by Hawaiian monk seals nearshore (30m depth)	• Mortality of fish	• Estimated predation by 200 monk seals in MHI is approximately 1,300 kg per day (2,900 lb per day) (Sprague et al. 2013)	-/+
Military activities			

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Mortality of fish • Fish habitat destruction • Temporary or permanent area restrictions to fishing during training	• Possible yet unlikely temporary threshold shift (TTS) impact to fish sensory systems due to sonar and explosive detonations. • Potential strike or contamination by torpedo and ship training activities. • Possible entanglement of fish in parachute assemblies, remote. • Detonation and explosive ordinance impacts to fish (*i.e.*, mortality). • Detonation impacts of buoys and RIMPAC and USWEX to fish. • Impacts to fish to include TTS injury and mortality. • Degradation or destruction of feeding habitat by underwater detonations and training activities. • Possible, however unlikely, TTS impact to fish due to sonar and explosive detonations. • Potential strike or mortality by training activities. • Potential closure or fisheries restrictions in areas where training activities occur.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS)			
Commercial			
Unregulated fishing (1913 - 2002)	• Mortality of fish • Reproductive effects on fish	• Unregulated take, reducing long term sustainability of populations for future fisheries. • Long-term catch trends suggest that there has been approximately an 80 percent decline in the nearshore stocks this century. Overfishing is partially due to an increase in population, improved fishing technology, improved gear, and failure to recognize or follow traditional conservation practices. Additionally, the number of commercial permits issued to collect reef fish increased by 39 percent between 1995 and 1998 (NOAA 2013).	-
Sea cucumber harvest (1882)			
Black-lipped oyster harvest (1928-1930)			
Lobster harvest (1970-1999)			

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Commercial bottomfish fisheries	• Changes in fisheries catch/landings • Overharvest • Fish mortality or injury	• 1948 – 1978: number of trips per year per fishermen increased and has remained about 8 trips per year between 1980 and 2004. Data suggest there are more fishermen catching fewer fish. • Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006).	-
Commercial pelagic fisheries		• 1996-2006: Increased fishing effort with number of hooks set increasing four-fold. Catch rates for apex predators such as blue shark, bigeye and albacore tunas, shortbill spearfish, and striped marlin declined from 3 to 9% per year while catch rates for mahimahi, sickle pomfret, escolar, and snake mackerel, increased by 6 to 18% per year (Polovina 2009). • 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). Decreased catch rates for large fishes has continued through at least 2011 (Polovina 2011). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013).	-/+
Recreational and subsistence fisheries		• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • Limited data on subsistence harvest of fish species in Hawaii make estimating harvest levels difficult. • 2013: daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) • Widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004).	
Inter-Island Transmission Cable	• Disturbance to fishing vessels	• Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to fish may occur while laying the cable, including entanglement and mortality.	-

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Special Coral Reef Ecosystem Fishing Permit to Kampachi Farms, LLC	• Aggregation of pelagic fish	• Culture and harvest a coral reef ecosystem management unit fish species kampachi (Seriola rivoliana, marketed as Kona Kampachi[supreg]) in a floating pen moored about 5.5 nm off the west coast of the Island of Hawaii in about 6,000 ft of water. A 132m [supcaret] 3 (approximately 21 feet in diameter) brass-link mesh aquapod (CuPod) tethered to a moored, 28-ft feed vessel would be used for harvesting. • Fishermen would be able to fish around the array. The small size of the array is not expected to have a large adverse impact on catches by other fishermen in the ocean in west Hawaii.	-
Wai`anae Wastewater Treatment Plan Modification Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Water quality improvements	• Wastewater treatment plant improvements would generally be expected to reduce contaminants and biological waste streams entering the coastal ecosystem. Thus, minimizing exposure of fish species to contaminants and biological waste would result in improvements in habitat and would likely be beneficial for fish.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices also widely impact coral reef habitat. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013).	-
Other Government Activities			
Hawai`i Environmental Justice Bill: Senate Bill 2145 EO 12898: Environmental Justice	• Protection of minority interests in fisheries	• To the extent that minority populations rely on fisheries (commercial, subsistence or recreational) for income or for food, protection of minorities from projects that may cause disproportionate impacts would result in benefits to these groups.	+

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	• Closed fishery	• 2006: regulations prohibited commercial fishing, except for the bottomfish fishery (and associated pelagic species catch), which had potential to continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). • 2009 remaining permit holders surrendered permits to NMFS in exchange for compensation from Federal Government and fishery was closed. Total NWHI bottomfish catch in 2009 was 29 metric tons.	-
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Habitat protection for fish • Redistribution of fishing activities to other areas	• No new fishing regulations would result from designating potential time-area closures for human activities such as wildlife viewing, swimming, boating, or fishing. Fishing activities may move to other areas where no time-area closures are in effect though overall this is not expected to reduce fish catch. • Fish populations may benefit from spinner dolphin protection measures due to potential time-area closures in bays around the MHI; potential additional protection of habitat; added recruitment could benefit fisheries.	+
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Reduction in marine debris	• Reduction in marine debris could reduce mortality or entanglement of fish. • Marine debris affects fish via ingestion (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). • Potential reduction in debris entanglement in commercial fishery nets.	+
Removal of marine debris from high entanglement zones	• Mortality • Injury		
Hawaiian Monk Seal Critical Habitat Designation	• Habitat protection	• No new fishing regulations would result from designating Hawaiian monk seal critical habitat. • Fish populations may benefit from Monk Seal Habitat designation due to the additional protection of habitat; added recruitment will benefit fisheries.	+

Hawaiian Bird Cumulative Actions and Events			
Action / Event	**Potential Effects**	**Description/Example**	**Effect**
Fishery Ecosystem Plan for the Hawai`i Archipelago	• Mortality • Prey availability	• Fishery plan may promote more stable prey resources. • Researchers may enhance habitat for fish when they remove marine debris during field activities. Marine debris affects fish via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on fish.	+ / -
Measures to End Bottomfish Overfishing in the Hawaiian Archipelago	• Indirect mortality • Prey availability	• Fishery plan may promote more stable prey resources.	+
Bottomfish and Seamount Groundfish Fisheries Management Plan (2005)	• Indirect mortality • Prey availability	• Fishery plan promotes more sustainable management of stocks and promotes stable prey resources.	+
Pilot Aquaculture Project (Tuna cultivation)	• Mortality • Disease • Genetic effects • Pollution	• Potential reduction in pressure on wild fish populations. • Escapement could impact native populations through disease and dilution of locally adaptive gene complexes, disrupt natural ecosystems and jeopardize recovery of depleted or endangered species. • Aquaculture facility can carry excessive nutrients, particulates, bacteria, other diseased organisms and polluting chemicals	+/-

Cumulative Effects Conclusion for Commercial Fisheries

The direct and indirect effects on commercial fisheries associated with the Hawaiian monk seal research and enhancement alternatives are negligible because proposed activities would not result in changes to landings. Thus, the contribution of monk seal research and enhancement to an overall cumulative effect from any of the alternatives is considered negligible.

Documented historical overfishing in the NWHI and MHI has adversely affected fish populations around Hawaii as shown in Table 4.7-11. The effects of ongoing subsistence and recreational fishing are not well understood due to lack of licensing requirements and reporting of catch. Though it is difficult to determine the level of catch for recreational and subsistence fisheries, Sprague et al (2013) reported that daily near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) compared to daily commercial nearshore catch of 1676 kg. In addition, Friedlander et al. 2004 stated that it is widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear. Based on these assumptions, there may be competition for fish between commercial and recreational/subsistence fisheries that may influence commercial landings. Notable fisheries management actions in the past have ended bottomfish overfishing in the MHI and FEPs for various fisheries would be expected to have beneficial effects on fish populations and therefore, could result in beneficial indirect effects on commercial catch.

Fisheries regulations, such as plans to end bottomfish overfishing in the Hawai‘i Archipelago, could indirectly affect recreational fishing, as commercial bottomfish fishermen will seek alternatives to supplement their incomes. This could result in changes in the populations of other fish species, including those popular for recreational fishing. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai‘i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the no action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of

implementation measures under these plans include, among others, ecosystem boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc. In 2012, WPFMC approved a 6% increase in bottomfish quota due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2012).

Effects of development, pollution, and human modifications of the coastal environment have all had adverse effects on fish populations and, thus, fisheries due to changes in overall fish habitat conditions. The local and global economic recession in recent years resulted in a reduction of fish exports by commercial fishermen, leading to reduced commercial catch. As the economy is beginning to recover, commercial catch is trending upwards and more tourists are visiting the MHI, which may increase recreational and subsistence fishing pressure.

Other ongoing federal government management actions to protect and enhance monk seal populations and other protected species such as spinner dolphins in the nearshore environment around Hawaiʻi could result in limited access to certain nearshore fisheries though this cannot be confirmed at this time as management measures are still being developed by NMFS. That said, designation of Hawaiian monk seal habitat is not anticipated to result in changes to fishing regulations. Protection of monk seal habitat may result in benefits to nearshore fish species through improved overall habitat protection and better recruitment. Whether this would be of benefit to commercial fisheries cannot be determined at this time.

Similar benefits could result from spinner dolphin protection measures such as time-area closures. Time-area closures however could result in limiting access to specific areas in bays around Hawaii. However, these potential spinner dolphin measures would not preclude fishermen from fishing in other areas where there were no closures thus the potential adverse effects of closures would likely be minimal.

Actions listed in Table 4.8-3 provide some overall perspective on actions and events that have had or could have effects (direct, indirect or cumulative) on commercial fisheries. While the net effects on subsistence fishing from past and future actions are not known, Hawaiian monk seal research and enhancement actions are not likely to result in anything but negligible direct, indirect or cumulative effects on commercial fisheries.

4.8.2 SUBSISTENCE FISHING

This section addresses the potential direct, indirect and cumulative effects of the alternatives on subsistence fishing. The analysis focuses on the nearshore areas surrounding the MHI. Sprague et al. (2013, see also Section 3.4.4 Subsistence Fishing) noted that in Hawaiʻi the line between recreational and subsistence fishing is blurred, and there is little collection of data to differentiate between the two. There is no saltwater fishing license for recreational or subsistence fishing,

and no requirement to report recreational catch in the State of Hawai'i. As a result, the data on recreational fishery landings are very limited, voluntarily reported and are often considered biased or incomplete, representing a minimum estimate of extraction. Despite these data shortcomings, effects on subsistence fishing are nevertheless evaluated separately from recreational fishing (Section 4.8.3) because the types of effects may be different, owing to the intent of these non-commercial fishing activities (for subsistence versus for recreation).

Fish are an important part of the diet for the people of Hawai`i, with about 90 pounds per capita consumed annually, over twice the national average. Some fish species also have cultural significance for Native Hawaiians. Effects on subsistence fishing could be expected if an action results in changes in fish consumption by Hawaiian residents and, therefore, affects not only their well-being and quality of life, but also has a larger effect on their way of life and identity. As per Table 4.4-6 in Section 4.4.3, these effects are measured through looking at any changes in the quantity of fish consumed.

One factor that could potentially affect consumption is change in access to fishing areas, especially for onshore and nearshore fishing, as many Hawaiians tend to fish close to their homes for subsistence purposes. None of the alternatives propose any area closures or other seasonal or catch restrictions. Another factor that may result in altering fish consumption is change in the amount of fish caught due to less fish available. This is examined in more detail below.

The alternatives are not anticipated to result in any direct effects on subsistence fishing. However, indirect effects on subsistence fishing may be possible if an alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the quantity of fish caught for subsistence purposes because Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are consumed by subsistence fishers. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators or competitors of those species.

It is widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander *et al.* 2004). Consistent with this, Sprague et al. (2013) obtained recreational (and subsistence, because there is no formal distinction between these in the available data) landings summaries from the Hawaii Marine Recreational Fishing Survey from 2003 to 2011. They considered only landings from shore or from within 3 miles of shore (in order to exclude pelagic fishes) and excluded pelagic species and sharks caught within 3 mi of shore, thereby excluding 90% of the reported recreational fishery catch. While daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Table 4.8-

3). Sprague et al. (2013) note that commercial fishery landings data come from mandatory reports of daily fishing activity, while subsistence/recreational fishery landings data are from voluntary surveys. Both methods may underreport the actual catch, but there is likely greater accuracy in the commercial data. In particular, reported near-shore recreational landings from spear-fishing and shoreline fishing may not be as well-represented as boat-based landings. Fish families found in the monk seal diet accounted for only 39% of reported recreational/subsistence fishery landings (by weight, excluding pelagic species). Or conversely, 61% of nearshore landings are from fish families not eaten by monk seals and therefore not likely to be impacted by any increase in monk seal consumption. Sprague et al. (2013) note that with better information on the actual (versus reported) fishery catch, this estimate over monk seal dietary overlap with fisheries could be refined in the future.

The uncertainty in data on subsistence fishery landings makes it more difficult to assess the potential impacts of the alternatives. However, even the likely underestimated amount of fish (2178 kg per day) extracted by nearshore subsistence and recreational fishing is considerably higher than the relatively reliable estimate (1676 kg) of nearshore fish extracted by commercial fisheries. It is clear, then, that the amount of fish eaten by Hawaiian monks seals is relatively smaller when compared to the subsistence/recreational catch than when compared to the commercial catch. Therefore, the analyses in Section 4.8.1, which found negligible impacts of alternatives on commercial fishing as a result of potential increases in the rate of MHI monk seal population growth, are likewise applicable to subsistence fishing.

As described in Section 4.8.1 for commercial fishermen, subsistence fishermen could be affected by Hawaiian monk seal interactions resulting from increased costs from damages to their catch or gear due to depredation of fishing lines or hooks by seals. Additionally, subsistence fishermen who fish from boats could bear additional costs resulting from idle time or additional fuel costs incurred from efforts to avoid interactions with seals. Thus, alternatives that may change the frequency of monk seal interactions could affect subsistence fishing.

Table 4.8-4. Recreational fishery landings reported in the Hawaii Marine Recreational Fishing Survey from 2003 to 2011 (from Sprague et al. 2013). All are landings from shore or from <3 miles from shore reported in pounds (lb). Families marked as "excluded" were not included in the analysis of biomass consumption.

Family	Common Name	2003	2004	2005	2006	2007	2008	2009	2010	2011	Annual Average (lbs)	Daily Average (lbs)	Daily Average (kg)
Abulidae	Bonefishes	8,508	259,526	60,409	214,624	38,330	97,764	88,143	40,675	29,288	93,030	255	116
Acanthuridae	Surgeonfishes	135,661	73,859	158,062	87,556	7,676	7,906	23,473	85,519	111,922	76,848	211	96
Balistidae & Monacanthidae	Triggerfishes & filefishes	0	0	0	0	0	0	0	0	0	0	0	0
Carangidae	Jacks	605,420	863,082	873,702	1,696,371	334,223	716,651	407,169	489,651	562,817	727,676	1,994	904
Chaetodontidae	Butterflyfishes	0	0	0	0	0	0	0	0	0	0	0	0
Cirrhitidae	Hawkfishes	0	2,546	11,158	3,565	1,858	0	0	1,012	0	2,238	6	3
Clupeidae	Herrings	0	0	0	0	0	0	0	0	0	0	0	0
Elopidae	Tarpon	0	0	0	4,658	0	0	0	0	0	776	2	1
Engraulidae	Anchovies	8,433	503	0	0	0	0	0	0	0	1,117	3	1
Holocentridae	Squirrelfishes & soldierfishes	15,708	0	3,519	6,376	2,480	25,058	0	14,531	2,039	7,746	21	10
Kuhliidae	Flagtails	176,581	29,778	69,080	75,246	10,615	32,304	5,551	5,390	3,219	45,307	124	56
Kyphosidae	Sea chubs	587,756	4,751	8,684	1,274	0	0	0	0	13,543	68,445	188	85

Family	Common Name	2003	2004	2005	2006	2007	2008	2009	2010	2011	Annual Average (lbs)	Daily Average (lbs)	Daily Average (kg)
Family	**Common Name**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Annual Average (lbs)**	**Daily Average (lbs)**	**Daily Average (kg)**
Labridae	Wrasses	137,096	226,437	186,500	86,192	22,002	529	0	41,469	18,402	79,847	219	99
Lutjanidae	Snappers	276,744	701,001	358,224	189,597	247,991	201,178	105,147	352,662	159,418	287,996	789	358
Mugilidae	Mullets	13,880	47,723	2,809	1,933	6,243	0	0	52,366	8,836	14,866	41	18
Mullidae	Goatfishes	250,189	360,749	75,621	189,917	134,687	70,610	32,950	77,173	14,630	134,058	367	167
Muraenidae, Ophichthidae, Ophidiidae, Congridae	Eels	0	0	0	0	0	0	0	0	0	0	0	0
Pleuronectidae	Flounders	0	0	0	0	0	0	0	0	0	0	0	0
Pomacentridae	Damselfishes	3,929	22,053	26,797	29,974	8,159	1,823	0	0	0	10,304	28	13
Scorpaenidae	Scorpionfishes	4,253	3,239	10,364	1,186	6,303	5,873	0	1,422	0	4,080	11	5
Serranidae	Sea basses	16,583	3,316	10,776	7,582	4,458	0	0	825	7,835	5,708	16	7
Sphyraenidae	Barracudas	15,130	45,349	26,599	1,894	0	9,319	4,850	2,996	2,518	12,073	33	15
Tetraodontidae	Puffers	0	0	0	0	0	0	0	0	0	0	0	0
-	Other fishes	1,232	197,979	1,225,586	94,192	7,485	5,313	11,713	35,428	45,219	180,461	494	224

Family	Common Name	2003	2004	2005	2006	2007	2008	2009	2010	2011	Annual Average (lbs)	Daily Average (lbs)	Daily Average (kg)
Subtotal		**2,257,103**	**2,841,890**	**3,107,888**	**2,692,139**	**832,511**	**1,174,328**	**678,997**	**1,201,119**	**979,687**	**1,752,576**	**4,802**	**2,178**
Family	**Common Name**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Annual Average (lbs)**	**Daily Average (lbs)**	**Daily Average (kg)**
EXCLUDED													
Coryphaenidae	Mahi mahi	757,212	274,801	310,547	416,585	313,067	240,116	223,562	85,976	117,023	304,321	834	378
Scombridae	Tunas & mackerels	4,195,789	932,788	1,071,461	656,714	458,733	558,609	774,013	880,979	481,632	1,112,302	3,047	1,382
-	Sharks	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		4,953,001	1,207,589	1,382,008	1,073,299	771,800	798,725	997,575	966,955	598,656	1,416,623	3,881	1,760
TOTAL		**7,210,104**	**4,049,479**	**4,489,896**	**3,765,438**	**1,604,311**	**1,973,053**	**1,676,572**	**2,168,074**	**1,578,343**	**3,169,199**	**8,683**	**3,938**

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In contrast to commercial fisheries, for which there is little or no evidence of monk seal interactions in the MHI, seals frequently interact with non-commercial fisheries (subsistence and recreational). Unequivocal evidence of interactions includes the numerous seal hookings on non-commercial gear in recent years as well as entanglements in gillnets (laynets) (see Section 3.3.1.7). A minimum of 15 monk seals were hooked or entangled in gillnet in 2012 in a population of approximately 200 seals. From the perspective of the monk seal population, that is a relatively high rate of interaction, especially considering that many interactions that involve hooking or entanglement are likely not observed, not reported or not confirmed. The number of interactions that do not result in hooking or entanglement may be far greater.

In contrast, there are a relatively high number of subsistence fishermen compared to the MHI monk seal population of approximately 200 seals, so that the likelihood of any one fishermen experiencing interactions with seals is probably quite low. However, at meetings and through the public comment process, fishermen have reported that they believe monk seal interactions are becoming more frequent. This is not unexpected given that the MHI monk seal population is increasing naturally. Unfortunately, there are currently no data to indicate the frequency, nature, cost or outcome of monk seal interactions with subsistence fishing in the MHI. It is important to recognize that the current level of interactions or impact of monk seals is considered the baseline state, and the analysis below focuses specifically on the impact of the alternatives, rather than on the overall potential impact of monk seals on subsistence fishing. The MHI monk seal population is growing naturally, irrespective of any PEIS alternative. The crux of the analysis is whether the alternatives will be likely to increase or decrease any impacts on subsistence fishing beyond those that will occur regardless of the alternatives.

4.8.2.1 DIRECT AND INDIRECT EFFECTS ON SUBSISTENCE FISHING OF ALTERNATIVE 1 – STATUS QUO

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a description of permitted research under Alternative 1, please refer to Section 2.7.

Alternative 1 is not anticipated to have any direct effects on subsistence fishing in the MHI. Indirect effects of Alternative 1 on subsistence fishing could be possible if there were marked changes in the availability of species fished for subsistence and, consequently, the quantity of subsistence catch, due to increased Hawaiian monk seal population resulting from Alternative 1. Furthermore, subsistence fishing could be affected by Hawaiian monk seal interactions that could increase costs from damages to catch and gear. Additionally, fishermen could bear

additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 1 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the near-shore MHI, and
- Only a portion (39%) of that consumption potentially overlaps with fish families fished for subsistence, and
- Apex predatory fish likely consume over 50 times more prey than the entire monk seal population

Also, the nearshore subsistence/recreational catch is considerably larger than the nearshore commercial catch. Therefore, any hypothetical additional fish consumption by monk seals associated with marginal increases in the monk seal population due to Alternative 1, would likely represent a smaller portion of the subsistence catch compared to the commercial catch. Given all these findings, any marginal increase in Hawaiian monk seal population due to Alternative 1 activities are anticipated to have negligible effects on subsistence fishing.

Conclusion for Direct and Indirect Effects on Subsistence Fishing from Alternative 1 (Status Quo)

None of the research and enhancement activities permitted under Alternative 1 would directly affect subsistence fishing in MHI. Therefore, direct effects are likely to be negligible. Marginal increases in the Hawaiian monk seal population growth rate in the MHI could possibly have an indirect adverse effect on subsistence fishing due to possible decreases in fish caught for subsistence purposes or increases in interactions with monk seals that damage catch or gear. However, this effect is likely to be negligible.

4.8.2.2 DIRECT AND INDIRECT EFFECTS ON SUBSISTENCE FISHING OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

The Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, changes in the monk seal population due to Alternative 2 would be unlikely. Consequently, any potential indirect effects on subsistence fishing associated with Alternative 2 are also unlikely. As discussed above, indirect effects on

subsistence fishing could stem from changes in the quantity of fish caught for subsistence purposes, leading to modifications in the amount of fish consumed. Furthermore, effects on subsistence fishing could stem from a change in the number of interactions between subsistence fishing and Hawaiian monk seals.

Alternative 2 is not anticipated to have any direct effects on subsistence fishing in the MHI. Because Alternative 2 is not likely to result in more than extremely marginal changes in the MHI monk seal population, indirect effects of Alternative 2 on subsistence fishing due to either additional fish consumption by seals or additional seal interactions with the fishery, are expected to be negligible.

Conclusion for Direct and Indirect Effects on Subsistence Fishing from Alternative 2 (No Action)

Alternative 2 is not anticipated to directly or indirectly affect subsistence fishing in MHI. The overall effects of Alternative 2 are expected to be negligible.

4.8.2.3 DIRECT AND INDIRECT EFFECTS ON SUBSISTENCE FISHING OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities. Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP) (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal increases in the MHI monk seal population if seals with undesirable behaviors are able to remain in the wild. This would be expected to involve only very few seals. Importantly, behavioral modification is in part intended to reduce habitual seal interactions with fishing operations. If this effort succeeds, then Alternative 3 may *reduce* potential effects on fishing by minimizing interactions. Alternative 3 is not anticipated to have any direct effects on subsistence fishing in the MHI.

Indirect effects of Alternative 3 on subsistence fishing could be possible if there were marked changes in the availability of species fished for subsistence and, consequently, the quantity of subsistence catch, due to increased Hawaiian monk seal population. Furthermore, subsistence fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 3 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the nearshore MHI, and
- Only a portion (39%) of that consumption potentially overlaps with species fished for subsistence, and
- Apex predatory fish likely consume over 50 times more prey than the entire monk seal population

Also, the nearshore subsistence/recreational catch is considerably larger than the nearshore commercial catch. Therefore, any hypothetical additional fish consumption by monk seals associated with marginal increases in the monk seal population due to Alternative 3, would likely represent a smaller portion of the subsistence catch compared to the commercial catch. Finally, while Alternative 3 activities may marginally increase the Hawaiian monk seal population, behavioral modification activities may succeed in reducing seal interactions with fisheries. Given all these findings, any marginal increase in Hawaiian monk seal population due to Alternative 3 activities are anticipated to have negligible effects on subsistence fishing.

Conclusion for Direct and Indirect Effects on Subsistence Fishing from Alternative 3 (Preferred Alternative)

None of the research and enhancement activities permitted under Alternative 3 would directly affect subsistence fishing in the MHI. Therefore, direct effects are likely to be negligible. A marginal increase in the Hawaiian monk seal population growth rate in the MHI due to Alternative 3 is not likely to result in an indirect adverse effect on subsistence fishing, especially coupled with actions designed to reduce fishery interactions. Therefore, this effect would likely be negligible.

4.8.2.4 DIRECT AND INDIRECT EFFECTS ON SUBSISTENCE FISHING OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that the benefit of Alternative 4 would primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth that is naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further,

should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 2 or 3 years of age. Alternative 4 is not anticipated to result in any direct effects on subsistence fishing in the MHI.

Indirect effects of Alternative 4 on subsistence fishing could be possible if there were marked changes in the availability of species fished for subsistence and, consequently, the quantity of subsistence catch, due to increased Hawaiian monk seal population. Furthermore, subsistence fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

Under this alternative, a maximum of 20 weaned pups per year could be translocated to the MHI from NWHI for the five-year permit period. Each group of monk seals would be returned to the NWHI once they reached 2 or 3 years of age. The maximum number of additional seals that would be present in a single year is 60 seals if it is assumed that:

- the maximum allowed number of juvenile monk seals per year (20) are translocated for at least 3 consecutive years;
- all of these are translocated from the NWHI to the MHI and not vice versa; and
- there is no mortality of translocated seals for three years;

While it is important to consider this scenario in order to understand what might happen if all of these seals survived, that would be very unlikely. A more realistic estimate of the maximum number of translocated monk seals in the MHI is derived by applying the survival rates of native-born MHI monk seals to translocated seals. Retaining the first two assumptions in the preceding bullets, this results in a projected maximum number of 51 additional seals. Again, while this analysis acknowledges that an additional 60 seals in these years would be unlikely, it uses this number (60) in order to present the worst-case scenario for the purposes of evaluating potential effects on commercial fish in the MHI under Alternative 4.

Based upon the liberal consumption rates in Sprague et al. (2013) juvenile monk seals eat approximately 5 kg (11 lb) of prey per day. Therefore, the additional 60 juvenile monk seals that could potentially occur temporarily in the MHI under Alternative 4 would consume at most 60 x 5 = 300 kg (662 lb) of prey per day. This represents at most 0.0018% of the estimated standing biomass of reef fish in the nearshore habitats of the MHI. Furthermore, apex predatory fish are estimated to consume at least 220 times as much as would these 60 potential juvenile monk seals. Interactions between the translocated seals and subsistence fishing could increase under Alternative 4, although as noted above, data are

lacking to quantify the current level of interaction. Likewise, it is not possible to reliably predict how much those interactions might increase due to the potential temporary addition of 60 juvenile seals to the population. It is reasonable to expect that some of those additional seals would interact with fisheries, though the associated cost of those interactions to the fishermen is not known. However, as under Alternative 3, behavioral modification activities under Alternative 4, if successful, could mitigate fishery interactions with both translocated and seals native to the MHI. Given the exceedingly small potential increase in prey consumption, only part of which would potentially overlap with species fished for subsistence, and the potential increase in fishery interactions (though mitigated by behavioral modification), overall Alternative 4 activities are anticipated to have negligible effects on subsistence fishing.

Conclusion for Direct and Indirect Effects on Subsistence Fishing from Alternative 4 (Enhanced Implementation)

None of the research and enhancement activities permitted under Alternative 4 would directly affect subsistence fishing in the MHI. Therefore, direct effects are likely to be negligible. A temporary increase in the MHI monk seal population due to Alternative 4 is not likely to result in an indirect adverse effect on subsistence fishing. Therefore, this effect would likely be negligible.

4.8.2.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON SUBSISTENCE FISHING

This section presents the cumulative effects on subsistence fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects on Subsistence Fishing

The alternatives are not anticipated to result in any direct effects on subsistence fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. Indirect effects on subsistence fishing would be negligible because measurable changes in the fish caught by subsistence fishers are not likely. Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are popular among the subsistence fishers however, some fish species may actually increase in abundance if Hawaiian monk seals consume predators of those species. Likewise, changes in the rate of costly interactions with Hawaiian monk seals are expected to be negligible given the marginal increase in the population of MHI monk seals, and implementation of behavioral modification techniques.

Direct and indirect effects of monk seal research and enhancement activities on subsistence fisheries are evaluated in terms of potential increases or decreases in subsistence catch. Table 4.8-5 summarizes the direct and indirect effects of the alternatives on subsistence fisheries.

Table 4.8-5 Summary of Direct and Indirect Effects of the Alternatives on Subsistence Fishing

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Subsistence Fisheries	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Subsistence Fishing

Past, present and reasonably foreseeable future actions that may affect subsistence fisheries catch are summarized in Table 4.8-6.

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Table 4.8-6 Effects of Past, Present and Reasonably Foreseeable Future Actions on Subsistence Fishing

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris	• Changes to fish habitat • Injury or mortality to fish • Changes in prey due to ecosystem shift • Changes in fish age class recruitment	• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris by fish and affects habitat suitability.	-
Climate Change		• Subtropical Pacific ecosystem changes evident although modest relative to changes from increased fishing effort. However, future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011). • Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish populations are affected by these changes and can be both beneficial and adverse.	+/-
Introduction of Invasive species		• Parasites have been shown to be significant stressors in many species. Reif et al. (2006). • Invasive fish species introduced through ballast water may cause changes in fish population dynamics.	-
Predation by apex predatory fish nearshore (30m depth)	• Mortality of fish	• Apex predatory fish consume a minimum of 66,000 kg/day (146,000 lb/day) approximately 50 times more than a Hawaiian monk seal (Sprague et al. 2013).	-/+
Predation by Hawaiian monk seals nearshore (30m depth)	• Mortality of fish	• Estimated predation by 200 monk seals in MHI is approximately 1,300 kg per day (2,900 lb per day) (Sprague et al. 2013)	-/+
Military activities			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Mortality of fish • Fish habitat destruction • Temporary or permanent area restrictions to fishing during training	• Possible yet unlikely temporary threshold shift (TTS) impact to fish sensory systems due to sonar and explosive detonations. • Potential strike or contamination by torpedo and ship training activities. • Possible entanglement of fish in parachute assemblies, remote. • Detonation and explosive ordinance impacts to fish (*i.e.*, mortality). • Detonation impacts of buoys and RIMPAC and USWEX to fish. • Impacts to fish to include TTS injury and mortality. • Degradation or destruction of feeding habitat by underwater detonations and training activities. • Possible, however unlikely, TTS impact to fish due to sonar and explosive detonations. • Potential strike or mortality by training activities. • Potential closure or fisheries restrictions in areas where training activities occur.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS)			
Commercial			
Unregulated fishing (1913 - 2002)	• Mortality of fish • Reproductive effects on fish	• Unregulated take, reducing long term sustainability of populations for future fisheries. • Long-term catch trends suggest that there has been approximately an 80 percent decline in the nearshore stocks this century. Overfishing is partially due to an increase in population, improved fishing technology, improved gear, and failure to recognize or follow traditional conservation practices. Additionally, the number of commercial permits issued to collect reef fish increased by 39 percent between 1995 and 1998 (NOAA 2013).	-
Sea cucumber harvest (1882)			
Black-lipped oyster harvest (1928-1930)			
Lobster harvest (1970-1999)			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Commercial bottomfish fisheries	• Changes in fisheries catch/landings • Overharvest • Fish mortality or injury	• 1948 – 1978: number of trips per year per fishermen increased and has remained about 8 trips per year between 1980 and 2004. Data suggest there are more fishermen catching fewer fish. • Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006).	-
Commercial pelagic fisheries		• 1996-2006: Increased fishing effort with number of hooks set increasing four-fold. Catch rates for apex predators such as blue shark, bigeye and albacore tunas, shortbill spearfish, and striped marlin declined from 3 to 9% per year while catch rates for mahimahi, sickle pomfret, escolar, and snake mackerel, increased by 6 to 18% per year (Polovina 2009). • 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). Decreased catch rates for large fishes has continued through at least 2011 (Polovina 2011). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013).	-/+
Recreational and subsistence fisheries		• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • Limited data on subsistence harvest of fish species in Hawaii make estimating harvest levels difficult. • 2013: daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) • Widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004).	
Inter-Island Transmission Cable	• Disturbance to fishing vessels	• Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to fish may occur while laying the cable, including entanglement and mortality.	-

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Special Coral Reef Ecosystem Fishing Permit to Kampachi Farms, LLC	• Aggregation of pelagic fish	• Culture and harvest a coral reef ecosystem management unit fish species kampachi (Seriola rivoliana, marketed as Kona Kampachi[supreg]) in a floating pen moored about 5.5 nm off the west coast of the Island of Hawaii in about 6,000 ft of water. A 132m [supcaret] 3 (approximately 21 feet in diameter) brass-link mesh aquapod (CuPod) tethered to a moored, 28-ft feed vessel would be used for harvesting. • Fishermen would be able to fish around the array. The small size of the array is not expected to have a large adverse impact on catches by other fishermen in the ocean in west Hawaii.	-
Wai`anae Wastewater Treatment Plan Modification Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Water quality improvements	• Wastewater treatment plant improvements would generally be expected to reduce contaminants and biological waste streams entering the coastal ecosystem. Thus, minimizing exposure of fish species to contaminants and biological waste would result in improvements in habitat and would likely be beneficial for fish.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices also widely impact coral reef habitat. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013).	-
Other Government Activities			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Hawai`i Environmental Justice Bill: Senate Bill 2145 EO 12898: Environmental Justice	• Protection of minority interests in fisheries	• To the extent that minority populations rely on fisheries (commercial, subsistence or recreational) for income or for food, protection of minorities from projects that may cause disproportionate impacts would result in benefits to these groups.	+
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	• Closed fishery	• 2006: regulations prohibited commercial fishing, except for the bottomfish fishery (and associated pelagic species catch), which had potential to continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). • 2009 remaining permit holders surrendered permits to NMFS in exchange for compensation from Federal Government and fishery was closed. Total NWHI bottomfish catch in 2009 was 29 metric tons.	-
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Habitat protection for fish • Redistribution of fishing activities to other areas	• No new fishing regulations would result from designating potential time-area closures for human activities such as wildlife viewing, swimming, boating, or fishing. Fishing activities may move to other areas where no time-area closures are in effect though overall this is not expected to reduce fish catch. • Fish populations may benefit from spinner dolphin protection measures due to potential time-area closures in bays around the MHI; potential additional protection of habitat; added recruitment could benefit fisheries.	+
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Reduction in marine debris	• Reduction in marine debris could reduce mortality or entanglement of fish. • Marine debris affects fish via ingestion (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). • Potential reduction in debris entanglement in commercial fishery nets.	+
Removal of marine debris from high entanglement zones	• Mortality • Injury		
Hawaiian Monk Seal Critical Habitat Designation	• Habitat protection	• No new fishing regulations would result from designating Hawaiian monk seal critical habitat. • Fish populations may benefit from Monk Seal Habitat designation due to the additional protection of habitat; added recruitment will benefit fisheries.	+

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Fishery Ecosystem Plan for the Hawai`i Archipelago	• Mortality • Prey availability	• Fishery plan may promote more stable prey resources. • Researchers may enhance habitat for fish when they remove marine debris during field activities. Marine debris affects fish via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on fish.	+ / -
Measures to End Bottomfish Overfishing in the Hawaiian Archipelago	• Indirect mortality • Prey availability	• Fishery plan may promote more stable prey resources.	+
Bottomfish and Seamount Groundfish Fisheries Management Plan (2005)	• Indirect mortality • Prey availability	• Fishery plan promotes more sustainable management of stocks and promotes stable prey resources.	+
Pilot Aquaculture Project (Tuna cultivation)	• Mortality • Disease • Genetic effects • Pollution	• Potential reduction in pressure on wild fish populations. • Escapement could impact native populations through disease and dilution of locally adaptive gene complexes, disrupt natural ecosystems and jeopardize recovery of depleted or endangered species. • Aquaculture facility can carry excessive nutrients, particulates, bacteria, other diseased organisms and polluting chemicals	+/-

Cumulative Effects Conclusion for Subsistence Fishing

The direct and indirect effects on subsistence fisheries associated with the Hawaiian monk seal research and enhancement alternatives are negligible because proposed activities would not result in changes to recreational fishing catch. Therefore, the contribution of monk seal research and enhancement to an overall cumulative effect from any of the alternatives is considered negligible.

Documented historical overfishing in the NWHI and MHI has adversely affected fish populations around Hawaii as shown in Table 4.8-7. The effects of ongoing subsistence and recreational fishing are not well understood due to lack of licensing requirements and reporting of catch. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries which would be expected to have beneficial effects on fish populations.

Subsistence fishing in Hawai`i is not regulated therefore, it is difficult to determine the level of catch for these fisheries though Sprague et al (2013) reported that near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013). In addition, Friedlander et al. 2004 stated that it is widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear . Fisheries regulations, such as plans to end bottomfish overfishing in the Hawai`i Archipelago, could indirectly affect recreational fishing, as commercial bottomfish fishermen will seek alternatives to supplement their incomes. This could result in changes in the populations of other fish species, including those popular for recreational fishing. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai`i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the no action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of implementation measures under these plans include, among others, ecosystem

boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc.

Effects of development, pollution, and human modifications of the coastal environment have all had adverse effects on fish populations and, thus, fisheries due to changes in overall fish habitat conditions. The local and global economic recession in recent years resulted in a reduction of fish exports by commercial fishermen, leading to reduced commercial catch. Consequently, there was possibly more fish available for recreational purposes. Another effect of the global recession on recreational fishing was decrease in tourism, leading to lesser non-local recreational fishermen in the MHI and possibly consequently more fish available for local subsistence fishermen, as well as for recreational and commercial fishing. However, as the economy is beginning to recover, commercial catch is trending upwards and more tourists are visiting the MHI, which may increase recreational and subsistence fishing pressure.

There are other ongoing federal government management actions to protect and enhance monk seal populations and other protected species such as spinner dolphins in the nearshore environment around Hawai'i. Designation of Hawaiian monk seal habitat is not anticipated to result in changes to fishing regulations. Protection of monk seal habitat may result in benefits to nearshore fish species through improved overall habitat protection. While it is difficult to determine these effects definitively at this time, improvements in habitat could result in better recruitment and increases in fish populations. Whether this would be of benefit to subsistence fisheries cannot be determined at this time. Similar benefits could result from spinner dolphin protection measures such as time-area closures. Time-area closures however could result in limiting access to specific areas in bays around Hawaii. However, these potential spinner dolphin measures would not preclude fishermen from fishing in other areas where there were no closures thus the potential adverse effects of closures would likely be minimal.

Actions listed in Table 4.8-6 provide some overall perspective on actions and events that have had or could have effects (direct, indirect or cumulative) on subsistence fisheries. While the net effects on subsistence fishing from past and future actions are not known, Hawaiian monk seal research and enhancement actions are not likely to result in anything but negligible direct, indirect or cumulative effects on fisheries.

4.8.3 RECREATIONAL FISHING

The potential direct, indirect and cumulative effects of the alternatives on recreational fishing are analyzed in this section. The analysis focuses on the nearshore areas surrounding the MHI. Sprague et al. (2013, see also Section 3.4.5 Recreational Fishing) noted that in Hawai'i the line between recreational and subsistence fishing is blurred, and there is little collection of data to differentiate between the two. There is no saltwater fishing license for recreational or

subsistence fishing, and no requirement to report recreational catch in the State of Hawai'i. As a result, the data on recreational fishery landings are very limited, voluntarily reported and are often considered biased or incomplete, likely representing a minimum estimate of extraction.

Fishing is popular with both the residents and tourists visiting Hawai'i. A quarter of Hawai'i's population participates in some form of fishing at least once a year (U.S. Department of the Navy 2008a). Effects on recreational fishing could be expected if an action results in changing the recreational experience of locals and tourists through either affecting the quantity or type of fish caught for recreational purposes, or the enjoyment derived from the natural beauty of their surroundings and wildlife. As per Table 4.4-6 in Section 4.4.3, these effects are measured through looking at any changes in the number of recreational fishing trips.

One factor that could potentially affect recreational fishing trips is the experience recreational fishermen derive from enjoying their surroundings. Alternatives that can potentially enhance that experience, such as those resulting in additional Hawaiian monk seals to view in the area, would have a positive effect on recreational fishing trips. It is acknowledged that some fishers may not derive a positive experience from viewing more seals. However, given the temporary and marginal change in the Hawaiian monk seal population in the MHI attributable to any of the alternatives, this effect on recreational fishing trips is considered negligible. Another factor considered here is whether there would be any change in the number of recreational fishing trips or a change in the amount of fish caught due to less fish being available. This is examined in more detail below.

The alternatives are not anticipated to result in any direct effects on recreational fishing. Indirect effects on recreational fishing, such as changes in the number of fishing trips or the quantity of fish caught for recreational purposes, are not likely under any of the alternatives. Hawaiian monk seals are not expected to reduce the population of certain fish species that are popular with recreational fishermen.

As described in Section 4.8.1 for commercial fishermen, recreational fishermen could be affected by Hawaiian monk seal interactions resulting from increased costs from damages to their catch or gear due to depredation of fishing lines or hooks by seals. Additionally, recreational fishermen who fish from boats could bear additional costs resulting from idle time or additional fuel costs incurred from efforts to avoid interactions with seals. Thus, alternatives that may change the frequency of monk seal interactions could affect recreational fishing.

It is widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander *et al.* 2004). Consistent with this, Sprague et al. (2013) obtained recreational (and subsistence, because there is no formal distinction between these in the available data) landings summaries from

the Hawaii Marine Recreational Fishing Survey from 2003 to 2011. They considered only landings from shore or from within 3 miles of shore (in order to exclude pelagic fishes) and excluding pelagic species and sharks caught within 3 mi of shore, thereby excluding 90% of the reported catch. Whereas daily commercial nearshore catch was estimated to be 1676 kg, the recreational and subsistence catch was estimated to be 2178 kg (Table 4.8-2). Sprague et al. (2013) note that commercial fishery landings data come from mandatory reports of daily fishing activity, while subsistence/recreational fishery landings data are from voluntary surveys. Both may significantly underreport the actual catch, but there is likely greater accuracy in the commercial data. In particular, reported near-shore recreational landings from spear-fishing and shoreline fishing may not be as well-represented as boat-based landings. Only 39% of reported recreational/subsistence fishery landings (by weight, excluding pelagic species) were from fish families also found in monk seal diet. Or conversely, 61% of nearshore landings are from fish families not eaten by monk seals and therefore not likely to be impacted by any increase in monk seal consumption. Sprague et al. (2013) note that with better information on the actual (versus reported) fishery catch, this estimate over monk seal dietary overlap with fisheries could be refined in the future.

The uncertainty in data on recreational fishery landings makes it more difficult to assess the potential impacts of the alternatives. However, even the likely underestimated amount of fish (2178 kg per day) extracted by nearshore recreational/subsistence fishing is considerably higher than the relatively reliable estimate (1676 kg) extracted by commercial fisheries. It is clear, then, that the amount of fish eaten by Hawaiian monks seals is relatively smaller when compared to the recreational/subsistence catch than when compared to the commercial catch. Therefore, the analyses in Section 4.8.1, which found negligible impacts of alternatives on commercial fishing as a result of potential increases in the rate of MHI monk seal population growth, are likewise applicable to recreational fishing.

In contrast to commercial fisheries, for which there is little or no evidence of monk seal interactions in the MHI, seals frequently interact with non-commercial (including recreational) fisheries. Unequivocal evidence of interactions includes the numerous seal hookings on non-commercial gear in recent years as well as entanglements in gillnets (laynets) (see Section 3.3.1.7). A minimum of 15 monk seals were hooked or entangled in gillnet in 2012 in a population of only approximately 200 seals. From the perspective of the monk seal population, that is a relatively high rate of interaction, especially considering that many interactions that involve hooking or entanglement are likely not observed, not reported or not confirmed. The number of interactions that do not result in hooking or entanglement may be far greater.

In contrast, there are a relatively high number of recreational fishermen compared to a maximum MHI monk seal population of approximately 200 seals,

so that the likelihood of any one fishermen experiencing interactions with seals is probably quite low. However, at meetings and through the public comment process, fishermen have reported that they believe monk seal interactions are becoming more frequent. This is not unexpected given that the MHI monk seal population is increasing naturally. Unfortunately, there are currently no data to indicate the frequency, nature, cost or outcome of monk seal interactions with recreational fishing in the MHI. It is important to recognize that the analysis below focuses specifically on the impact of the alternatives, rather than on the overall potential impact of monk seals on recreational fishing. The MHI monk seal population is growing naturally, irrespective of any PEIS alternative. The crux of the analysis is whether the alternatives will be likely to increase or decrease any effects on recreational fishing beyond those that will occur regardless of the alternatives.

4.8.3.1 DIRECT AND INDIRECT EFFECTS ON RECREATIONAL FISHING OF ALTERNATIVE 1 – STATUS QUO

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a description of permitted research under Alternative 1, please refer to Section 2.7.

Alternative 1 is not anticipated to have any direct effects on recreational fishing in the MHI. Indirect effects of Alternative 1 on recreational fishing could be possible if there were marked changes in the availability of species fished for recreational and, consequently, the quantity of recreational catch, due to increased Hawaiian monk seal population resulting from Alternative 1. Furthermore, recreational fishing could be affected by Hawaiian monk seal interactions that could increase costs from damages to catch and gear. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 1 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the nearshore MHI, and
- Only a portion (39%) of that consumption potentially overlaps with fish families fished for recreation, and
- Apex predatory fish likely consume over 50 times more prey than the entire monk seal population

Also, the nearshore recreational/subsistence catch is considerably larger than the nearshore commercial catch. Therefore, any hypothetical additional fish consumption by monk seals associated with marginal increases in the monk seal

population due to Alternative 1, would likely represent a smaller portion of the recreational catch compared to the commercial catch. Given all these findings, any marginal increase in Hawaiian monk seal population due to Alternative 1 activities are anticipated to have negligible effects on recreational fishing.

Conclusion for Direct and Indirect Effects on Recreational Fishing from Alternative 1 (Status Quo)

None of the research and enhancement activities permitted under Alternative 1 would directly affect recreational fishing in MHI. Therefore, direct effects are likely to be negligible. Marginal increases in the Hawaiian monk seal population growth rate in the MHI could possibly have an indirect adverse effect on recreational fishing due to possible decreases in fish caught for recreational purposes or increases in interactions with monk seals that damage catch or gear. However, this effect is likely to be negligible.

4.8.3.2 DIRECT AND INDIRECT EFFECTS ON RECREATIONAL FISHING OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

The Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, changes in the monk seal population due to Alternative 2 would be unlikely. Consequently, any potential indirect effects on recreational fishing associated with Alternative 2 are also unlikely. As discussed above, indirect effects on recreational fishing could stem from changes in the quantity of fish caught for recreational purposes, leading to modifications in the amount of fish consumed. Furthermore, effects on recreational fishing could stem from a change in the number of interactions between recreational fishing and Hawaiian monk seals.

Alternative 2 is not anticipated to have any direct effects on recreational fishing in the MHI. Because Alternative 2 is not likely to result in more than extremely marginal changes in the MHI monk seal population, indirect effects of Alternative 2 on recreational fishing due to either additional fish consumption by seals or additional seal interactions with the fishery, are expected to be negligible.

Conclusion for Direct and Indirect Effects on Recreational Fishing from Alternative 2 (No Action)

Alternative 2 is not anticipated to directly or indirectly affect recreational fishing in MHI. The overall effects of Alternative 2 are expected to be negligible.

4.8.3.3 *DIRECT AND INDIRECT EFFECTS ON RECREATIONAL FISHING OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities. Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP) (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal increases in the MHI monk seal population if seals with undesirable behaviors are able to remain in the wild. This would be expected to involve only very few seals. Importantly, behavioral modification is in part intended to reduce habitual seal interactions with fishing operations. If this effort succeeds, then Alternative 3 may *reduce* potential effects on fishing by minimizing interactions. Alternative 3 is not anticipated to have any direct effects on recreational fishing in the MHI.

Indirect effects of Alternative 3 on recreational fishing could be possible if there were marked changes in the availability of species fished for recreation and, consequently, the quantity of recreational catch, due to increased Hawaiian monk seal population. Furthermore, recreational fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear due to depredation. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

The Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 3 may marginally enhance this growth. Sprague et al. (2013) estimated that

- An entire population of 200 monk seals consumes a maximum of 0.009% of the estimated available prey biomass in the nearshore MHI, and
- Only a portion (39%) of that consumption potentially overlaps with fish families fished for recreation, and
- Apex predator fish likely consume over 50 times more prey than the entire monk seal population

Also, the nearshore recreational/subsistence catch is considerably larger than the nearshore commercial catch. Therefore, any hypothetical additional fish consumption by monk seals associated with marginal increases in the monk seal population due to Alternative 3, would likely represent a smaller portion of the recreational catch compared to the commercial catch. Finally, while Alternative 3 activities may marginally increase the Hawaiian monk seal population,

behavioral modification activities may succeed in reducing seal interactions with fisheries. Given all these findings, any marginal increase in Hawaiian monk seal population due to Alternative 3 activities are anticipated to have negligible effects on recreational fishing.

Conclusion for Direct and Indirect Effects on Recreational Fishing from Alterative 3 (Preferred Alternative)

None of the research and enhancement activities permitted under Alternative 3 would directly affect recreational fishing in the MHI. Therefore, direct effects are likely to be negligible. A marginal increase in the Hawaiian monk seal population growth rate in the MHI due to Alternative 3 is not likely to result in an indirect adverse effect on recreational fishing, especially coupled with actions designed to reduce fishery interactions. Therefore, this effect would likely be negligible.

4.8.3.4 DIRECT AND INDIRECT EFFECTS ON RECREATIONAL FISHING OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that the benefit of Alternative 4 would primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth that is naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 2 or 3 years of age. Alternative 4 is not anticipated to result in any direct effects on recreational fishing in the MHI.

Indirect effects of Alternative 4 on recreational fishing could be possible if there were marked changes in the availability of species fished for subsistence and, consequently, the quantity of recreational catch, due to increased Hawaiian monk seal population. Furthermore, recreational fishing could be affected by Hawaiian monk seal interactions that could increase their costs from damages to their catch and gear. Additionally, fishermen could bear additional costs resulting from idle time and fuel costs in an effort to avoid interaction with Hawaiian monk seals.

Under this alternative, a maximum of 20 weaned pups per year could be translocated to the MHI from NWHI for the five-year permit period. Each group of monk seals would be returned to the NWHI once they reached 2 or 3 years of age. The maximum number of additional seals that would be present in a single year is 60 seals if it is assumed that:

- the maximum allowed number of juvenile monk seals per year (20) are translocated for at least 3 consecutive years;
- all of these are translocated from the NWHI to the MHI and not vice versa; and
- there is no mortality of translocated seals for three years;

While it is important to consider this scenario in order to understand what might happen if all of these seals survived, that would be very unlikely. A more realistic estimate of the maximum number of translocated monk seals in the MHI is derived by applying the survival rates of native-born MHI monk seals to translocated seals. Retaining the first two assumptions in the preceding bullets, this results in a projected maximum number of 51 additional seals. Again, while this analysis acknowledges that an additional 60 seals in these years would be unlikely, it uses this number (60) in order to present the greatest potential impact scenario for the purposes of evaluating potential effects on commercial fish in the MHI under Alternative 4.

Based upon the liberal consumption rates in Sprague et al. (2013) juvenile monk seals eat approximately 5 kg (11 lb) of prey per day. Therefore, the additional 60 juvenile monk seals that could potentially occur temporarily in the MHI under Alternative 4 would consume at most 60 x 5 = 300 kg (662 lb) of prey per day. This represents at most 0.0018% of the estimated standing biomass of reef fish in the nearshore habitats of the MHI. Furthermore, apex predatory fish are estimated to consume at least 220 times as much as would these 60 potential juvenile monk seals. Interactions between the translocated seals and recreational fishing could increase under Alternative 4, although as noted above, data are lacking to quantify the current level of interaction. Likewise, it is not possible to reliably predict how much those interactions might increase due to the potential temporary addition of 60 juvenile seals to the population. It is reasonable to expect that some of those additional seals would interact with fisheries, though the associated cost of those interactions to the fishermen is not known. However, as under Alternative 3, behavioral modification activities under Alternative 4, if successful, could mitigate fishery interactions with both translocated and seals native to the MHI. Given the exceedingly small potential increase in prey consumption, only part of which would potentially overlap with species fished for subsistence, and the potential increase in fishery interactions (though mitigated by behavioral modification), overall Alternative 4 activities are anticipated to have negligible effects on recreational fishing.

Conclusion for Direct and Indirect Effects on Recreational Fishing from Alterative 4 (Enhanced Implementation)

None of the research and enhancement activities permitted under Alternative 4 would directly affect recreational fishing in the MHI. Therefore, direct effects are likely to be negligible. A temporary increase in the MHI monk seal population due to Alternative 4, combined with implementation of a behavioral modification program, is not likely to result in an indirect adverse effect on recreational fishing. Therefore, this effect would likely be negligible.

4.8.3.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON RECREATIONAL FISHING

This section presents the cumulative effects on recreational fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects on Recreational Fishing

The alternatives are not anticipated to result in any direct effects on recreational fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. Indirect effects on recreational fishing, such as a change in the number of fish caught for recreation or a reduction in the population of certain recreational fish species, are not expected to result due to Alternative 4 actions. Likewise, potential increases in fishing cost (*i.e.*, fuel and fishing time expended) due to interactions with Hawaiian monk seals are expected to be negligible given the marginal increase in the population of MHI monk seals expected to result from Alternative 4, and implementation of behavioral modification tools..

Direct and indirect effects of monk seal research and enhancement activities on recreational fisheries are evaluated in terms of potential increases or decreases in recreational catch. Table 4.8-7 summarizes the direct and indirect effects of the alternatives on recreational fisheries.

Table 4.8-7 Summary of Direct and Indirect Effects of the Alternatives on Recreational Fishing

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Recreational Fisheries	Negligible	Negligible	Negligible	Negligible

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Recreational Fishing

Past, present and reasonably foreseeable future actions that may affect recreational fisheries catch are summarized in Table 4.8-8.

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Table 4.8-8 Effects of Past, Present and Reasonably Foreseeable Future Actions on Recreational Fishing

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris		• 2011 Japanese Tohoku earthquake and tsunami debris • Debris increases likelihood of ingestion of debris by fish and affects habitat suitability.	-
Climate Change	• Changes to fish habitat • Injury or mortality to fish • Changes in prey due to ecosystem shift • Changes in fish age class recruitment	• Subtropical Pacific ecosystem changes evident although modest relative to changes from increased fishing effort. However, future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011). • Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish populations are affected by these changes and can be both beneficial and adverse.	+/-
Introduction of Invasive species		• Parasites have been shown to be significant stressors in many species. Reif et al. (2006). • Invasive fish species introduced through ballast water may cause changes in fish population dynamics.	-
Predation by apex predatory fish nearshore (30m depth)	• Mortality of fish	• Apex predatory fish consume a minimum of 66,000 kg/day (146,000 lb/day) approximately 50 times more than a Hawaiian monk seal (Sprague et al. 2013).	-/+
Predation by Hawaiian monk seals nearshore (30m depth)	• Mortality of fish	• Estimated predation by 200 monk seals in MHI is approximately 1,300 kg per day (2,900 lb per day) (Sprague et al. 2013)	-/+
Military activities			

Action / Event	Potential Effects	Description/Example	Effect
U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Mortality of fish • Fish habitat destruction • Temporary or permanent area restrictions to fishing during training	• Possible yet unlikely temporary threshold shift (TTS) impact to fish sensory systems due to sonar and explosive detonations. • Potential strike or contamination by torpedo and ship training activities. • Possible entanglement of fish in parachute assemblies, remote. • Detonation and explosive ordinance impacts to fish (*i.e.*, mortality). • Detonation impacts of buoys and RIMPAC and USWEX to fish. • Impacts to fish to include TTS injury and mortality. • Degradation or destruction of feeding habitat by underwater detonations and training activities. • Possible, however unlikely, TTS impact to fish due to sonar and explosive detonations. • Potential strike or mortality by training activities. • Potential closure or fisheries restrictions in areas where training activities occur.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS)			
Commercial			
Unregulated fishing (1913 - 2002)	• Mortality of fish • Reproductive effects on fish	• Unregulated take, reducing long term sustainability of populations for future fisheries. • Long-term catch trends suggest that there has been approximately an 80 percent decline in the nearshore stocks this century. Overfishing is partially due to an increase in population, improved fishing technology, improved gear, and failure to recognize or follow traditional conservation practices. Additionally, the number of commercial permits issued to collect reef fish increased by 39 percent between 1995 and 1998 (NOAA 2013).	-
Sea cucumber harvest (1882)			
Black-lipped oyster harvest (1928-1930)			
Lobster harvest (1970-1999)			

Action / Event	Potential Effects	Description/Example	Effect
Commercial bottomfish fisheries	• Changes in fisheries catch/landings • Overharvest • Fish mortality or injury	• 1948 – 1978: number of trips per year per fishermen increased and has remained about 8 trips per year between 1980 and 2004. Data suggest there are more fishermen catching fewer fish. • Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006).	-
Commercial pelagic fisheries		• 1996-2006: Increased fishing effort with number of hooks set increasing four-fold. Catch rates for apex predators such as blue shark, bigeye and albacore tunas, shortbill spearfish, and striped marlin declined from 3 to 9% per year while catch rates for mahimahi, sickle pomfret, escolar, and snake mackerel, increased by 6 to 18% per year (Polovina 2009). • 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). Decreased catch rates for large fishes has continued through at least 2011 (Polovina 2011). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013).	-/+
Recreational and subsistence fisheries		• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • Limited data on subsistence harvest of fish species in Hawaii make estimating harvest levels difficult. • 2013: daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) • Widely believed that nearshore recreational and subsistence catch is equal to or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004).	
Inter-Island Transmission Cable	• Disturbance to fishing vessels	• Impacts of cable installation are brief and minimal. Laying cable does cause some disturbance of the ocean floor, but within days the area returns to normal. • Impacts to fish may occur while laying the cable, including entanglement and mortality.	-
Special Coral Reef Ecosystem Fishing Permit to Kampachi	• Aggregation of pelagic fish	• Culture and harvest a coral reef ecosystem management unit fish species kampachi (Seriola rivoliana, marketed as Kona Kampachi[supreg]) in a floating pen moored about 5.5 nm off the west coast of the Island of Hawaii in	-

Action / Event	Potential Effects	Description/Example	Effect
Farms, LLC		about 6,000 ft of water. A 132m [supcaret] 3 (approximately 21 feet in diameter) brass-link mesh aquapod (CuPod) tethered to a moored, 28-ft feed vessel would be used for harvesting. • Fishermen would be able to fish around the array. The small size of the array is not expected to have a large adverse impact on catches by other fishermen in the ocean in west Hawaii.	
Wai`anae Wastewater Treatment Plan Modification Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Water quality improvements	• Wastewater treatment plant improvements would generally be expected to reduce contaminants and biological waste streams entering the coastal ecosystem. Thus, minimizing exposure of fish species to contaminants and biological waste would result in improvements in habitat and would likely be beneficial for fish.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices also widely impact coral reef habitat. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013).	-
Other Government Activities			
Hawai'i Environmental Justice Bill: Senate Bill 2145 EO 12898: Environmental Justice	• Protection of minority interests in fisheries	• To the extent that minority populations rely on fisheries (commercial, subsistence or recreational) for income or for food, protection of minorities from projects that may cause disproportionate impacts would result in benefits to these groups.	+

Action / Event	Potential Effects	Description/Example	Effect
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	• Closed fishery	• 2006: regulations prohibited commercial fishing, except for the bottomfish fishery (and associated pelagic species catch), which had potential to continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). • 2009 remaining permit holders surrendered permits to NMFS in exchange for compensation from Federal Government and fishery was closed. Total NWHI bottomfish catch in 2009 was 29 metric tons.	-
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Habitat protection for fish • Redistribution of fishing activities to other areas	• No new fishing regulations would result from designating potential time-area closures for human activities such as wildlife viewing, swimming, boating, or fishing. Fishing activities may move to other areas where no time-area closures are in effect though overall this is not expected to reduce fish catch. • Fish populations may benefit from spinner dolphin protection measures due to potential time-area closures in bays around the MHI; potential additional protection of habitat; added recruitment could benefit fisheries.	+
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	• Reduction in marine debris	• Reduction in marine debris could reduce mortality or entanglement of fish. • Marine debris affects fish via ingestion (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). • Potential reduction in debris entanglement in commercial fishery nets.	+
Removal of marine debris from high entanglement zones	• Mortality • Injury		
Hawaiian Monk Seal Critical Habitat Designation	• Habitat protection	• No new fishing regulations would result from designating Hawaiian monk seal critical habitat. • Fish populations may benefit from Monk Seal Habitat designation due to the additional protection of habitat; added recruitment will benefit fisheries.	+

Action / Event	Potential Effects	Description/Example	Effect
Fishery Ecosystem Plan for the Hawai`i Archipelago	• Mortality • Prey availability	• Fishery plan may promote more stable prey resources. • Researchers may enhance habitat for fish when they remove marine debris during field activities. Marine debris affects fish via ingestion of anthropogenic materials (*e.g.*, plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on fish.	+ / -
Measures to End Bottomfish Overfishing in the Hawaiian Archipelago	• Indirect mortality • Prey availability	• Fishery plan may promote more stable prey resources.	+
Bottomfish and Seamount Groundfish Fisheries Management Plan (2005)	• Indirect mortality • Prey availability	• Fishery plan promotes more sustainable management of stocks and promotes stable prey resources.	+
Pilot Aquaculture Project (Tuna cultivation)	• Mortality • Disease • Genetic effects • Pollution	• Potential reduction in pressure on wild fish populations. • Escapement could impact native populations through disease and dilution of locally adaptive gene complexes, disrupt natural ecosystems and jeopardize recovery of depleted or endangered species. • Aquaculture facility can carry excessive nutrients, particulates, bacteria, other diseased organisms and polluting chemicals	+/-

Cumulative Effects Conclusion for Recreational Fishing

The direct and indirect effects on recreational fisheries associated with the Hawaiian monk seal research and enhancement alternatives are negligible because proposed activities would not result in changes to recreational fishing catch. Therefore, the contribution of monk seal research and enhancement to an overall cumulative effect from any of the alternatives is considered negligible.

Documented historical overfishing in the NWHI and MHI has adversely affected fish populations around Hawaii as shown in Table 4.8-9. The effects of ongoing subsistence and recreational fishing are not well understood due to lack of licensing requirements and reporting of catch. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries which would be expected to have beneficial effects on fish populations.

There is no license required for saltwater recreational fishing in Hawai`i and, therefore, it is difficult to regulate these fisheries. Fisheries regulations, such as plans to end bottomfish overfishing in the Hawai`i Archipelago, could indirectly affect recreational fishing, as commercial bottomfish fishermen will seek alternatives to supplement their incomes. This could result in changes in the populations of other fish species, including those popular for recreational fishing. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai`i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the no action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of implementation measures under these plans include, among others, ecosystem boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc.

Effects of development, pollution, and human modifications of the coastal environment have all had adverse effects on fish populations and, thus, fisheries due to changes in overall fish habitat conditions. The local and global economic recession in recent years resulted in a reduction of fish exports by commercial fishermen, leading to reduced commercial catch. Consequently, there was

possibly more fish available for recreational purposes. Another effect of the global recession on recreational fishing was decrease in tourism, leading to lesser non-local recreational fishermen in the MHI and possibly consequently more fish available for local recreational fishermen, as well as for subsistence and commercial fishing. However, as the economy is beginning to recover, commercial catch is trending upwards and more tourists are visiting the MHI, which may increase recreational fishing pressure.

There are other ongoing federal government management actions to protect and enhance monk seal populations and other protected species such as spinner dolphins in the nearshore environment around Hawaiʻi. Designation of Hawaiian monk seal habitat is not anticipated to result in changes to fishing regulations. Protection of monk seal habitat may result in benefits to nearshore fish species through improved overall habitat protection. While it is difficult to determine these effects definitively at this time, improvements in habitat could result in better recruitment and increases in fish populations. Whether this would be of benefit to recreational fisheries cannot be determined at this time. Similar benefits could result from spinner dolphin protection measures such as time-area closures. Time-area closures however could result in limiting access to specific areas in bays around Hawaii. However, these potential spinner dolphin measures would not preclude fishermen from fishing in other areas where there were no closures thus the potential adverse effects of closures would likely be minimal.

Actions listed in Table 4.8-8 provide some overall perspective on actions and events that have had or could have effects (direct, indirect or cumulative) on recreational fisheries. While the net effects on recreational fishing from past and future actions are not known, Hawaiian monk seal research and enhancement actions are not likely to result in anything but negligible direct, indirect or cumulative effects on fisheries.

4.8.4 CULTURAL RESOURCES, TRADITIONAL CULTURAL PRACTICES, AND HISTORIC PROPERTIES

CULTURAL RESOURCES AND TRADITIONAL CULTURAL PRACTICES

A range of cultural resources (other than historic properties, which are discussed in the following section) and traditional cultural practices has the potential to be impacted by monk seal recovery actions proposed under this PEIS. The potential impacts can take two forms: 1) impacts resulting directly from the conduct of the recovery actions themselves, and 2) impacts resulting from the activities of seals influenced by the recovery actions, for example, seals that are translocated or seals that are subject to behavior modification techniques.

The cultural resources that may be directly affected by activities associated with Hawaiian monk seal recovery include shoreline resources such as native strand plants that are traditionally gathered for their medicinal properties. These plants

could be accidentally trampled and damaged by NMFS staff and volunteers during observation, translocation, or other monk seal recovery related activities. Inshore resources such as fish, shellfish, and other marine organisms traditionally collected for food are much less likely to be affected, although patches of edible *limu* (seaweed) could be disturbed. Due to the temporary and transient nature of the physical activities proposed in the PEIS, it is unlikely that customary practices such as fishing, gathering, swimming, or surfing will be significantly affected by recovery activities themselves.

This section evaluates direct, indirect, and cumulative effects to cultural resources and practices that may occur as a result of the four proposed alternatives described in Section 2.6. The effects of proposed Alternatives on the cultural practice of subsistence fishing are addressed in Section 4.8.2.

4.8.4.1 DIRECT AND INDIRECT EFFECTS ON CULTURAL RESOURCES OF ALTERNATIVE 1 – STATUS QUO

Alternative 1, the Status Quo, involves the continuation of currently authorized activities past 2014. These include activities, such as monitoring and some sample collection that do not involve the capture and handling of seals, as well as activities that do involve the capture and handling of seals, such as marking, measuring, sample collection, vaccination, de-worming, disentanglement, removal, and translocation. Under this alternative, the translocation of seals only takes place within the MHI or within the NWHI. There is no translocation of seals from the NWHI to the MHI or from the MHI to the NWHI.

Activities conducted under Alternative 1 include aerial, vessel, and land-based surveys, and some handling and transportation of Hawaiian monk seals. Boats and land vehicles will be used to transport researchers and possibly animals. Researchers will traverse beach and dune areas on foot to reach monk seals. Recovery activities will be conducted throughout the project area, in the MHI, NWHI, and on Johnston Atoll. Researchers will seasonally (typically April or May through August) occupy existing campsites in the NWHI (see Section 3.3.1.9).

Direct impacts to cultural resources other than historic properties that could occur under Alternative 1 within the MHI include the disturbance, damage, or destruction of coastal plants that are used in *lāʻau lapaʻau* (traditional medicine). This could occur if researchers drive over or walk through areas where these plants grow. Training of researchers and volunteers to recognize and avoid native strand flora, as presented in Chapter 5, should serve to mitigate these potential impacts. Activities involved in the observation or translocation of monk seals, as conducted under Alternative 1 are unlikely to directly impact marine resources (fish, shellfish and other marine organisms) that are traditionally gathered for food. The only exception is the possibility that boat landings could disturb beds of *limu kohu* (*Asparagopsis sanfordiana*), *limu loloa* (*Gelindium spp.*), and other edible sea weeds that were traditionally gathered

along the shoreline. Again, this potential impact can be mitigated by training researchers and volunteers to recognize and avoid these resources.

One of the roles of the existing stakeholder and community-based programs described in Chapter 5 has been to develop and maintain a network of Hawaiian cultural practitioners and *kūpuna* (elders) to advise NMFS on cultural matters and to conduct cultural protocols during Hawaiian monk seal response and other monk seal management and recovery-related activities. This network of culturally knowledgeable individuals can assist in developing a cultural awareness training program for monk seal researchers and volunteers.

Permits are required for access to conduct Hawaiian monk seal research and enhancement activities within the limits of the Monument. Any activities associated with monk seal recovery actions undertaken within the NWHI must therefore comply with Monument regulations and the terms and conditions of Presidential Proclamation 8031. Monument regulations state that "permittees [must] attend a cultural briefing on the significance of Monument resources to Native Hawaiians" and that there are "prohibitions against the disturbance of any cultural or historic property" (NMFS 2008b). Under the terms of the Monument permit, researchers and volunteers involved in monk seal recovery actions are required to coordinate their activities with Monument staff to ensure that they do not adversely impact any of the Monument's cultural resources.

Public consultation undertaken in conjunction with this PEIS has revealed some concerns regarding the potential or perceived indirect impacts of current Hawaiian monk seal recovery activities on traditional use of marine resources within the MHI. Many subsistence fishers perceived monk seals to be direct competitors for marine resources. Others felt that the presence of a Federally recognized endangered species within shoreline areas where they normally fished would restrict their access to those areas. These concerns have been addressed in detail in Section 4.8.2 (Subsistence Fishing), where the effects of all alternatives on fishing were determined to be negligible. The public outreach and community collaboration programs outlined in Chapter 5 can assist in resolving the concerns of subsistence fishers regarding monk seal recovery actions.

In summary, Alternative 1 is expected to result in negligible to minor adverse impacts on cultural resources and practices. As defined in Table 4.4-7, minor adverse impacts entail "possible contact with cultural resources, but no effect" on cultural resources or cultural practices due to the temporary nature of contact. Any possible effect is expected to be mitigated as discussed above and in Sections 5.4 - 5.6.

4.8.4.2 DIRECT AND INDIRECT EFFECTS ON CULTURAL RESOURCES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Under Alternative 2, presently authorized activities as permitted under the existing permit (10137) will continue until 2014. Once the present permit expires,

most research and enhancement activities would cease. After 2014 there would be no field research to monitor Hawaiian monk seal populations, implement de-worming, or conduct translocation. During the execution of the current permit through 2014, the potential impacts to cultural resources and traditional practices would be the same as for Alternative 1, and the same precautions are recommended. After the current permit expires, activities would be limited to remote observation and some collection of samples from materials left by monk seals. No monk seal translocation or handling would occur. Therefore, after 2014, Alternative 2 would involve less boat and land vehicle traffic, and less shoreline activity. The likelihood that shoreline resources would be directly impacted would be greatly reduced. Cultural awareness training for researchers and volunteers involved in monk seal recovery actions would still be recommended so as to help mitigate potential direct impacts.

In summary, Alternative 2 is expected to result in negligible to at most minor adverse impacts on cultural resources and practices. As defined in Table 4.4-7, minor adverse impacts entail "possible contact with cultural resources, but no effect on" cultural resources or cultural practices due to the temporary nature of contact. Any possible adverse effect is expected to be mitigated as discussed above and in Sections 5.4 – 5.6.

4.8.4.3 DIRECT AND INDIRECT EFFECTS ON CULTURAL RESOURCES OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)

Under Alternative 3 currently authorized activities under Alternative 1 would be continued and additional activities would be conducted. These additional actions would include increased permitted takes of Hawaiian monk seals for vaccination, deworming, and other activities. Alternative 3 would also include a seal behavior modification program intended to mitigate human-monk seal interactions. This program would serve to mitigate interactions between seals and people engaged in cultural practices such as subsistence fishing and other ocean use activities.

Under Alternative 3 the permitted scope and number of translocations would be expanded. This would include the translocation of monk seals within the MHI or within the NWHI, as well as the translocation of a limited numbers of seals from the MHI to the NWHI. As a result, boat and land vehicle activity, as well as shoreline activities, could be greater under Alternative 3 than under Alternatives 1 or 2. For example, approximately twenty-five more weaned pups could be translocated annually within the MHI under Alternative 3 than under Status Quo (Alternative 1). The direct effects of this increased activity on cultural resources could be successfully mitigated through the implementation of the training program recommended under Alternative 1.

As discussed in Section 4.8.2.3, the marginal increase in the Hawaiian monk seal population growth rate in the MHI resulting from Alternative 3's survival

enhancement activities is not likely to result in an indirect adverse effect on subsistence fishing.

In summary, Alternative 3 is expected to result in negligible to at most minor adverse impacts on cultural resources and practices. As defined in Table 4.4-7, minor adverse impacts entail "possible contact with cultural resources, but no effect on" cultural resources or cultural practices due to the temporary nature of contact. Any possible effect is expected to be mitigated as discussed above and in Sections 5.4 – 5.6.

4.8.4.4 DIRECT AND INDIRECT EFFECTS ON CULTURAL RESOURCES OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Alternative 4 would encompass all of the activities permitted under Alternative 3, plus two-stage translocation of Hawaiian monk seal pups from NWHI to MHI, and then back to the NWHI when the seals reach age two or three years. This translocation program would be a phased process with a gradual increase in seal numbers. Any adverse interactions with humans occurring as a result of translocations would influence whether and at what level the program would continue. The increased capture and transport of the seals under Alternative 4 would result in increased boat and land vehicle traffic, as well as pedestrian traffic to and from capture sites. The mitigation measures recommended under Alternatives 1 and 3 and in more detail in Sections 5.4 – 5.6 should ensure that impacts to cultural resources remain negligible to minor.

Concerns were expressed during public meetings held in association with the PEIS that the introduction of increased numbers of monk seals to the MHI from the NWHI under alternative 4 would result in a depletion of fish stock, directly impacting the livelihood of fishers practicing traditional subsistence fishing. This potential is evaluated in detail in Section 4.8.2.4, and the temporary increase in the MHI monk seal population associated with two-stage translocation under Alternative 4 would be likely to have negligible indirect adverse effects on subsistence fishing.

In summary, Alternative 4 is expected to result in negligible to at most minor adverse impacts on cultural resources and practices. As defined in Table 4.4-7, minor adverse impacts entail "possible contact with cultural resources, but no effect on" cultural resources or cultural practices due to the temporary nature of contact. Any possible effect is expected to be mitigated as discussed above and in Sections 5.4 – 5.6.

4.8.4.5 CUMULATIVE EFFECTS ON CULTURAL RESOURCES AND TRADITIONAL CULTURAL PRACTICES

Summary of Direct and Indirect Effects on Cultural Resources

As described above, the effects of research and enhancement activities proposed under Alternatives 1, 2, 3, and 4 could result in negligible to at most minor direct

and indirect effects on cultural resources and traditional cultural practices within the affected environment. Current and proposed research and enhancement activities would occur infrequently in limited areas along the shorelines of both the MHI and the NWHI. Due to the restricted nature of the activities, the direct effects would also be limited. The recommended mitigation measures described above and in Sections 5.4 – 5.6 would serve to minimize these potential effects. Possible indirect effects to cultural resources and traditional cultural practices from Hawaiian monk seal recovery actions would primarily be associated with the possible impacts of increased monk seal presence on traditional subsistence fishing practices in the MHI. These impacts were found to be negligible in Section 4.8.2 for all alternatives, with impacts potentially additionally mitigated by the behavioral modification programs instituted under Alternatives 3 and 4. The mitigation programs are designed to reduce interactions between monk seals and people engaged in traditional cultural practices such as subsistence fishing and other ocean use activities.

Direct and indirect effects of monk seal research and enhancement activities on cultural/traditional practices and cultural and historic properties are evaluated in terms of how cultural practices might be impeded or properties might be altered. Table 4.8-9 summarizes the direct and indirect effects of the alternatives on cultural/traditional practices and cultural and historic properties.

Table 4.8-9 Summary of Direct and Indirect Effects of the Alternatives on Cultural Resources and Traditional Cultural Practices

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Cultural Resources or Traditional Cultural Practices	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor

Past, Present and Future Actions and Events Contributing to Cumulative Effects

Past, present and reasonably foreseeable future actions that may affect cultural/traditional practices and cultural and historic properties are summarized in Table 4.8-10.

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Table 4.8-10 Effects of Past, Present and Reasonably Foreseeable Future Actions on Cultural and Historic Practices and Properties

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris	• Damage to cultural resources or properties • Restricted access to traditional areas for cultural practices •	• 2011 Japanese Tohoku earthquake and tsunami debris • Storm damage to cultural flora and fauna. • Debris increases likelihood of damage to cultural flora and fauna.	-
Climate Change		• Subtropical Pacific ecosystem changes evident. Future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011). • Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish populations are affected by these changes and can be both beneficial and adverse.	+/-
Introduction of Invasive species		• Parasites have been shown to be significant stressors in many species (Reif et al. 2006). • Invasive plants may outcompete native plants used for cultural practices.	-
Predation by apex predatory fish nearshore (30m depth)	• Mortality of fish	• Apex predatory fish consume a minimum of 66,000 kg/day (146,000 lb/day) approximately 50 times more than a Hawaiian monk seal (Sprague et al. 2013). Predatory fish may consume smaller fish sought for cultural practices.	-/+
Military activities			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Acoustic or physical stressors on cultural resources and historic properties	• "Acoustic stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not affect submerged cultural resources. Training and testing would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated within the US territorial waters because measures have been previously implemented to protect these resources" (HSST EIS/OEIS 2013). • Physical stressors resulting from use of seafloor devices during training and testing could affect submerged cultural resources however measures are currently implemented to mitigate these effects" (HSST EIS/OEIS 2013). • To the extent that HSST activities could affect culturally important marine flora and fauna used in traditional practices, potential impacts to cultural resources could occur though based on available information the nature and extent of these impacts cannot be defined at this time.	-
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS)			
Commercial			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Unregulated fishing (1913 - 2002) Sea cucumber harvest (1882) Black-lipped oyster harvest (1928-1930) Lobster harvest (1970-1999)	• Mortality of fish • Reproductive effects on fish	• Unregulated take, reducing long term sustainability of marine fish populations for cultural practices. • Long-term catch trends suggest that there has been approximately an 80 percent decline in the nearshore stocks this century. Overfishing is partially due to an increase in population, improved fishing technology, improved gear, and failure to recognize or follow traditional conservation practices. Additionally, the number of commercial permits issued to collect reef fish increased by 39 percent between 1995 and 1998 (NOAA 2013).	-
Commercial bottomfish fisheries	• Competition for culturally important fish and other marine fauna	• Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006). • Overfishing may affect the availability of culturally important fish.	-
Commercial pelagic fisheries		• 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013). • To the extent that commercial fisheries compete for resources with cultural uses, the availability of fish and other marine fauna for cultural practices may be affected though the nature and extent of this impact cannot be determined best on available data. However, recreational and subsistence fisheries likely harvest more fish than commercial fisheries as described below.	-
Recreational and subsistence fisheries		• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • Limited data on subsistence harvest of fish species in Hawaii make estimating harvest levels difficult. • 2013: daily commercial nearshore catch was estimated to be 1676 kg, the near-shore recreational and subsistence catch was estimated to be 2178 kg (Sprague et al. 2013) • Widely believed that nearshore recreational and subsistence catch is equal to	-

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
		or greater than the nearshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004). • These data suggest that subsistence and recreational fishing may have a greater impact on the availability of resources for cultural practices than commercial fisheries.	
Wai`anae Wastewater Treatment Plan Modification Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Water quality improvements	• Wastewater treatment plant improvements would generally be expected to reduce contaminants and biological waste streams entering the coastal ecosystem. Thus, minimizing exposure of marine fauna to contaminants and biological waste would result in improvements in habitat and would likely be beneficial for species used in cultural practices.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices widely impact coral reef habitat where cultural resources may be found. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013). • To the extent that culturally important resources are located in areas where sediment runoff and pollution are problematic, cultural resources could be adversely affected.	-
Other Government Activities			

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Hawai`i Environmental Justice Bill: Senate Bill 2145 EO 12898: Environmental Justice	• Protection of minority interests for cultural practices	• To the extent that minority populations rely on subsistence fisheries for cultural practices, protection of minorities from projects that may cause disproportionate impacts would result in benefits to these groups.	+
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	• Closed fishery	• 2006: regulations prohibited commercial fishing, except for the bottomfish fishery (and associated pelagic species catch), which had potential to continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). • 2009 remaining permit holders surrendered permits to NMFS in exchange for compensation from Federal Government and fishery was closed. Total NWHI bottomfish catch in 2009 was 29 metric tons. • Closure of the commercial fishery may have increased the amount of fish species available for cultural use though the extent of this change is difficult to assess using currently available data.	+
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Redistribution of cultural activities to other areas • Protection of culturally significant historic properties	• Cultural practices may move to other areas where no time-area closures are in effect though overall this is not expected to have a long term negative on cultural practices. • Historic properties may benefit from spinner dolphin protection measures due to potential time-area closures in bays around the MHI; potential additional protection of habitat and better recruitment of marine fauna could benefit and therefore provide more resources for cultural use.	+
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas Removal of marine debris from high seas	• Reduction in marine debris	• Reduction in marine debris could minimize potential damage to culturally important flora and fauna. •	+
Hawaiian Monk Seal Critical Habitat Designation	• Habitat protection	• Marine fauna populations may benefit from Monk Seal Habitat designation due to the additional protection of habitat and better recruitment of marine fauna could benefit and therefore provide more resources for cultural use.	+

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Fishery Ecosystem Plan for the Hawai`i Archipelago	• Improved protection of culturally important species	• Fishery plan may promote more stable prey resources important for cultural practices.	+ / -
Measures to End Bottomfish Overfishing in the Hawaiian Archipelago		• Fishery plan may promote more stable prey resources that are important for cultural practices.	+

Cumulative Effects Conclusion for Cultural Resources

Among the primary past human activities that have affected cultural resources and traditional cultural practices within the affected environment is the extensive coastal development (residential, commercial, and governmental) that has taken place within the MHI since the 1950s. Areas of native coastal vegetation have been disturbed and shoreline access has been restricted. Overfishing from commercial, recreational and even subsistence fishing (PIFSC 2011; Moffitt et al. 2006; Polovina 2011) has also resulted in a depletion of traditional marine subsistence resources. Past military operations have resulted in coastal disturbance on Midway and some of the other NWHI. Significant storm events such as hurricanes and tsunami events have impacted traditional cultural resources both in the MHI and the NWHI due to storm damage or debris. Continued development and overfishing have the potential to further impact these resources.

The contribution of any of the Alternatives to a cumulative impact on cultural resources and traditional cultural practices is considered negligible in light of other stressors described above such as coastal development. In addition, the mitigation measures outlined above and discussed in more detail in Chapter 5 would minimize any long term effects of all Alternatives on cultural resources and traditional cultural practices.

HISTORIC PROPERTIES

As described in Section 3.4.7.3, a variety of historical properties and traditional historic properties are present within the project area for proposed Hawaiian monk seal recovery actions. These sites are most abundant within the MHI, but also occur in the NWHI. The effects to these resources from the recovery actions proposed in this PEIS may be either direct or indirect. Direct effects are those that physically alter the historic property in some way, while indirect effects diminish some significant aspect of the property, but do not physically alter it. The purpose of this section is to identify direct, indirect and cumulative effects to cultural and historical resources that may result from proposed monk seal recovery actions.

Potential direct impacts to historic and cultural resources can result from the physical activities associated with monk seal recovery actions or from the activities of monk seals relocated as part of the recovery effort. Pedestrian and vehicle traffic through remote areas in order to access seal locations and vessel traffic to access seals on remote beaches have the greatest potential to affect historic and cultural resources. Land based pedestrian and vehicle traffic has the potential to directly impact fragile stacked stone structures, subsurface archaeological deposits, and human burials. These sites may be located along the route of travel from the established road to the study or translocation area, on the beach itself, or in adjacent sand dunes. There is much less likelihood that the

activities will affect areas that may be eligible for listing as Traditional Cultural Properties. It is important, however, that NMFS staff and volunteers be aware of such areas and treat them with respect. Vessel anchoring has the potential to directly impact marine wreck sites and other underwater historic properties. Due to the short term nature of monk seal recovery activities there is much less potential for indirect effects on historic properties, such as long-term visual impacts.

During their normal haul out activities, Hawaiian monk seals seldom venture further inland than the high tide line, and therefore translocated seals are unlikely to adversely impact coastal historic and cultural sites. One possible exception is coastal fishponds. A number of traditional *loko iʻa* (fishponds), located along the coastlines of the MHI, have been returned to operation in the last few years. A translocated monk seal that managed to enter such a pond could feed on the fish being raised there, thus disrupt aquaculture operations. The physical activities involved in removing the monk seal from within the pond could possibly result in damage to the structure.

4.8.4.6 DIRECT AND INDIRECT EFFECTS ON HISTORIC PROPERTIES OF ALTERNATIVE 1 – STATUS QUO

Alternative 1, the Status Quo, involves the continuation of currently authorized activities past 2014. These include activities such as monitoring and some sample collection that do not involve the capture and handling of seals, as well as activities that do involve the capture and handling of seals (marking, measuring, sample collection, vaccination, de-worming, disentanglement, carcass removal, translocation). Under this alternative, the translocation of seals only takes place within the MHI or within the NWHI (*i.e.*, no translocation of seals from the NWHI for release in the MHI or from the MHI to the NWHI).

Activities conducted under Alternative 1 may include aerial, vessel, and land-based surveys, as well as some handling and translocation of monk seals. Boats and land vehicles will be used to transport researchers and possibly animals. Researchers will also traverse beach and dune areas on foot to reach monk seal locations. Recovery activities may be conducted throughout the APE, in the MHI, NWHI, and on Johnston Atoll. Researchers will seasonally (typically April or May through August) occupy existing camp sites in the NWHI (see Section 3.3.1.9).

Monk seal recovery actions are likely to take place in both well-traveled beach areas and in more remote locations that have not been subject to much human traffic. The remote areas are fragile and susceptible to disturbance. Archaeological sites located along the path of access to and from monk seal locations have the potential to be affected. Stacked stone structures and surface scatters of cultural material could be impacted by vehicle or pedestrian traffic, as could fragile dune areas that may contain buried cultural deposits or human remains. In order to mitigate potential impacts, researchers and volunteers

undertaking monk seal recovery activities would need to recognize and avoid these sensitive sites and areas. At times researchers will be required to set up temporary campsites near a seal (often a mother and weaning pup) to monitor and protect the seal(s). In these instances, care will need to be taken to avoid establishing campsites on or near historic or cultural sites. While vessel-based activities are less likely to impact historic sites, anchoring could result in damage to marine wreck sites.

There is also the possibility that Hawaiian monk seals may enter fishponds on their own accord and may have to be physically removed from them. The activities associated with the removal of a monk seal from the interior of a fishpond have the potential to result in damage to the fishpond walls and other structural features.

The mitigation measures outlined at the end of this section and further discussed in Chapter 5 have been designed alleviate the potential adverse effects of the activities described above on historic and cultural resources. If these recommended measures are followed, research and enhancement activities authorized under Alternative 1 would not result in any direct impacts to archaeological and cultural sites.

In summary, Alternative 1 is expected to result in negligible to at most minor adverse impacts on historic properties. As defined in Table 4.4-8, minor adverse impacts entail "possible contact with (a) site (or property), but no effect." Any possible effect is expected to be mitigated as discussed above and in Sections 5.4 – 5.6.

4.8.4.7 DIRECT AND INDIRECT EFFECTS ON HISTORIC PROPERTIES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Under Alternative 2, presently authorized activities as permitted under the existing permit (10137) will continue until 2014. Once the present permit expires, most research and enhancement activities would cease. After 2014 there would be no field research to monitor populations, implement de-worming, or conduct translocation. During the execution of the current permit through 2014, the potential impacts to cultural resources and traditional practices would be the same as for Alternative 1, and the same precautions would be taken. After the current permit expires, activities would be limited to remote observation and some collection of samples from materials left by Hawaiian monk seals. No monk seal translocation or handling would occur except potentially under the Marine Mammal Health and Stranding Response Program. Therefore, after 2014, Alternative 2 would involve less boat and land vehicle traffic, and less shoreline activity. The potential for adverse impacts to shoreline cultural and historic resources would be greatly reduced. Mitigation measures associated with monk seal recovery actions (discussed below) would still be recommended for the duration of the permit so as to help mitigate potential direct and indirect impacts.

In summary, Alternative 2 is expected to result in negligible to at most minor adverse impacts on historic properties. As defined in Table 4.4-8, minor adverse impacts entail "possible contact with (a) site (or property), but no effect." Any possible effect is expected to be mitigated as discussed above and in Sections 5.4 – 5.6.

4.8.4.8 *DIRECT AND INDIRECT EFFECTS ON HISTORIC PROPERTIES OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Under Alternative 3 currently authorized activities under Alternative 1 would be continued and additional activities would be conducted. These additional actions could include increased handling of Hawaiian monk seals for vaccination, de-worming, and other activities. Alternative 3 would also include a seal behavior modification program intended to prevent or reduce human-seal seal interactions, including interactions with people engaged in cultural practices. The scope and number of permitted translocations would also be expanded. This would include the potential for translocation of monk seals within the MHI or within the NWHI, as well as the potential for translocation of monk seals from the MHI to the NWHI. As a result, boat and land vehicle activity, as well as shoreline activities, could be greater under Alternative 3 than under Alternatives 1 or 2. For example, approximately 25 more weaned pups may be translocated annually within the MHI under Alternative 3 than under Status Quo (Alternative 1). Despite the increase in monk seal recovery activities under Alternative 3, the direct effects of these activities could be successfully mitigated through the behavior modification action and implementation of the mitigation measures outlined below.in Chapter 5.

In summary, Alternative 3 is expected to result in negligible to at most minor adverse impacts on historic properties. As defined in Table 4.4-8, minor adverse impacts entail "possible contact with (a) site (or property), but no effect." Any possible effect is expected to be mitigated as discussed in Sections 5.4 – 5.6.

4.8.4.9 *DIRECT AND INDIRECT EFFECTS ON HISTORIC PROPERTIES OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION*

Alternative 4 would encompass all of the activities permitted under Alternative 3, plus two-stage translocation of Hawaiian monk seal pups from NWHI to MHI, and then back to the NWHI when the seals reach age two or three years. This translocation program would be a phased process with a gradual increase in seal numbers. Any adverse interactions with humans occurring as a result of translocations would influence whether and at what level the program would continue. The increased capture and transport of the seals under Alternative 4 would result in increased boat and land vehicle traffic, as well as pedestrian traffic to and from capture sites. As a result of potentially increased translocation activities carried out under Alternative 4, a maximum of sixty additional monk seals could be present temporarily within the MHI. The potential exists that

some of these introduced seals may find their way into coastal fishponds or fish traps. The monk seal behavior modification program included in Alternatives 3 and 4 could help prevent or mitigate the impact of seals on coastal fishponds and fish traps. In addition, the monk seal removal measures outlined below and discussed in detail in Section 5.5.3 should allow these errant seals to be successfully removed without damage to the historic structures. The mitigation measures recommended under Alternatives 1, 2 and 3 (and discussed further in Chapter 5) would not change with Alternative 4. The implementation of these mitigation measures should ensure that impacts to historic and cultural sites remain negligible to minor at most.

In summary, Alternative 1 is expected to result in negligible to at most minor adverse impacts on historic properties. As defined in Table 4.4-8, minor adverse impacts entail "possible contact with (a) site (or property), but no effect." Any possible effect is expected to be mitigated as discussed in Sections 5.4 – 5.6.

4.8.4.10 CUMULATIVE EFFECTS OF THE ALTERNATIVES ON HISTORIC PROPERTIES

The analysis of cumulative effects on historical properties, including traditional cultural properties, considers the potential direct and indirect effects of proposed alternatives within the APE, as well as external (not research or enhancement) past activities that may have resulted in substantial impacts (see Table 4.4-10). In addition, any external future actions that are reasonably foreseeable, referred to as RFFAs, must be considered (see Table 4.4-10 for the list of RFFAs considered in this PEIS).

Summary of Direct and Indirect Effects on Historic Properties

The effects of research and enhancement activities proposed under any of the proposed Alternatives could result in negligible to minor direct and indirect effects on cultural and historic resources within the project area. Research and enhancement activities would be temporary and would occur in a very limited area along and adjacent to the shoreline within the MHI and NWHI where those resources that do occur could be successfully avoided. Mitigation measures presented in Sections 5.4 – 5.6 should mitigate any potential adverse effects.

Table 4.8-11 Summary of Direct and Indirect Effects of the Alternatives on Cultural and Historic Properties

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Cultural and Historic Properties	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Historic Properties

Past, present and reasonably foreseeable future actions that may affect cultural/traditional practices and cultural and historic properties are summarized in Table 4.8-9 presented in Section 4.8.4.5.

Past actions on cultural and historic properties within the Project Area that may have caused impacts included but are not limited to coastal human settlements or development (earth moving activities for residential, commercial, government or transportation projects), military operations or warfare, looting or other deleterious activities, and significant storm events such as a hurricane or tsunami. While awareness and protection of cultural and historic resources throughout Hawai‘i is supported through legislation such as the NHPA and State regulations, potential impacts to these resources could still occur as a result of the same activities and events listed as past actions.

Among the primary past actions that have affected historic properties within the project area is the extensive coastal development (residential, commercial, and governmental) that has taken place within the MHI since the 1950s. Both surface structures and buried cultural deposits have been disturbed or destroyed completely. While awareness of cultural and historic resources throughout Hawai‘i has increased in recent decades, and their protection is supported through legislation such as the NHPA and State regulation, impacts to these resources continue to occur. Significant storm events such as a hurricanes and tsunami have also affected historic properties both in the MHI and the NWHI. Past military operations have resulted in coastal disturbance on Midway and some of the other NWHI. Since the establishment of the Monument, adverse impacts to cultural and historic resources there have been greatly diminished.

Cumulative Effects Conclusion for Historic Properties

Given the temporary and limited nature of the monk seal recovery actions addressed in this PEIS, the likelihood of adverse impacts to cultural and historic

properties is low. The implementation of the mitigation measures presented below will further reduce the potential for adverse effects. The contribution of Alternatives 1, 2, 3, and 4 to cumulative effects on cultural and historic resources is therefore negligible in light of other external activities that may be impacting historic properties throughout Hawaii.

4.8.5 RECREATION AND TOURISM

This section addresses potential direct, indirect and cumulative effects of the alternatives on recreation and tourism in the MHI. In general, there are two potential types of effects on recreation and tourism of any type of action: effects on the recreation and tourism economy that may result from changes in the number of visitors and their expenditures, and effects on the level of enjoyment and value of the experience to the recreators/tourists themselves. These two types of effect are closely related as the level of visitor enjoyment also affects the number of visitors and their expenditures. Based on these types of potential effect, Table 4.4-6 in Section 4.4.3 summarizes the criteria used to evaluate effects of the alternatives on recreation and tourism. As indicated in the table, the number of recreation and tourism trips is the primary criteria used to evaluate effects on recreation and tourism.

The alternatives are not expected to result in direct effects on recreation or tourism because such actions as vaccination or translocation will not likely occur in locations popular for recreation or tourism activities. However, it is possible that there may be indirect effects on recreation or tourism if an Alternative affects the monk seal population in the MHI, and then the monk seal population, in turn, affects the number or value of recreation/tourism trips.

Changes in the monk seal population could affect recreation and tourism activities if the size of the population affects any of the four characteristics of recreation/tourism resources:

1. Quality or quantity of recreation/tourism resources,
2. Level of access to recreation/tourism resources,
3. Public safety associated with use of recreation / tourism resources, and
4. Cost of recreation/tourism resources.

The following discussion analyzes the potential for monk seal populations to affect recreation and tourism through these four pathways.

4.8.5.1 QUALITY/QUANTITY OF RECREATION RESOURCES

Tourism is the #1 industry in Hawaii in terms of value to the state's economy (State of Hawaii Department of Business, Economic Development & Tourism, 2011). Hawaii Tourism Authority surveys indicate that visitors view Native Hawaiian culture and natural beauty as major assets of Hawaii as a destination. Wildlife-related recreation, including whale watching, is popular in Hawai'i. Many people enjoy viewing wildlife, particularly marine mammals such as

whales and monk seals, in their native habitat. A Sierra Club survey of visitors to Maui found that excursions into nature were the most memorable part of most people's trips to Hawaii (53.4%) (Sierra Club Maui Group, 1998). Economically, wildlife viewing opportunities are worth hundreds of millions of dollars to Hawaii's $10 billion a year tourism industry. And tourists are willing to pay more to protect Hawaii's environment: 81% expressed willingness to contribute $1 per day in addition to their room rate to preserve natural areas, coastline and Hawaiian cultural sites. Over 90% of visitors to Hawaii indicated that the preservation of natural areas would be an important factor in their decision to return to the islands (Sierra Club Maui Group, 1998; Dayer *et al.* 2006). Native threatened and endangered species are also important to Hawaii's residents. Based on a 2004 "Wildlife Values in the West" survey, a large majority of Hawaii's residents (71.4%) strongly agree that it is important to take steps to prevent the extinction of endangered species (Dayer *et al.* 2006). To the extent that the monk seal population in the MHI increases due to an alternative, the alternative may indirectly enhance the recreation/tourism experience through increased wildlife viewing opportunities and benefit the recreation/tourism economy.

Increases in the monk seal population could potentially affect recreational fishing, but all such effects under all alternatives are expected to be negligible (See Section 4.8.3). It is possible that such changes in fish abundance associated with change in the monk seal population due to the alternatives may also affect other aquatic recreation activities, such as snorkeling. However, as noted in Section 4.8.3, effects on the abundance of fish species due to any of the alternatives are expected to be negligible.

Therefore, it is expected that any measurable effects on the quality/quantity of recreation resources in the MHI due to the alternatives would be related to changes in wildlife viewing opportunities, specifically, monk seal viewing opportunities that would be enhanced with increased populations of monk seal.

4.8.5.2 *ACCESS TO RECREATION / TOURISM RESOURCES*

Many recreation and tourism activities in Hawai`i are beach and water-related. Recreation and tourism can be affected if an alternative affects access to recreational resources, such as shoreline or waters for boating. NMFS does not use beach closures as a part of their seal management strategy at present, and no such management is part of any of the alternatives. At times, NMFS does establish temporary protective zones on beaches for seals, particularly areas where monk seals are pupping. These protective zones are not closures and do not prohibit access, but simply discourage people from

At times, NMFS does establish temporary protective zones on beaches for seals. These protective zones are not closures and do not prohibit access, but simply discourage people from approaching the monk seals too closely.

approaching the monk seals too closely. If an alternative were to increase the monk seal population such that more monk seals are pupping on public beaches and more protective zones are established, access to some areas of some beaches would be discouraged. It is expected that the benefit of viewing the monk seals would outweigh any adverse effects of reduced access, resulting in a net positive for tourists and recreationists. Pupping in such areas would provide high quality wildlife viewing opportunities for beach recreationists. Many tourists and recreationists actively seek and value marine wildlife viewing opportunities, as indicated by the popularity of such activities as whale watching tours, snorkeling, and scuba diving. Furthermore, reduced access from the establishment of protective zones is not mandatory, but is rather a recommendation. So no enforced access reduction is expected to occur.

4.8.5.3 PUBLIC SAFETY

It is also possible that increased monk seal populations due to an alternative could result in increased human-seal interactions, with potential implications for public safety. However, as discussed in more detail in Section 3.4.9 Public Safety, there are few reported incidents of adverse human-seal interactions. Alternatives 3 and 4 include provisions for behavior modification to develop new strategies for resolving conflicts with habituated seals that might pose a risk to public safety. Given the short-term and marginal increase in the population of monk seal in the MHI under the alternatives and the fact, under Alternative 4 (the only alternative allowing two-stage translocation of young seals from the NWHI to the MHI) no translocated seals will pup in the MHI (they will be moved back to NWHI prior to reaching breeding age), the public safety implications, and attendant effects on recreation and tourism resources due to the proposed alternatives, are expected to be negligible. In fact, behavioral modification activities proposed under Alternatives 3 and 4 are intended, in part, to mitigate seals behaving in a way that involves public safety concerns.

Despite evidence of shark predation on Hawaiian monk seal there is no evidence that more monk seals in the MHI will lead to more shark attacks on humans. For example, while the monk seal population has increased in the MHI over the past 10 years, incidents of shark attacks on people have shown no corresponding increase (see Table 3.3-6).

4.8.5.4 COST OF RECREATION RESOURCES

Changes in cost can also affect recreation and tourism. However, it is not expected that there would be any direct or indirect effects on the cost of business for recreation or tourism service providers that would translate into changes in prices, or any effects on costs of admission to parks and other recreational areas. Therefore, it is not expected that changes in the monk seal population due to any of the alternatives would affect the cost to tourists or recreationists of enjoying recreational resources in Hawai'i.

4.8.5.5 *DIRECT AND INDIRECT EFFECTS ON RECREATION RESOURCES OF ALTERNATIVE 1 – STATUS QUO*

Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011*a*) independent of any actions taken by NMFS. While this growth that is occurring naturally already may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As discussed above, increases in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 1 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 1 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, increases to the monk seal population would likely enhance wildlife viewing recreation, and consequently, enhance the visitor experience.

Increases in the monk seal population associated with Alternative 1 may limit small portions of some public beaches if more protective zones are established to discourage people from approaching monk seals too closely. However, the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access. Some weaned pup translocations within the MHI are intended to move pups away from areas where they may be interacting with people and pose a public safety risk. By translocating seals that may be socializing with humans, public safety as well as safety for the seals, would likely be improved. Finally, any small increases in the monk seal population due to alternative 1 would have negligible effects on public safety and cost of recreation experiences.

Conclusion for Direct and Indirect Effects on Recreation Resources from Alternative 1 (Status Quo)

There are negligible direct effects of Alternative 1 anticipated for recreation and tourism activities in Hawai'i. Marginal increases in the MHI monk seal population due to Alternative 1 may have an indirect effect on recreation and tourism activities, but is likely to be negligible due to the small population increase predicted. In summary, direct and indirect effects on recreation and tourism due to changes in the monk seal population under Alternative 1 are expected to be negligible but may result in positive effects on wildlife viewing opportunities.

4.8.5.6 *DIRECT AND INDIRECT EFFECTS ON RECREATIONAL RESOURCES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS OR AUTHORIZATIONS)*

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (No. 10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

As discussed above, changes in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 2 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 2 related to changes in the monk seal population would likely be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a smaller increase in the monk seal population compared to Alternative 1 will result in smaller positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Changes in the monk seal population under Alternative 2 would be negligible as no research or enhancement would occur after 2014. Activities that could occur prior to that date are not anticipated to result in notable changes to beach access if protective zones were established to discourage people from approaching monk seals too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 2 is expected to provide fewer benefits to recreation/tourism than Alternative 1. Some weaned pup translocations within the MHI are intended to move pups away from areas where they may be interacting with people and pose a public safety risk. By translocating seals that may be socializing with humans, public safety as well as safety for the seals, would likely be improved. Under Alternative 2 effects on public safety and cost of recreation experiences are expected to be negligible.

Conclusion for Direct and Indirect Effects on Recreational Resources from Alterative 2 (No Action)

There are negligible to no direct effects of Alternative 2 anticipated for recreation and tourism activities in Hawai`i. Compared to Alternative 1, MHI monk seal population may increase slightly less, resulting in less indirect effect on recreation and tourism activities. In summary, Alternative 2 is expected to provide fewer benefits to recreation/tourism than Alternative 1 due to fewer wildlife viewing opportunities from a smaller monk seal population.

4.8.5.7 *DIRECT AND INDIRECT EFFECTS ON RECREATIONAL RESOURCES OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities.

Under Alternative 3, changes in the MHI monk seal population could affect recreation and tourism if any of the following characteristics of recreation/tourism resources were affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 3 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 3 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a larger increase in the monk seal population compared to Alternative 1 will result in larger positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Increases in the monk seal population under Alternative 3 could reduce access to some additional public beaches, compared to Alternative 1, if more protective zones were established to discourage people from approaching monk seals too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 3 is expected to provide greater benefits to recreation/tourism than Alternative 1. Changes in the monk seal population due to Alternative 3 would have negligible effects on the cost of recreation experiences. Behavioral modification proposed under Alternative 3 is intended to reduce public safety concerns by reducing human-seal interactions. This would likely result in a moderate beneficial effect on public safety.

Conclusion for Direct and Indirect Effects on Recreational Resources from Alternative 3 (Preferred Alternative)

There are negligible to no direct effects of Alternative 3 anticipated for recreation and tourism activities in Hawai`i. Compared to Alternative 1, the MHI monk seal population may increase slightly more, resulting in greater indirect effect on recreation and tourism activities. However, public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized. Alternative 3 is expected to provide more benefits to recreation and tourism than Alternative 1 due to the potential for more wildlife viewing opportunities of monk seals as well as improve public safety by reducing human-seal interactions. Therefore, the effect of Alternative 3 on tourism and recreation is likely to be moderate and beneficial.

4.8.5.8 *DIRECT AND INDIRECT EFFECTS ON RECREATIONAL RESOURCES OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION*

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving weaned seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. The benefit of Alternative 4 is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would comprise a small portion of the total MHI monk seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the population of monk seals due to that action because seals would be returned to the NWHI once they reach age 2 or 3 yr.

As discussed above, changes in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality or quantity of resources, level of access, public safety, and cost. Alternative 4 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 4 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a larger increase in the monk seal population compared to Alternative 1 will result in larger positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Similar to Alternative 3, increases in the monk seal population under Alternative 4 could reduce access to some additional public beaches, compared to Alternative 1, if more protective zones were established to discourage people from approaching monk seal too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 4 could provide slightly greater benefits to recreation/tourism than Alternative 1. Changes in the monk seal population due to Alternative 4 would have negligible effects on public safety and cost of recreation experiences. Public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized. For this reason, the overall effect of Alternative 4 on public safety would likely be moderate and beneficial.

Conclusion for Direct and Indirect Effects on Recreational Resources from Alterative 4 (Enhanced Implementation)

Under Alternative 4, behavioral modification would likely reduce the number of human-seal interactions, thereby improving public safety and safety for seals. Assuming there would be better seal survival, more wildlife viewing opportunities from a larger monk seal population could occur. The overall effect of Alternative 4 on public safety would likely be moderate and beneficial.

4.8.5.9 CUMULATIVE EFFECTS OF ALTERNATIVES ON RECREATION AND TOURISM

Summary of Direct and Indirect Effects on Recreational Resources

As summarized in Table 4.8-12, the alternatives are not expected to result in any direct effects on recreation or tourism as such actions as vaccination or translocation will not likely occur in locations popular for recreation or tourism activities. However, it is possible that there may be indirect effects on recreation or tourism if an alternative affects the monk seal population in the MHI, and then the monk seal population, in turn, affects the number or value of recreation/tourism trips. In particular, indirect effects include changes in recreation opportunities related to monk seal wildlife viewing. Many people enjoy viewing wildlife, particularly marine mammals such as whales and the monk seal, in their native habitat. To the extent that the monk seal population in the MHI increases due to an Alternative, the Alternative may indirectly enhance the recreation/tourism experience through increased wildlife viewing opportunities and benefit the recreation/tourism economy.

Table 4.8-12 Summary of Direct and Indirect Effects of the Alternatives on Recreation or Tourism

	Alternative 1 **Status Quo**	**Alternative 2** **No Action; No Permit After 2014**	**Alternative 3** **Limited Translocation (Preferred Alternative)**	**Alternative 4** **Enhanced Implementation**
Changes in Recreation or Tourism	Negligible	Negligible	Moderate Beneficial	Moderate Beneficial

Past, Present and Future Actions and Events Contributing to Cumulative Effects on Recreation and Tourism

Past, present and reasonably foreseeable future actions that may affect recreation and tourism are summarized in Table 4.8-13.

Table 4.8-13 Past, Present and Reasonably Foreseeable Future Actions on Recreation and Tourism

Action / Event	Potential Effects	Description/Example	Effect
Natural Events			
Tsunami, Volcano, Earthquake, Hurricane Japanese Tohoku earthquake and tsunami debris	• Damage to recreation and tourism resources • Restricted access to recreation and tourism resources	• 2011 Japanese Tohoku earthquake and tsunami debris • Storm damage to recreation and tourism resources. • Debris increases likelihood of damage or restricted access to recreational or tourism areas.	-
Climate Change		• Subtropical Pacific ecosystem changes evident. Future climate change projected to shift ecosystem towards smaller fish even if fishing remains constant (Polovina 2011). • Long-term dynamics are driven in large part by climate (ocean variability) (Baker et al. 2012). Variability in fish populations are affected by these changes and can be both beneficial and adverse.	+/-
Military activities			
U.S. Navy Training - Hawai'i Range Complex (Hawaii Southern California Training and Testing Activities [HSST])	• Visibility of Naval Ships off the coast • Interference with recreation (*i.e.*, surfing or wildlife viewing)	• "Navy vessels present on the waters of the HRC represent a small fraction of the overall commercial and recreational boat traffic and, correspondingly, account for only a small fraction of the potentially restrictive circumstances present in the open-ocean area around Hawaii" (HSST EIS/OEIS 2013). • Tourism and recreational activities would be closer to shore than Naval activities thus interference of Navy training or other activities is not expected (HHST EIS OEIS 2013).	-
Commercial			

Action / Event	Potential Effects	Description/Example	Effect
Unregulated fishing (1913 - 2002) Sea cucumber harvest (1882) Black-lipped oyster harvest (1928-1930) Lobster harvest (1970-1999)	• Decreased population of marine species important for tourism (*i.e.*, wildlife viewing, etc.)	• Unregulated take, reducing long term sustainability of marine fish and other marine fauna populations important for sustaining tourism or recreation (*i.e.*, wildlife viewing, snorkeling tours, etc.).	-
Commercial bottomfish fisheries	• Decreased population of fish important for wildlife viewing or other recreation	• Aggregated bottomfish stock is below maximum sustainable yield (a fisheries management metric) suggesting that overfishing is resulting in declines in fish populations. Overfishing is most severe in MHI (PIFSC 2011; Moffitt et al. 2006). • Overfishing may affect the availability of fish for wildlife viewing.	-
Commercial pelagic fisheries		• 1950 – 1990s: fishing impacts on marine ecosystems (Pauly 2005). • 2010: pelagic fishery landings 26.6 million pounds (WPacFin 2011). • 2014: 6% increased quota recommended for bottomfish due to improved reporting and reduction in management uncertainty about stocks (WPFMC 2013). • Overfishing may affect the availability of fish for wildlife viewing..	-
Recreational and subsistence fisheries		• No license requirements in Hawaii making it difficult to manage overfishing (Moffitt et al. 2006). • Though data are lacking, recreational overfishing very likely contributing to decreases in fish species and therefore declines commercial fisheries landings (PIFSC 2011). • While recreational fishing is an important component of tourism and recreation overall, the impacts of recreational fishing on other tourism could be adverse if fish populations become overfished.	-
Wai`anae Wastewater Treatment Plan Modification Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	• Water quality improvements	• Wastewater treatment plant improvements would generally be expected to reduce contaminants and biological waste streams entering the coastal ecosystem. This would be beneficial for tourism and recreation due to improved water quality as well as indirect beneficial effects on marine flora and fauna sustainability.	+
Agriculture	• Nutrient pollution • Sedimentation	• Sediment runoff and pollution and nutrients from agricultural practices widely impact coral reef habitat where cultural resources may be found. • Sources of sediment on Hawaiian reefs include: improperly managed construction sites; cleared agricultural lands; heavy grazed lands; and eroding stream banks. Nutrients from fertilizers and pollutants such as	-

Action / Event	Potential Effects	Description/Example	Effect
		bacteria from livestock, herbicides, and insecticides enter marine waters in runoff and seepage. Nutrient pollution and sediments from coastal development and farming can block sunlight, smother corals, and impede larval settlement (NOAA 2013). • Increased sedimentation and pollution would result in more contaminants and biological waste streams entering the coastal ecosystem. This would have a negative effect on tourism and recreation due to poor water quality as well as indirect adverse effects on marine flora and fauna sustainability.	
Other Government Activities			
Closure of Bottomfish Fishery in the Hawaiian Archipelago (2006)	• Closed fishery	• 2006: regulations prohibited commercial fishing, except for the bottomfish fishery (and associated pelagic species catch), which had potential to continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). • 2009 remaining permit holders surrendered permits to NMFS in exchange for compensation from Federal Government and fishery was closed. Total NWHI bottomfish catch in 2009 was 29 metric tons. • Closure of the commercial fishery may have increased the diversity and populations of fish species important for tourism and recreation (*i.e.*, snorkeling tours, wildlife viewing, etc.).	+
Hawaiian Spinner Dolphin Human Interaction Protection Measures	• Redistribution of tourism and recreation activities to other areas • Protection of natural habitats valued by tourists and recreationists	• Recreation or tourism may move to other areas where no time-area closures are in effect though overall this is not expected to have a long term negative impacts on overall tourism or recreation. • Natural habitats and species (*i.e.*, spinner dolphins) would benefit from protection measures due to potential time-area closures in bays around the MHI. The additional protection of habitat and better recruitment of marine fauna is likely valued by many tourists and recreationists.	+
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas Removal of marine debris from high seas	• Reduction in marine debris	• Reduction in marine debris could result in safer, cleaner recreation and tourism areas.	+
Hawaiian Monk Seal Critical Habitat	• Habitat protection	• Restrictions on beach activities would likely have negligible effects on beach access or areas important for recreation. • Marine fauna populations may benefit from Monk Seal Habitat designation	+

Action / Event	Potential Effects	Description/Example	Effect
Designation		due to the additional protection thus benefitting valued resources important for recreation and tourism.	
Measures to End Bottomfish Overfishing in the Hawaiian Archipelago	• Improved protection of important species for recreation and tourism	• Fishery plan may promote more stable prey resources that are important for tourism and recreation.	+

The primary past effect on recreation and tourism in the MHI is the national and global economic decline in recent years that resulted in reduced tourism to the MHI. According to the Hawai`i Tourism Authority, in 2006 and 2007, there were a total of 69.1 million visitor days in Hawai`i. Visitor days decreased to 63.1 million in 2008 and then decreased further to 60.3 million in 2009. Tourism visits in 2010 started recovering (as discussed in Affected Environment section), with an increase of nearly 9 percent over 2009 visitor days.

Global health concerns can also limit air travel and affect the number of visitors to the MHI. For example, the 2009 H1N1 flu virus affected the number of visitors to Hawai`i, particularly from China, Taiwan, Singapore, and Japan (HTA, 2009).

While global economic and health concerns have affected the number of total visitors, visitor surveys show that the level of satisfaction and the likelihood of repeat visits by Hawai`i tourists has actually increased from 2005 to 2009, indicating that visitor perception of the overall quality of recreation and tourism resources in Hawai`i is becoming more positive (HTA 2009).

Reasonably foreseeable future wildlife management that may affect recreation and tourism on beaches and near shore areas include potential restrictions on human interaction with spinner dolphins in Hawai`i. NOAA is currently preparing an EIS (Spinner Dolphin Human Interaction EIS) regarding conservation measures to protect wild spinner dolphins. Among other potential effects, these management actions may limit opportunities for 'swim with wild dolphin' tours or boating tours that closely approach the spinner dolphins. Other future conservation efforts by NMFS and the State of Hawai`i may also affect recreation and tourism on the MHI, with potential positive effects (*i.e.*, enhanced wildlife populations and therefore increased chances of wildlife viewing) and potential adverse effects (*i.e.*, decreased proximity of access) on wildlife-viewing opportunities.

Cumulative Effects Conclusion for Recreation and Tourism

The alternatives would take place against a backdrop of recovering recreation and tourism levels. However, as discussed above, the direct and indirect effects of the alternatives on recreation and tourism are expected to be negligible. As the direct and indirect effects are anticipated to be so small, none of the alternatives is expected to contribute to overall cumulative effects on recreation and tourism.

4.8.6 ENVIRONMENTAL JUSTICE

CEQ, which has oversight of Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued guidance in 1997 for implementing the EO. Since then, some federal agencies such as the Department of Energy's (DOE) Office of NEPA Policy and Compliance, have provided additional detailed guidance for implementation through NEPA. In addition to NMFS' guidance for environmental justice

implementation through NEPA, CEQ and DOE guidance was also followed in this analysis.

The legal foundations for environmental justice in Hawai‘i were also considered in this analysis, including but not limited to the Hawai‘i Constitution, Hawai‘i Revised Statutes, and the Hawai‘i Environmental Justice Bill – Act 294 as presented in Kahihikolo (2008).

EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2011). Fair treatment is further explained to mean that no population group of any makeup should "bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies" (EPA 2011).

For each alternative, this analysis considered if disproportionately high and adverse human health or environmental (inclusive of the social and economic environment) effects would occur to minority and low-income populations that would appreciably exceed effects to the general population or other comparison group. Specifically, this analysis considered if there were different or unique exposure pathways, exposure rates, special sensitivities, or different uses of natural resources (Office of NEPA Policy and Compliance 2004; CEQ 1997).

As noted in Section 3.4.10 in Table 3.4-12 Study Area Race and Ethnicity 2010, a high percentage of minority populations exist in the state of Hawai‘i in all counties and islands, ranging from 64.2% on the island of Maui (Maui County) to 86.0% on Lāna‘i (Maui County). Statewide, the average presence of minority populations is 75.3%. With the entire state of Hawai‘i comprising the Project Area, all communities are assumed to be minority population communities.

Table 3.4-13 Study Area Income Below Poverty Level 2010, presents the percentage of Hawaiian residents with low-income living on each of the islands and collectively from a statewide perspective. The threshold for analysis is the state of Hawai‘i poverty level, which is approximately 9.6% of residents earning incomes below the poverty level. The counties and islands with greater percentages of residents living in poverty include Molokai (13.4%) and the Big Island (14.4%). The counties and islands with lesser percentages of residents living in poverty include the City and County of Honolulu (8.8%), Maui and Lāna‘i in Maui County (8.9% and 2.9% respectively), Kaua‘i County (8.8%), Honolulu County (8.8%), and Kalawao County (4.1%).

Using the State's poverty level rate as a threshold, disproportionately high and adverse human health and environmental effects experienced by the communities on the islands of Kaua‘i, Moloka‘i, and the Big Island would trigger environmental justice concerns. However, all communities in the Project Area are assumed to be those of minority makeup; therefore, any disproportionately high

and adverse human health or environmental effects to the populations of Hawaiian communities would raise environmental justice concerns that would need to be addressed and potentially mitigated.

In the context of effects to environmental justice communities for this PEIS, specific concerns would arise from potential effects to subsistence fishers who target a fish species that overlaps with one of the various fish species the monk seal includes in their diet. Any such overlap would have to decrease availability of targeted fish species to fishers, and this decreased availability would have to result from an alternative. As described in Section 4.8.2, effects of the alternatives on subsistence fishing are likely to be negligible.

As described in Section 3.4.4, the State defines subsistence fishing as the customary and traditional Native Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing. As Native Hawaiians are a minority population covered under environmental justice, this analysis considers that potential effects to subsistence could merit potential environmental justice concerns. Economic effects realized from commercial and recreation fishing could also warrant potential environmental justice concerns. Additionally, environmental justice concerns could arise from effects to cultural resources and historic properties meaningful to Native Hawaiians and potentially other minority groups. Mitigations to address any potential disproportionately high and adverse environmental effects to environmental justice communities would be developed and implemented as appropriate.

With regard to human health, potential effects would result from a significant decrease in subsistence fish if they were the primary sustenance for a family or individual for cultural or economic reasons. No alternatives would result in human health effects from the perspective of diminished resources impacting diet; therefore, environmental justice communities would not experience disproportionately high or adverse human health effects.

Under all alternatives, NMFS would continue to conduct education and outreach efforts (to varying degrees), ensuring that environmental justice communities are included in those efforts so that these populations are aware of best practices around wild Hawaiian monk seals. These efforts are conducted in part to limit highly unlikely potential negative consequences of interaction with the wild animals.

4.8.6.1 DIRECT AND INDIRECT EFFECTS ON ENVIRONMENTAL JUSTICE OF ALTERNATIVE 1 – STATUS QUO

Under Alternative 1 Status Quo, the current level of research and enhancement activities would be sustained through the next permit cycle. The population of monk seals is expected to naturally increase in the MHI for the timeframe of this PEIS with this level of research and enhancement activities. However, the overall population will decrease. As such, effects to fishery resources (commercial,

subsistence, or recreation) that low-income and minority populations might depend on would likely continue with their current trends, barring any unforeseen disruptive natural occurrences. Additionally, minor effects to cultural resources and historic properties would be expected under this alternative.

Disproportionately high and adverse effects to environmental justice communities would not be likely because negligible to no effects on fishery resources are expected, and only potential minor adverse effects on cultural resources and historic properties are expected. NMFS implements best management practices and other mitigations are also in place to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.8.6.2 *DIRECT AND INDIRECT EFFECTS ON ENVIRONMENTAL JUSTICE OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)*

If no action is taken with regard to issuing new permits for research and enhancement for Hawaiian monk seals after 2014, then the number of seals is likely to decrease in the NWHI and increase in the MHI. Although fishing occurs in the MHI where the monk seal population is increasing naturally, on fishing are expected to be negligible. Cultural resources and historic properties effects are expected to be minor under this alternative.

As no fishery, economic, or cultural effects would appreciably exceed effects to the general population, it is unlikely disproportionately high and adverse effects to environmental justice communities would result. For the remainder of the current permit cycle, NMFS would continue to implement best management practices and have other mitigations in place to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.8.6.3 *DIRECT AND INDIRECT EFFECTS ON ENVIRONMENTAL JUSTICE OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)*

Alternative 3 Limited Translocation encompasses all activities in Alternative 1 Status Quo; plus increased activities as listed in Section 2.9.

Although the rate of MHI monk seal population growth may increase marginally due to Alternative 3 activities, the potential fisheries effects are expected to be negligible. Consequently, disproportionately high and adverse effects to environmental justice communities would not be likely because negligible effects on fishery resources are expected, and only potential minor adverse effects on cultural resources and historic properties are expected. As in the previous two alternative scenarios, NMFS would continue to implement best management practices and maintain other mitigations to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not

suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.8.6.4 DIRECT AND INDIRECT EFFECTS ON ENVIRONMENTAL JUSTICE OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Alternative 4 Enhanced Implementation differs from Alternative 3 with regard to the way translocations would be conducted. Under this alternative, weaned Hawaiian monk seals could be moved from the NWHI to the MHI, and then taken back to the NWHI when they reach the age of 2 to 3 years. Details of this alternative are included in Section 2.10 Alternative 4 Enhanced Implementation.

Effects under Alternative 4 are expected to be negligible. Disproportionately high and adverse effects to environmental justice communities would not be likely, as negligible effects on fishery resources are expected, and only potential minor adverse effects on cultural resources and historic properties are expected. As in the previous two alternative scenarios, NMFS would continue to implement best management practices and maintain other mitigations to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.8.6.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON ENVIRONMENTAL JUSTICE

As discussed, anticipated environmental effects that could potentially raise environmental justice concerns would be negligible and not likely to be disproportionately borne by Native Hawaiians, other minority populations, and/or low-income populations. Nor would any of these effects appreciably exceed effects to the general population. Further, human health effects are not expected.

Also, under all alternatives, NMFS would continue to conduct education and outreach efforts, ensuring that environmental justice communities are included in those efforts so that these populations are aware of best practices around wild Hawaiian monk seals. To further minimize any potential for disproportionately high and adverse effects to environmental justice communities, NMFS would continue to implement best management practices and maintain other mitigations to minimize and/or eliminate potential effects to socioeconomic resources.

All alternatives would result in negligible effects to fisheries, economics, and cultural resources. As a result, the alternatives are not likely to contribute cumulative effects that would raise environmental justice concerns.

4.8.7 MILITARY ACTIVITIES

Military operations and exercises occur along the shoreline and in the offshore areas within the Project Area described in Section 1.3 Description of the Project

Area. The Army installations (DMR and MMR) together have approximately three miles of shoreline. The shoreline area adjacent to the U.S. Coast Guard (USCG) installation has been removed from base operations.

As described in Section 3.4.12.3, NMFS currently has an MOU with the USCG to assist with translocation activities that are part of the Marine Mammal Health and Stranding Response Program (MMHSRP) (Permit 932-1905). Thus, the translocation described in this assessment would not necessarily involve the USCG. The USCG area operates in an area of approximately 14.2 million square miles in and around the Hawaiian Archipelago (USCG and NOAA, 2010; see Section 3.4.12.3 Coast Guard).

The U.S. Marine Corps (USMC) operates in approximately 12.5 miles of shoreline and nearly four square miles of area directly offshore of the Marine Corps Base Hawai`i (MCBH).

Both the Air Force and the Navy operate in approximately 40 miles of shoreline (Pearl Harbor and PMRF) and approximately 1,200 square miles of ocean in and around the Hawaiian Archipelago.

This section discusses the potential direct and indirect effects for military installations in Hawai`i. There would be no direct effects associated with any of the alternatives. Indirect effects for the Navy, USMC and the Air Force are based upon whether or not the proposed alternatives would be likely to result in changes to military operations, exercises or military response efforts throughout the Project Area. As described in Chapter 3, the Hawaiian monk seal are located where the majority of military activities occur in Hawai'i.

4.8.7.1 DIRECT AND INDIRECT EFFECTS ON MILITARY ACTIONS OF ALTERNATIVE 1 – STATUS QUO

Under Alternative 1 Status Quo, the current NMFS Research and Enhancement Permit (10137) would continue until expiring in 2014. Following this date, subsequent permits will be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.7.

Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker et al 2011*a*) independent of actions take by NMFS. While this growth may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As described above, NMFS may cordon off small sections of beaches where monk seals haul out but this would be temporary until the seal moved or swam away.

Under Alternative 1, at most 85 Hawaiian monk seals can be translocated by boat, vehicle, or aircraft per year (Table 2.10-1). While the *Coast Guard* does assist NMFS with the translocation of Hawaiian monk seals, approximately three to five annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. NMFS may involve USCG in future translocations if the activity fits within existing operations and does not require significant effort. Thus the majority of these 85 possible translocations would not involve *Coast Guard* assistance (NMFS personal communication 2011). Any small areas to be cordoned off around seals would not likely affect USCG activities and would therefore be negligible.

As previously described, the MHI Hawaiian monk seals population is naturally increasing independent of any research or enhancement taken by NMFS. The implementation of Alternative 1 may have a negligible indirect effect on MHI Hawaiian monk seal population beyond that of natural MHI population growth due to de-hooking, disentanglement and weaned pup translocation. However, it is anticipated that this small population effect will have negligible indirect effects upon military training and operations within the MHI.

Conclusion for Direct and Indirect Effects on Military Activities from Alterative 1 (Status Quo)

None of the research methods permitted under Alternative 1 would directly affect military activities or operations in Hawai`i. Furthermore, it is unlikely that Hawaiian monk seal population changes within the MHI resulting from enhancement activities would indirectly affect military training activities or operations. Therefore, direct and indirect effects are likely to be negligible.

4.8.7.2 DIRECT AND INDIRECT EFFECTS ON MILITARY ACTIVITIES OF ALTERNATIVE 2 – NO ACTION (NO NEW PERMITS AFTER 2014)

Under the No Action Alternative, existing research as permitted under the current permit (10137) would continue until 2014. Once this permit expires, no research or enhancement activities on monk seals would occur. Unlike the activities under other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation once the permit expires in 2014.

As discussed above, demographic data for monk seals suggests that the Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of NMFS actions. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on military activities under Alternative 2 would not likely occur and are therefore considered negligible.

It is unlikely that Alternative 2 would result in any direct or indirect affect on the military in Hawai`i. Under Alternative 2, regardless of any NMFS action, the MHI Hawaiian monk seal population is anticipated to grow, however under this

Alternative this increase is expected to be lower than all other Alternatives. Indirect effects of Alternative 2 might include fewer occasions of cordoning off areas near military installation shorelines and fewer instances of Navy training exercise conflicts. However, the potential effects of Alternative 2 would likely be negligible for all branches of the military.

Conclusion for Direct and Indirect Effects on Military Activities from Alternative 2 (No Action)

It is anticipated that there would be no direct affects to military activities or operations in Hawai`i resulting from Alternative 2. Given that most research and enhancement would cease once the permit expires in 2014, military activities are not likely to be affected and therefore, potential effects would be considered negligible.

4.8.7.3 DIRECT AND INDIRECT EFFECTS ON MILITARY ACTIVITIES OF ALTERNATIVE 3 – LIMITED TRANSLOCATION (PREFERRED ALTERNATIVE)

Under Alternative 3, the research and enhancement activities currently permitted would be expanded (see Section 2.9 for details).

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on slowing Hawaiian monk seal population decline within the NWHI. The expanded activities under Alternative 3 would include translocation, vaccination, behavioral modification, and deworming none of which, themselves would likely affect military activities. Emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP)(Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP.

The implementation of Alternative 3 could result in translocations of seals (see Appendix H, Take Tables) by boat, vehicle, or aircraft. While the Coast Guard does assist NMFS with the translocation of approximately three to five Hawaiian monk seals annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. Therefore, these possible translocations would not involve Coast Guard assistance (NMFS 2011).

The geographic extent of haul out occurrences within the MHI is not likely to expand as a result of NMFS actions, rather independent of such actions as the natural population growth in the MHI may continue to alter their distribution (Baker *et al.* 2011). While it is noted that the frequency of these events could increase it is not likely to be attributable to NMFS actions under Alternative 3 and the effect of increased haulouts on military operations is anticipated to be negligible for each military branch.

The marginal population increase in monk seal populations in the MHI due to research and enhancement activities are not likely to result in any change in the

number of conflicts with Navy training activities. It is anticipated that the number of Navy training exercises affected by monk seal is to be negligible.

Conclusion for Direct and Indirect Effects on Military Activities from Alternative 3 (Preferred Alternative)

None of the research methods permitted under Alternative 3 would directly affect military activities or operations in Hawai`i. Furthermore, it is unlikely that Hawaiian monk seal population changes within the MHI resulting from enhancement activities will indirectly affect military training activities or operations. Therefore, direct and indirect effects of Alternative 3 are likely to be negligible.

4.8.7.4 DIRECT AND INDIRECT EFFECTS ON MILITARY ACTIVITIES OF ALTERNATIVE 4 – ENHANCED IMPLEMENTATION

Under Alternative 4, the research and enhancement activities would be the same as presented for Alternative 3 with the addition of the potential to translocate weaned seals from areas of low survival in the NWHI to areas of higher survival in the MHI temporarily until age 2 or 3 yr at which point they would be returned to the NWHI.

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 will exhibit the greatest benefit to Hawaiian monk seal populations relative to all alternatives. However, that benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the already underway MHI population growth.

The implementation of Alternative 4 could result in additional monk seal translocation activities each year for 5 years. While the Coast Guard does assist NMFS with the translocation of Hawaiian monk seals, approximately three to five annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. Therefore, these possible translocations would not involve Coast Guard assistance (NMFS 2011).

Indirect effects of Alternative 4 on military activities could occur if there were marked changes in the population of Hawaiian monk seals within the MHI due to NMFS action. Under this alternative, up to a maximum of 60 translocated (from the NWHI) juvenile Hawaiian monk seals could be present in the MHI in some years. This temporary increase in the Hawaiian monk seal population is anticipated to have negligible effect on military training activities and operations.

Conclusion for Direct and Indirect Effects on Military Activities from Alternative 4 (Enhanced Implementation)

None of the activities permitted under Alternative 4 would directly affect military activities or operations in Hawai'i. Furthermore, it is unlikely that temporary Hawaiian monk seal population increases within the MHI resulting from enhancement activities would indirectly affect military training activities or operations. Therefore, direct and indirect effects would likely be negligible.

4.8.7.5 CUMULATIVE EFFECTS OF ALTERNATIVES ON MILITARY ACTIVITIES

Research and enhancement activities would likely result in negligible direct and indirect effects on military operations under all alternatives. Thus, cumulative impacts of proposed research and enhancement activities under any Alternative would not likely contribute to any cumulative effect on military activities.

4.9 Summary of Effects on All Resources

The following tables (Tables 4.9-1 through 4.9-12) summarize the direct, indirect, and cumulative effects under each alternative for resources where environmental consequences were evaluated. More detailed discussions of direct, indirect, and cumulative effects can be found in Sections 4.7 through 4.8.

Table 4.9-1 Summary of Direct/Indirect and Cumulative Effects – Hawaiian Monk Seals

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
HAWAIIAN MONK SEALS				
DIRECT / INDIRECT EFFECTS				
Mortality	**Minor Adverse** - could result in a reduction of total abundance of 9 seals, representing a 1% decline.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Minor to Moderate Adverse** - small changes in the population, a small number of individuals would be affected, although levels of take are not likely to be realized.	**Minor to Moderate Adverse** – same as Alternative 3.
Reproduction	**Negligible** - precautionary measures undertaken such that no adult female is captured that appears to be pregnant.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.
Contribution to Conservation Objectives	**Moderate beneficial** - addresses conservation though not at a level that would be expected to result in notable effects on recovery.	**Major adverse** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals. No contribution towards conservation objectives after 2014.	**Major beneficial** - provides a variety of ways to conduct enhancement at any one time. Benefits are more likely to be long-term.	**Major beneficial** - flexibility to adapt to potential future conditions that might make translocations from the NWHI to MHI even more beneficial would allow NMFS to adapt strategies to a greater range of future scenarios for promoting survival.
CUMULATIVE EFFECTS				
Mortality	**Negligible** - Relative to mortalities caused by predation, starvation, entanglement, intentional lethal shootings by humans and potential diseases, contribution of effects of Alternative would be negligible.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.
Reproduction	**Negligible** - alternatives vary in the amount of research- and enhancement-related disturbance although none of the proposed alternatives are expected to contribute anything but negligible effects on reproduction.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
Contribution to Conservation Objectives	**Moderate beneficial contribution –** addresses conservation though not at a level that would be expected to result in notable cumulative effects on recovery.	**Major adverse contribution** - no additional research or enhancement would occur on wild seals could result in higher seal mortality.	**Major beneficial contribution** - provides a variety of ways to conduct enhancement at any one time. Benefits are more likely to be long-term.	**Major beneficial contribution –** enhanced translocation promotes greatest flexibility in translocation options along with all actions contained in Alternative 3.

Table 4.9-2 Summary of Direct/Indirect and Cumulative Effects – Sea Turtles

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
SEA TURTLES				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - Injury or mortality affecting sea turtles rare.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible**- injury or mortality due to collisions with sea turtles extremely rare; no effect on population/species level. Despite slight increase in level of activities, BMPs and other mitigations minimize risks for collisions with turtles.	**Negligible** - same as Alternative 3.
Reproduction	**Negligible**- disturbance is not likely to result in effects on sea turtle reproduction.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible** - while level of disturbance may increase, this is not likely to cause measurable changes in sea turtle reproduction.	**Negligible –** same as Alternative 3.
CUMULATIVE EFFECTS				
Mortality and Reproductive Effects	**Negligible contribution** - compared with other external sources of mortality, BMPs and other mitigation measures minimize risk of mortality and potential effects on reproduction.	**Negligible contribution** - no research or enhancement on wild seals after 2014. Contribution to sea turtle population declines negligible.	**Negligible contribution** - despite slight increase in research and enhancement, compared with other external sources of mortality, BMPs and other mitigation measures minimize risk of mortality and potential effects on reproduction.	**Negligible contribution –** same as Alternative 3.

Table 4.9-3 Summary of Direct/Indirect and Cumulative Effects – Cetaceans

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
CETACEANS				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - injury or mortality due to collisions with cetaceans from activities such as vessel surveys extremely rare.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible** – same as Alternative 1.	**Negligible** – same as Alternative 1.
Reproduction	**Negligible** - vessel activity infrequent; disturbance would be short-term and not likely to result in reproductive effects.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible** – same as Alternative 1.	**Negligible** – same as Alternative 1.
CUMULATIVE EFFECTS				
Mortality and reproductive effects	**Negligible contribution** - potential effects of all alternatives on mortality or reproduction negligible at the population level relative to other external stressors. BMPs and other mitigation measures in place to minimize risks of collisions and disturbance. Vessel activity infrequent and not likely to result in any long-term effects. Under Alternative 2, no research or enhancement on wild seals after 2014. Contribution to cetacean population declines negligible. Long-term effects on reproduction negligible.			

Table 4.9-4 Summary of Direct/Indirect and Cumulative Effects – Fish

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
FISH				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - given the wide variety of fish consumed by monk seals, long-term decline in fish populations not likely.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
CUMULATIVE EFFECTS				
Mortality	**Negligible contribution** -relative to other external sources of fish mortality, research and enhancement alternatives are not likely to result in any measurable effects on mortality.	**Negligible contribution** - no research or enhancement on wild seals after 2014.	**Negligible contribution** - same as Alternative 1.	**Negligible contribution** - same as Alternative 1.

Table 4.9-5 Summary of Direct/Indirect and Cumulative Effects – Birds

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
BIRDS				
DIRECT / INDIRECT EFFECTS				
Productivity	**Minor adverse** effects expected from human disturbance on beach-nesting seabirds. **Negligible** effects on shorebird productivity. **Minor adverse** effects on Laysan Finch from research and enhancement camp activities.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible to Minor adverse** – same as Alternative 1.	**Negligible to Minor adverse** – same as Alternative 1.
Survival	**Minor adverse** - periodic effects on avian survival due to potential collisions with aircraft and fencing from monk seal holding pens, and camp activities.	**Negligible** - no research or enhancement on wild seals after 2014.	**Minor adverse** – same as Alternative 1.	**Minor adverse** - same as Alternative 1.
Habitat Alteration	**Minor adverse** - strict protocols for entering the NWHI prevent the spread of invasive species. Despite protocols, minor effects on habitat, survival, and productivity due to introduction of invasive species.	**Negligible** - no research or enhancement on wild seals after 2014.	**Minor adverse** - increased translocation of seals from MHI to NWHI may introduce invasive species to the Monument but would be mitigated through strict protocols.	**Minor adverse** – same as Alternative 3.
CUMULATIVE EFFECTS				
	Minor adverse contribution– Relative to other sources of mortality and effects on productivity such as longline fisheries, climate change, invasive species and marine debris, the contribution of research and enhancement activities is considered minor adverse for avian mortality, productivity and habitat. Precautions would be implemented to avoid take of birds and nesting birds on beaches would be avoided.			

Table 4.9-5 Summary of Direct/Indirect and Cumulative Effects – Corals

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
CORALS				
DIRECT / INDIRECT EFFECTS				
Damage to coral and live rock.	**Negligible** effects due to strict protocols to minimize damage.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible–** Some increase in activities that could impact corals, but adherence to strict protocols maintained.	**Negligible–** same as Alternative 3.
CUMULATIVE EFFECTS				
Damage to coral and live rock.	**Negligible contribution.** Considering that there would only be negligible direct and indirect effects are anticipated under any of the Alternatives, there would be no contribution of monk seal research and enhancement activities to a cumulative impact on coral species.			

Table 4.9-6 Summary of Direct/Indirect and Cumulative Effects – Invasive Species

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
INVASIVE SPECIES				
DIRECT / INDIRECT EFFECTS				
Spread of Invasive Species	**Minor adverse** - strict protocols described for entering the NWHI under a Monument permit prevent the spread of invasive species.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild.	**Minor adverse** - strict protocols for entering the Monument would help prevent spread of invasive species; however, increased activity may slightly increase chances of doing so.	**Minor adverse** – same as Alternative 3.
CUMULATIVE EFFECTS				
Spread of Invasive Species	**Negligible** – given the high population and level of ecotourism, recreation, fishing, and other human activities in the MHI, research and enhancement activities proposed would be expected to result in negligible effects. Strict protocols for entering the Monument limit spread of invasive species.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals thus there would be no potential to spread invasive species	**Negligible** – despite increased translocation of seals from MHI to NWHI, spread of invasive species would be negligible and be mitigated through strict monument protocols. High population and level of ecotourism, recreation, fishing, and other human activities in the MHI would be expected to have a greater probability to spread invasive species.	**Negligible** – same as Alternative 3.

Table 4.9-7 Summary of Direct/Indirect and Cumulative Effects – Commercial Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
COMMERCIAL FISHERIES				
DIRECT / INDIRECT EFFECTS				
Commercial Landings	**Negligible –** no direct effect on commercial fishing. Marginal Hawaiian monk seal population increase within the MHI not likely to result in indirect effect on commercial fishing. While indirect effects on commercial fishing could stem from costs associated with interactions between fishers and Hawaiian monk seals, these are likely to be negligible.	**Negligible –** after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** no direct effect on commercial fishing in MHI. Analysis does not indicate that the effects of the alternative on the number of monk seals would measurably affect the amount of fish available to be harvested commercially, or the number of interactions with commercial fishing. Behavioral modification may reduce seal interactions with fishing operations. Marginal monk seal population increase not likely to result in an indirect adverse effect on commercial fishing.	**Negligible –** same as Alternative 3. Small, temporary monk seal population increase in MHI not likely to result in an indirect adverse effect on commercial fishing.
CUMULATIVE EFFECTS				
Commercial Landings	**Negligible contribution** - Commercial fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Overfishing could result in reduction in fish populations for sustainable harvest. Offshore military activities could have temporary effects on fishing through access restrictions or TTS on fish hearing due to underwater training. The direct and indirect effects associated with the Alternatives are expected to be negligible, thus would not contribute to the overall cumulative effects on subsistence fishing. Direct and indirect effects associated with the alternatives are negligible and would not contribute to overall cumulative effects on commercial fishing.			

Table 4.9-8 Summary of Direct/Indirect and Cumulative Effects – Subsistence Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
SUBSISTENCE FISHERIES				
DIRECT / INDIRECT EFFECTS				
Subsistence Catch	**Negligible** - no direct effect on subsistence fishing. Marginal Hawaiian monk seal population increase within the MHI not likely to result in indirect effect on subsistence fishing. While indirect effects on subsistence fishing could stem from costs associated with interactions between fishers and Hawaiian monk seals, these are likely to be negligible.	**Negligible –** after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** no direct effect on subsistence fishing in MHI. Analysis does not indicate that the effects of the alternative on the number of monk seals would measurably affect the amount of fish available to be harvested for subsistence, or the number of interactions with subsistence fishing. Behavioral modification may reduce seal interactions with fishing operations. Marginal monk seal population increase not likely to result in an indirect adverse effect on subsistence fishing.	**Negligible –** same as Alternative 3. Small, temporary monk seal population increase in MHI not likely to result in an indirect adverse effect on subsistence fishing.
CUMULATIVE EFFECTS				
Subsistence Catch	**Negligible contribution –** Subsistence fishing in the MHI could be affected by fisheries management actions in Hawai`i, as well as the local and global economy. Overfishing could result in reduction in fish populations for sustainable harvest. Offshore military activities could have temporary effects on fishing through access restrictions or TTS on fish hearing due to underwater training. The direct and indirect effects associated with the Alternatives are expected to be negligible, thus would not contribute to the overall cumulative effects on subsistence fishing.			

Table 4.9-9 Summary of Direct/Indirect and Cumulative Effects – Recreational Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
RECREATIONAL FISHERIES				
DIRECT / INDIRECT EFFECTS				
Recreational Catch	**Negligible –** no direct effects on recreational fishing in MHI. No decrease in fishing trips or in number of fish caught for recreation. While indirect effects on recreational fishing could stem from costs associated with interactions between fishers and Hawaiian monk seals, these are likely to be negligible.	**Negligible –** after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** no direct effect on recreational fishing in MHI. Analysis does not indicate that the effects of the alternative on the number of monk seals would measurably affect the amount of fish available to be harvested for recreation, or the number of interactions with recreational fishing. Behavioral modification may reduce seal interactions with fishing operations. Marginal monk seal population increase not likely to result in an indirect adverse effect on recreational fishing.	**Negligible –** same as Alternative 3. Small, temporary monk seal population increase in MHI not likely to result in an indirect adverse effect on recreational fishing.
CUMULATIVE EFFECTS				
Recreational Catch	**Negligible contribution –** recreational fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Overfishing could result in reduction in fish populations for sustainable harvest. Offshore military activities could have temporary effects on fishing through access restrictions or TTS on fish hearing due to underwater training. Direct and indirect effects associated with the alternatives are negligible, thus would not contribute to the overall cumulative effects on recreational fishing.			

Table 4.9-10 Summary of Direct/Indirect and Cumulative Effects –Cultural Resources and Traditional Cultural Practices; and Historic and Traditional Cultural Properties

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
CULTURAL RESOURCES AND TRADITIONAL CULTURAL PRACTICES				
DIRECT / INDIRECT EFFECTS				
Traditional Fishing and Gathering Resources and Activities	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential direct and indirect effects to cultural resources. Pedestrian traffic to and from monk seal locations in remote areas could cause minor disturbance to native medicinal plants located along the path of access. Marine resources are not likely to be impacted by vessel based activities. These effects are expected to be mitigated by the implementation of the mitigation measures presented in Chapter 5.	**Minor adverse –** The potential effects listed under Alternative 1 would remain until after the permit expires in 2014. Beyond that point no additional research or enhancement would occur on wild seals.	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential direct and indirect effects to cultural resources. Increased handling and translocation of monk seals under Alternative 3 would slightly increase the potential for effects to cultural resources and traditional customary practices. Pedestrian traffic to and from monk seal locations in remote areas could cause minor disturbance to native medicinal plants located along the path of access. Marine resources are not likely to be impacted by vessel-based activities. The indirect effects of potential marginal increases in the MHI monk seal population growth associated with the alternative could include locally increased interactions between monk seals and traditional fishers. These effects can be mitigated by the seal behavior modification actions included under Alternative 3 and by the implementation of the mitigation measures presented in Chapter 5.	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential direct and indirect effects to cultural resources. The increased handling and translocation of monk seals under Alternative 4 would slightly increase the potential for effects to cultural resources and traditional customary practices. Pedestrian traffic to and from monk seal locations in remote areas could cause minor disturbance of native medicinal plants located along the path of access. Marine resources are not likely to be impacted by vessel-based activities. Temporary translocation of seals from the NWHI is expected to have negligible impact on subsistence fishing (See Section 4.8.2) and on traditionally collected marine resources. The indirect effects of monk seal translocation from the NWHI and within the MHI could include increased interactions between monk seals and traditional fishers. These effects can be mitigated by the seal behavior modification actions included under Alternative 4 and by the

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
				implementation of the mitigation measures presented in Chapter 5.
CUMULATIVE EFFECTS				
Traditional Fishing and Gathering Resources and Activities	**Negligible contribution –** The temporary nature of monk seal research and enhancement activities and their restriction to the shoreline and immediate off-shore zones would limit direct and indirect effects on cultural resources and traditional practices. Some potential exists for minor impacts on shoreline plant resources, and to a lesser extent on marine resources, but these can be mitigated by the implementation of mitigation measures presented in Chapter 5.5. The potential for increased interactions between monk seals and traditional fishers could be mitigated by the seal behavior modification actions and by the implementation of the other mitigation measures. These would serve to make the contribution of any alternative to cumulative effects on cultural resources and traditional practices negligible.			
HISTORIC AND TRADITIONAL CULTURAL PROPERTIES				
DIRECT / INDIRECT EFFECTS				
Archaeological Sites, and other Historic Sites, and Cultural Properties	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential to impact cultural and historic properties. Pedestrian traffic to and from monk seal locations in remote areas could directly affect archaeological sites located along the path of access. Shipwrecks and other offshore sites have the potential to be impacted by vessel based activities. The removal of monk seals from within coastal fish ponds could possibly result in minor structural damage to these sites. These effects can be mitigated by implementation of the mitigation measures presented in Section 5.5.	**Minor adverse –** The potential effects listed under Alternative 1 would remain until after the permit expires in 2014. Beyond that point no additional research or enhancement would occur on wild seals.	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential to impact cultural and historic properties. Increased handling and translocation of monk seals under Alternative 3 would increase the potential for effects to cultural and historic properties. Pedestrian traffic to and from monk seal locations in remote areas could directly affect archaeological sites located along the path of access. Shipwrecks and other offshore sites have the potential to be impacted by vessel-based activities. The removal of monk seals from within coastal fish ponds could possibly result in minor structural damage to these sites. These effects can be mitigated by the seal behavior modification actions included under Alternative 3 and by implementation of the mitigation measures presented in Section 5.5.	**Minor adverse –** The temporary and geographically limited nature of monk seal recovery activities limits the potential to impact cultural and historic properties. As with Alternative 3, the increased handling and translocation of monk seals would increase the potential for effects to cultural and historic properties. Pedestrian traffic to and from monk seal locations in remote areas could directly affect archaeological sites located along the path of access. Shipwrecks and other offshore sites have the potential to be impacted by vessel-based activities. The removal of monk seals from within coastal fish ponds could possibly result in minor structural damage to these sites. These effects can be mitigated by the seal behavior modification actions included in Alternative 4 and by implementation of the mitigation measures presented in Section 5.5.
CUMULATIVE EFFECTS				

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
Archaeological Sites, and other Historic Sites, and Cultural Properties	**Negligible contribution –** The temporary nature of monk seal research and enhancement activities and their restriction to the shoreline and immediate off-shore zones would limit encounters with cultural or historic properties. Some potential exists for direct impacts on archaeological sites, but these can be mitigated by the implementation of mitigation measures presented in Section 5.5. Compared to other sources of disturbance to cultural and historic resources including development, major storm events, previous military actions (*i.e.,* warfare), looting or other deleterious activities, the contribution of any alternative to cumulative effects on cultural and historic resources would be negligible.			

Table 4.9-11 Summary of Direct/Indirect and Cumulative Effects – Recreation and Tourism

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
RECREATION AND TOURISM				
DIRECT / INDIRECT EFFECTS				
Recreation Experience and Cost, and Public Safety	**Negligible** - small portions of some public beaches may be cordoned off but benefits associated with increased wildlife presence. Pup translocations would continue to minimize human-seal interactions.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals. While there is potential for increased seal-human interactions due to lack of behavioral modification, any change in these interactions is still likely to be negligible.	**Moderate beneficial** – same as Alternative 1. Potential for more wildlife viewing opportunities of monk seals. Despite evidence of shark predation on seals, there is no evidence that more monk seals in the MHI will lead to more shark attacks on humans. Public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized.	**Moderate beneficial** – same as Alternative 3.
CUMULATIVE EFFECTS				
Recreation Experience and Cost, and Public Safety	**Negligible contribution** - alternatives would take place against a backdrop of recovering recreation and tourism levels due to the nation's economic downturn. Direct and indirect effects are anticipated to be so small, none of the alternatives is expected to contribute to overall cumulative effects on recreation and tourism.			

Table 4.9-12 Summary of Direct/Indirect and Cumulative Effects – Environmental Justice

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
ENVIRONMENTAL JUSTICE				
DIRECT / INDIRECT EFFECTS				
Disproportionate Effects on Minority Populations	**Negligible -** disproportionately high and adverse effects to environmental justice communities would not be likely because negligible to no effects are expected to fishery resources or cultural resources and historic properties.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals. While there is potential for increased seal-human interactions due to lack of behavioral modification, any change in these interactions is still likely to be negligible.	**Negligible -** same as Alternative 1.	**Negligible -** same as Alternative 1.
CUMULATIVE EFFECTS				
Disproportionate Effects on Minority Populations	**Negligible contribution** - none of the alternatives would likely contribute to cumulative effects that would raise environmental justice concerns.			

Table 4.9-13 Summary of Direct/Indirect and Cumulative Effects – Military Activities

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (Preferred Alternative)	Alternative 4: Enhanced Implementation
MILITARY ACTIVITIES				
DIRECT / INDIRECT EFFECTS				
Military Activities	**Negligible –** no direct effect on military activities. Translocation of seals would likely not involve USCG. Any small areas to be cordoned off around seals would not likely affect military activities or operations.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
CUMULATIVE EFFECTS				
Military Activities	**Negligible contribution** -RFFAs that may potentially affect military activities and operations may include but are not limited to those actions that could alter the ability of the military to carry out missions, additional administrative requirements, new restrictions or changes to areas where operations may occur, or other potential natural disasters such as tsunamis or hurricanes, etc. Direct and indirect effects associated with alternatives would be negligible, thus would not contribute to the overall cumulative effects on military activities.			

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5.0 NEPA COMPLIANCE, IMPLEMENTATION, AND ADAPTIVE MANAGEMENT

5.1 IMPLEMENTATION OF THE HAWAIIAN MONK SEAL RECOVERY ACTIONS PEIS UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT

The purpose of this chapter is to:

1) Explain procedures that will be used to implement future National Environmental Policy Act (NEPA) compliance on permitting activities addressed in the Final Programmatic Environmental Impact Statement (PEIS) for Hawaiian Monk Seal Recovery Actions;
2) Document actions planned or underway to address concerns raised during preparation of this PEIS regarding translocation, vaccinations, behavioral modification, and stakeholder and community coordination; and
3) Provide an overview of additional activities (or mitigation measures) intended, in part, to support successful implementation of Hawaiian monk seal research and enhancement actions, and to mitigate potential adverse impacts that have been identified during the course of the NEPA process.

A number of recommendations for further actions were made during the comment period that fall within two general categories:

- Monitoring plans for the translocation and vaccination processes, and
- Additional outreach and coordination with local communities, stakeholders and partners.

The National Marine Fisheries Service (NMFS) determined it was most appropriate to address these issues outside the scope of any one alternative as these issues and recommendations are considered significant enough that they should be considered and implemented independent of any selected alternative.

5.1.1 *Need for NEPA Compliance*

This PEIS addresses research and enhancement permit activities that are proposed in the foreseeable future. NMFS staff, the permit applicant, and the general public should understand the process for preparing research and enhancement permit applications and how they would be reviewed for NEPA compliance using this PEIS. In addition to providing an overview of the NEPA compliance requirements, the following sections provide:

- Guidance to the Pacific Islands Fisheries Science Center (PIFSC) in preparing their permit applications;

- Information for other stakeholders regarding the level of subsequent NEPA review that would take place and when; and
- Monitoring plans for specific research and enhancement activities proposed under Alternatives 3 and 4.

5.1.2 *NEPA Compliance Review of Research and Enhancement Permit Applications using the PEIS*

The Final PEIS for Hawaiian Monk Seal Recovery Actions covers proposed research and enhancement programs for monk seals over the next 10 years or more. Within this 10-year timeframe, permit applications will require a NEPA compliance review of the information presented in this PEIS. Future NEPA compliance reviews will depend on the scope of the proposed research and enhancement. Subsequent site-specific or more detailed actions within the scope of this PEIS and associated Record of Decision (ROD) may tier from the background information and evaluation of impacts presented herein if necessary. Tiered NEPA documents will focus on issues "ripe for decision" (CEQ 2005). This process is described in more detail in Section 5.1.2.1 below.

Public notice of receipt of a new 5-year permit application submitted by PIFSC (File No. 16632) was published in the *Federal Register* on March 1, 2013 for a 45-day comment period (78 FR 13863). This application includes activities described in the Preferred Alternative (Alternative 3 – Limited Translocation). NMFS anticipates future submission of permit applications and permit amendments over the duration of this Final PEIS, as issued permits are only valid for a five year period and may be amended independent of or in response to a request from a permit holder.

Permit applications for research and enhancement activities can be submitted at any time of year, with one year lead-time recommended. At the time of submission, the NMFS Office of Protected Resources, Permits and Conservation Division determines if the proposed activity is covered by the assessment of impacts in this PEIS. Additional information about the permit process can be found on the NMFS website at http://www.nmfs.noaa.gov/pr/permits/.

The Record of Decision (ROD) for this PEIS, which will be published after the notice of availability of the Final PEIS, will identify any conditions of approval relevant to permit applications and permits, and will provide a listing of research and enhancement permit activities addressed by Alternative 3 (Preferred) identified in the Final PEIS. Both the PEIS and the ROD represent decision documents that will be used for the purpose of documenting NEPA compliance of ongoing and future activities addressed within the PEIS.

Proposed research and enhancement permit activities identified and analyzed within Alternative 3 (Preferred) will be subject to routine NEPA compliance, as described in the following subsection (Section 5.1.1.2 Permit Review Procedures). Proposed research and enhancement permit activities not identified and

analyzed in Alternative 3 (Preferred) will be subject to a separate NEPA compliance review, the level of which will be determined when the application is submitted.

5.1.2.1 *Permit Review Procedures for NEPA Compliance*

Applications for new permits (including application File No. 16632) and amendments or modifications to permits for research or enhancement activities on Hawaiian monk seals will be reviewed by the NMFS Office of Protected Resources. New permit application and permit amendments are processed using the following procedures with respect to NEPA compliance:

- NMFS review of the permit application and the Final PEIS for Hawaiian Monk Seal Recovery Actions and ROD to determine if the proposed research and enhancement is within the scope of Alternative 3 (Preferred). In addition, permit applications are distributed for a 30-day public review and comment;
- A Memorandum to the File will be prepared if the proposed research or enhancement activities in the permit application was identified and analyzed within the range of alternatives presented in the Final PEIS. The Memorandum would document that NEPA compliance for issuance of the permit is provided by the Final PEIS and any conditions of approval apply as documented in the ROD. A copy of the ROD would be attached to the Memorandum;
- Site-specific or more detailed actions may tier from this PEIS in the form of an Environmental Assessment (EA), EA accompanied by a Finding of No Significant Impact (FONSI), or a Supplemental Environmental Impact Statement (EIS), depending on the potential impacts of the activity. These tiered documents would be very focused, incorporating by reference detailed background information and evaluation of impacts presented herein; and
- For any research and enhancement activities proposed in future permit applications that is not within the range of alternatives presented and analyzed in this PEIS, a Categorical Exclusion, EA or Supplemental EIS would be prepared. The level of NEPA analysis will depend on the potential effects of the proposed new activity.

5.1.2.2 *Reporting Requirements*

NMFS Office of Protected Resources requires annual and final reports from permit holders. Special reports are also required for activities including, but not limited to, lethal takes and exceeding authorize take levels. In addition, permit holders must report on unexpected events they observe that could impose significant adverse effects upon the permitted species or the ecosystem of which they are part (Reporting and Recordkeeping Requirements Final Rule 1996).

NMFS Office of Protected Resources has a publicly accessible, web-based permit application and permit tracking system that includes information on: project information and description; location and take information; NEPA evaluation; project contacts; permit status; permit modifications; and reports. This web page is publicly accessible by interested parties (https://apps.nmfs.noaa.gov/).

The NMFS PIFSC has a publications webpage that includes technical memoranda, journal publications, data reports, conference proceedings, etc. and more related to Hawaiian monk seal research, which is publicly accessible by interested parties (http://www.pifsc.noaa.gov/psd/).

The NMFS Office of Protected Resources also has a publication web page that includes current and past Stock Assessment Reports for Hawaiian monk seals. PIFSC research and monitoring data is used to generate these reports, which include population trends and abundance estimates, distribution, factors limiting recovery, and other information pertinent to the status of Hawaiian monk seals. Please see http://www.nmfs.noaa.gov/pr/sars/.

5.2 *MONITORING PLAN FOR THE TWO-STAGE TRANSLOCATION PROCESS*

Concerns were raised during scoping and the public comment process for the Draft PEIS regarding the two-stage translocation process as proposed under Alternative 4 (Enhanced Implementation), in which weaned pups could be collected in the NWHI and released in the MHI. Specifically, some stakeholders wanted details about how researchers would choose release sites in the MHI and how the process would be evaluated for effectiveness over time.

The Preferred Alternative (Alternative 3) in this Final PEIS involves implementing a two-stage translocation program whereby weaned pups are taken from areas of lower survival to areas of higher survival within the NWHI, within the MHI, or from the MHI to the NWHI. ***This excludes taking weaned pups born in the NWHI to the MHI***. This translocation would include the option of returning the translocated seals to their birth location or nearest appropriate site at age 2 years and older. Note that seals born in the MHI and previously translocated to the NWHI may be returned to the MHI.

The generalized two-stage translocation strategy is detailed in Appendix F and covers activities proposed under Alternative 3 (Preferred) and Alternative 4. The specific provision for translocating pups from the NWHI and releasing them in the MHI an option included only in Alternative 4. A multitude of variables exist that contribute to uncertainty of outcomes, thus the translocation program would be monitored and guided by a complex and adaptive decision framework described in Appendix F.

A 'decision framework' is a tool that helps guide decisions throughout a process, in this case, the monk seal translocation process. Many of the inputs to the decision framework rely on direct observation of key indicators such as population status, juvenile survival rates, and outcomes from previous

translocation actions. Also, at various points in the decision framework, researchers would use a computer model (called a stochastic simulation model) updated with the most recent seal population data to estimate the likely range of benefits associated with different choices.

Two decision trees, one for each of the two stages of the translocation strategy, have been developed to support decision-making and assessment as translocation projects progress. The Stage 1 decision tree addresses translocation of weaned Hawaiian monk seal pups from areas of lower survival to areas of higher survival. The Stage 2 decision tree addresses returning previously translocated seals from the recipient site to their donor sites. The decision framework is described in detail in Appendix F and is briefly characterized below.

The decision framework consists of several progressive steps and is designed to structure the decision making process so as to maximize the benefits and reduce the risks associated with the translocation project, including the following:

- NMFS would carefully choose the donor and recipient sites to achieve the greatest possible benefit (in terms of increasing juvenile survival and enhancing the population);
- Public input would play a role in deciding the most appropriate release sites if translocations of weaned pups were done from the NWHI to the MHI (as proposed under Alternative 4). Specific release sites would be chosen both to minimize potential conflict with beach and ocean users and maximize the chances that the translocated seals would be successful. Seals would likely be most successful when they are released in remote areas where they are less likely to encounter people. It should be recognized that weaned seals will begin to travel around the island where they were released and will even swim between islands;
- Monk seal monitoring and intervention activities critical to a successful two-stage translocation between the NWHI and MHI (as proposed under Alternative 4) would require further development and refinement; these monitoring and intervention activities could be developed and refined under Alternative 3 (Preferred);
- NMFS would monitor recipient sites to ensure the capacity of a site to support additional monk seals is not exceeded. This would be determined from observations of juvenile condition and survival at each site, supplemented by simulation modeling to better quantify the probable benefit;
- NMFS would suspend translocation actions in response to unforeseen developments such as the failure to return previously translocated seals to their natal site or region once they reach the stipulated age;
- While seals are in the wild at the recipient site, NMFS would monitor them to learn as much as possible about their location, activities, health

and welfare, and whether any human-seal interactions were occurring. Initially seals would typically be monitored with satellite transmitters, and later through regular population assessments; or, if in the MHI, through the established Hawaiian monk seal sighting network; and

- Translocated seals that become socialized or involved in human-seal interactions would be managed in the same fashion as other seals through behavior modification or other measures appropriate to the situation.

Proper care and safe transport of seals as well as mitigating risks of transmitting disease via translocations are other important considerations that NMFS has accounted for. Details of the measures involved in selection, health screen, care in captivity, quarantine and unforeseen contingencies are addressed in Appendix G. NMFS has a great deal of experience handling and transporting monk seals, especially weaned pups, and best practices developed to date will be employed. As new information accrues during the implementation of future translocations, this would augment and help refine protocols further.

As envisioned, the translocation project would initially be implemented as a small-scale experiment. The first phase may involve the experimental translocation of a small number of juvenile or sub-adult seals from one site to another (*e.g.*, from MHI to NWHI) to better assess how well the second stage of the translocation would proceed. As the project proceeds, results from the preceding actions would be used to inform future efforts and better predict the expected outcome from each candidate action. For example, researchers are particularly interested in knowing how survival of translocated seals would differ from those that have spent their entire lives at a site. Once there are data with which to assess that difference, it would be used to better refine the predictions from the simulation model.

Two particular areas of concern for Hawaiian monk seals with two-stage translocation include:

- Minimizing the risk of disease transmission; and
- Minimizing stress and the potential for harm during the actual process of capturing, transporting and releasing seals.

These details are covered in depth in Appendix G. In brief, seals being considered for translocation would be given a thorough health screening prior to completion of the translocation operation. Veterinary care would be provided from the point of capture until release, and quarantine procedures would be followed as appropriate to avoid transporting an ill animal and exposing other seals to infectious disease. Translocated seals would also be monitored closely after release to detect any health problems that may arise.

5.3 *PLAN FOR THE VACCINATION PROCESS*

The proposed vaccination program is somewhat unique among the actions in this PEIS, in that it is designed to address a potential, rather than a realized, threat to the Hawaiian monk seal. That is, according to research to date, infectious disease does not currently appear to be significantly impacting the species. However, there is great potential for infectious disease to have devastating effects on the species.

Two factors make disease outbreaks especially concerning:

1) Hawaiian monk seals have been largely isolated for most of their evolutionary history in the Hawaiian Archipelago. Until humans arrived on the islands, there were no terrestrial mammals (and their associated diseases) except the Hawaiian hoary bat. Now there are numerous domestic, feral and invasive mammals on the islands that pose a threat as disease vectors.

2) The monk seal population is already quite small and has extremely low genetic diversity, which may make the species especially vulnerable to the outbreak of a new disease.

Because of these concerns, NMFS is committed to being prepared to rapidly respond to, if not prevent, outbreaks of the perceived greatest viral disease threats through vaccination research and enhancement activities. There are currently two types of viral disease that pose a great potential threat to monk seals, but for which vaccines have already been developed.

Morbilliviruses are a group of related viruses that cause disease in a wide variety of species. Morbillivirus outbreaks have caused mass die offs in other seal populations, including a 1988 event in which approximately 18,000 (70% of the population) harbor seals (*Phoca vitulina*) in Europe died from Phocine Distemper Virus (PDV) infection (Heide-Jørgensen *et al.* 1992). A second outbreak occurred in the North Sea in 2002, which killed over 20,000 harbor seals (Jensen *et al.* 2002). Outbreaks of canine distemper virus (CDV) killed 5-10,000 Baikal seals (*Pusa sibirica*) in 1987-1988 (Grachev *et al.* 1989) and 10,000 Caspian seals (*P. caspica*) in 2000 (Kennedy *et al.* 2000).

West Nile virus (WNV) is a mosquito-borne pathogen that causes disease in a wide variety of wildlife, domesticated species and humans. WNV is currently not present in Hawaii, and the State has rigorous surveillance and response plans for this virus due to its public health importance. Although WNV has not been known to affect wild marine mammals to date, the death of a captive monk seal in Texas from WNV infection indicates monk seals are susceptible. It has also killed captive harbor seals in the mainland U.S. Thus, the possibility of extensive mortality in monk seals exists if the virus were to be introduced to Hawaii.

Fortunately, vaccines are in existence for both WNV and morbillivirus. There are two main concerns when giving an existing vaccine to a new species. The first is that the vaccine is safe (does not cause disease or any dangerous reaction) and

the second is that it is effective (actually protects the animal from disease as intended). Both the vaccines for WNV and CDV have been proven safe and effective in other species and have been tested on some captive monk seals with no ill effects (see Appendix E).

The proposed vaccination activities (detailed in Appendix E) for Hawaiian monk seals involve two primary elements as follows:

1) Continue research to test these vaccines on captive seals, confirm the vaccines' safety, and determine whether the expected immune response occurs by following up with blood tests; and

2) Be prepared with response plans should a "trigger" occur (for example, a case of morbillivirus in a wild monk seal). Even in the case of such a response, vaccinations would be initially limited to the population perceived to be at immediate risk, and would be expanded only after confirmation of safety and efficacy.

Prophylactic (preventative) vaccination may be considered in the future, but again, only after careful and conservative incremental testing proves that such an approach would be safe and effective.

5.4 PLAN FOR DEVELOPMENT OF A BEHAVIOR MODIFICATION PROGRAM

As described in Section 2.5, a variety of aversive and disruptive stimuli may be considered for behavioral modification.

Behavioral modification that does not involve the use of aversive stimuli and which does not necessitate a research permit includes humans altering their behavior in the presence of a curious seal by avoiding eye contact and ignoring the seal; refraining from making noise near, touching, swimming with, and feeding seals; and moving away and leaving an area when seals actively approach humans. Following these guidelines would be an essential component to preventing the development of abnormal socialization of seals with humans. These guidelines are available on the NMFS web site

http://www.fpir.noaa.gov/PRD/prd_good_neighbors.html and are an important component of ongoing outreach efforts.

The Hawaiian monk seal behavior modification program would be a joint effort between NMFS and their partners. This partnership would also have a public nexus as it would require participation by the community in reporting and describing seal behaviors/interactions throughout the process. NMFS would establish a Behavior Modification Advisory Committee that would consist of a group of researchers and managers (internal and external) to help with the development and implementation of the program. This committee would also serve to determine if an animal of concern is a candidate for behavioral modification, continue to advise as each case progresses, and provide recommendation for modifying or escalating techniques.

The program would also consist of implementation teams. These are the groups that would be on-site monitoring and documenting behaviors/interactions and applying any behavioral modification methods. Implementation teams would receive training to maintain consistent data records, safety protocols, and application of behavior modification techniques. It is important that these techniques be administered properly according to a standardized research plan designed to address the specific behaviors displayed by each seal, and that the efficacy of methods applied be accurately recorded. Therefore, only people that have proper authorization and training would be allowed to apply behavioral modification techniques, including aversive conditioning techniques. A core mission of these teams would also be conducting outreach to explain the actions being undertaken and educating the public on proper behaviors to prevent the socialization of seals with humans.

Behavioral modification techniques would be applied only in situations where wild seals are beginning to regularly demonstrate behaviors that put themselves or humans at risk. Some examples include (but are not limited to):

1) Regularly interacting with snorkelers, divers or other ocean users. These interactions are directed behavior towards humans, which could include rubbing, scratching, biting, soliciting feeding, and more. Early on when these behaviors are novel or low in terms of aggression, low-level aversive stimuli or alternatively, positive stimuli or removing the positive stimuli to redirect behaviors, may be applied. If these behaviors are more ingrained the level of aversive stimuli applied may be escalated as appropriate.
2) Regularly interacting with fishermen or fishing gear. Seals that repeatedly target nets or fishing lines are at risk of drowning, hooking, entanglement and other injuries. Some deterrents may be effective at discouraging seals from supplementing their diet by depredating fishing gear.

There are a number of aversive or possibly positive stimuli that could be used for monk seals. It is difficult to predict the efficacy of any technique until it is applied. Any method would be carefully tested in an experimentally rigorous fashion to determine it is safe and effective prior to being adopted as an approved tool for monk seal behavior modification. Hawaiian monk seals or other pinnipeds in captivity may be used to test each method prior to initiating research trials on wild monk seals.

The successful development of this program would depend in large part on public input and cooperation. Of particular importance would be immediate notification of any seal exhibiting the early stages of habituated behavior. This would require ongoing dialogue with ocean users and interest groups likely to encounter seals in their recreation or commercial activities. By identifying which tools are most appropriate for each situation, and having an implementation team trained in the proper application of each technique, NMFS hopes to reduce

the likelihood that monk seal recovery in the MHI would be accompanied by undue hardship or inconvenience for the public.

5.5 *MITIGATING POTENTIAL IMPACTS TO CULTURAL RESOURCES, CULTURAL PRACTICES, AND HISTORICAL PROPERTIES*

NMFS intends to implement activities (or mitigation measures) described below that are specifically designed to mitigate potential adverse impacts to cultural resources and practices, and historic properties, including traditional cultural properties. This section provides an overview of these mitigation measures and further description is provided in Appendices B and K. Additional activities that engage the local community, such as those described in Section 5.6, are also expected to support this type of mitigation through improved community participation and communications with NMFS.

5.5.1 *Coordination with the State of Hawaii, State Historic Preservation Division*

As mentioned in Section 3.4.7, the Hawai'i State Historic Preservation Division (SHPD) is currently updating its Geographic Information System (GIS) database of historic properties located within the MHI. This database will show the exact location of all historic properties (including traditional cultural properties) for which accurate location coordinates are available. Once the database is fully operational, it will be possible to quickly identify any documented sites located within the vicinity of the proposed research and enhancement activities. The SHPD GIS database can serve as a useful tool in assessing locations where the activities will be implemented to avoid impacting known historic properties. Teams planning recovery activities should be able to ascertain the types and locations of the identified historic properties located within the areas in which the activities will be implemented. This information, supplemented by knowledge from local individuals, can help in determining where and how to conduct activities to minimize direct impact on historic properties. In addition, SHPD staff is located in each county and possess a wide knowledge base of documented historic properties on their respective islands. The SHPD staff may be able to suggest areas that would be suitable and unsuitable for the translocation of seals. They can also provide assistance in planning monitoring or medical related activities. Whenever possible, NMFS staff will consult with SHPD during the planning of monk seal activities so as to obtain their input and guidance.

5.5.2 *Training in the Recognition, Avoidance, Reporting of Cultural Resources and Historic Properties*

While many of the archaeological and cultural sites located within the project area for proposed Hawaiian monk seal recovery actions have been previously identified, others remain either undiscovered or unrecorded. When appropriate and feasible, specific NMFS staff and volunteers conducting monk seal recovery actions will be designated to be responsible for recognizing, avoiding, and

reporting cultural resources and historic properties in the field and these personnel will receive sufficient training to carry out this responsibility. The training will be developed by NMFS in close collaboration with the Hawaii SHPD and other qualified organizations and individuals. This training will include an overview of the types of cultural resources, archaeological sites, and historic properties (including traditional cultural properties) that are likely to be encountered, as well as instructions on their recognition and avoidance. Proper and respectful protocol to be practiced while working around cultural and historic sites would also be discussed. In addition, the training will cover the procedures for reporting the inadvertent discovery of unrecorded resources, archeological sites and/or historic properties, most particularly human remains, should they be encountered.

This course of training will also include the recognition of shoreline cultural resources, such as strand dwelling plants utilized in traditional medicine or edible seaweeds that were traditionally gathered along the shoreline. Such resources could be impacted by pedestrian or boat traffic associated with monk seal recovery related activities. Knowledge of such resources is expected to allow recovery teams to recognize and avoid impacting them.

5.5.3 *Procedures Regarding Monk Seals in Fishponds*

NMFS will develop a protocol for dealing with the removal of Hawaiian monk seals if they enter traditional fishponds. This protocol would involve consultation with the landowner and/or kahu (caretaker) of the pond, SHPD, local Native Hawaiian Organizations (if appropriate), and other appropriate entities to plan and coordinate the safe removal of the monk seal in a manner that would have the least impact on the structural integrity of the fishpond.

5.5.4 *Northwestern Hawaiian Islands*

Permits are required for access to conduct Hawaiian monk seal research and enhancement activities within the limits of the Papahānaumokuākea Marine National Monument. Any activities associated with monk seal recovery actions undertaken within the NWHI must therefore comply with Monument regulations and the terms and conditions of Presidential Proclamation 8031.

Monument regulations state that "permittees [must] attend a cultural briefing on the significance of Monument resources to Native Hawaiians" and that there are "prohibitions against the disturbance of any cultural or historic property" (NOAA 2008b). Thus, the "Monument permit program allows for a comprehensive review of proposed activities and will be administered to ensure compliance with Presidential Proclamation 8031, as well as other applicable Federal statutes (such as the NHPA) and state laws and regulations" (NOAA 2008b).

Under the terms of the Monument permit, researchers and volunteers involved in Hawaiian monk seal recovery actions coordinate their activities with the

Monument archaeologist and historic preservation specialists to ensure that they do not adversely impact any of the Monument's historic properties. All researchers landing on Nihoa or Mokumanana (Necker) are instructed to limit their activities to coastal areas. The only exceptions are camping in designated camping areas and traveling between coastal areas.

The campsites in the NWHI to be used by researchers have already been in seasonal use since the 1980s, with rigorous protocols in place to protect the natural and cultural resources surrounding them (see Appendix L, Monument Permit PMNM-2011-001). These protocols will be followed by all researchers involved in Hawaiian monk seal recovery actions to ensure that use of the NWHI camps will not impact cultural and historic resources.

5.6 COORDINATION WITH STAKEHOLDERS AND COMMUNITIES

NMFS intends to further develop and maintain close coordination with key stakeholders, community members, and partners to facilitate implementation of the proposed recovery actions. Ocean-oriented stakeholders and community members, such as fishers, surfers, Native Hawaiian practitioners, coastal property managers, etc., are among those most likely to encounter monk seals or most likely to have unique knowledge or experience that would be useful for successful implementation of the proposed activities in the MHI. Government agency and non-government organizations have been, and will continue to be, essential partners in successful recovery action implementation. This section summarizes community-based programs NMFS has and/or will support to the maximum extent possible and discusses how these or similar programs could facilitate implementation of the proposed recovery actions.

5.6.1 Marine Mammal Response Network

NMFS manages the Marine Mammal Response Network in Hawaii in partnership with several government and non-government partners, and with oversight and authorization from the NMFS National Marine Mammal Health and Stranding Response Program. The network is comprised of island-based response coordinators who oversee the activities of numerous volunteers and partner agency staff. The network:

- Responds to monk seals (and other marine mammals) that are reported to be sick, injured, entangled, or hooked in the MHI.
- Responds to "routine" monk seal haul outs to monitor seals, and when seals are in areas of high human use, cordons off a "seal protection zone" around the seal to protect the seal from disturbance and alert the public that a seal is resting on the beach.
- Conducts outreach and education activities, such as giving presentations at schools and staffing information booths at community events.

The network has grown significantly over recent years, and now has hundreds of trained volunteers and NMFS-funded coordinators on almost every inhabited island in the MHI. The sighting data that accrue from this network of observers contribute directly to monk seal population assessment tasks in the MHI. For example, resights of known seals are used to calculate age-specific survival rates, reproductive rates, and movements. Sightings of previously unknown seals, along with any identifying marks that may distinguish them, are particularly useful because they help determine the number of seals present in the MHI.

The sighting data are also used to characterize seal distribution and haulout habitat and for a variety of other purposes. The sighting network is well suited for seal monitoring in the MHI, where seals are distributed over a vastly larger area and where it would take a very large staff to canvas and detect all of the seals now reported through the sighting network.

The Marine Mammal Response Network also includes a network of Hawaiian practitioners who advise NMFS on appropriate integration of Hawaiian cultural protocols with response activities.

Members of the network are active in community engagement, education and outreach related to Hawaiian monk seal recovery, and will support and/or participate in many of the community-based efforts that result from the MHI Monk Seal Management Plan, outreach plan and partnership programs described below.

5.6.2 *Hawaiian Monk Seal Recovery Team*

Pursuant to the ESA, NMFS may engage a recovery team as part of its endangered species recovery efforts. As indicated in ESA Sec 4(f)(2), "(t)he Secretary (of Commerce), in developing and implementing recovery plans, may procure the services of appropriate public and private agencies and institutions and other qualified persons. Recovery teams appointed pursuant to this subsection shall not be subject to the Federal Advisory Committee Act."

NMFS convened a Hawaiian Monk Seal Recovery Team (HMSRT) to support development of the revised Hawaiian Monk Seal Recovery Plan (2007). As of late 2013, PIRO was in the process of convening a new HMSRT to support implementation of the revised recovery plan, including implementation of research and enhancement actions proposed in this PEIS. The expected role of the new HMSRT will be to advise NMFS on a variety of matters concerning the conservation and recovery of the endangered Hawaiian monk seal. The new HMSRT is expected to focus, in particular, on matters related to implementing the revised Hawaiian Monk Seal Recovery Plan (2007) and any related policy documents or plans that arise from Hawaiian monk seal recovery plan implementation, such as the MHI Management Plan discussed in Section 5.6.3.

Members of the new HMSRT are expected to be selected to provide NMFS with advice from a wide range of relevant expertise, including expertise in Hawaiian

culture practices, ocean-related tourism, subsistence and recreational fishing, etc. HMSRT advice may be related to evaluating research and enhancement actions, assessing the efficacy of achieving recovery criteria, and recommending new or emergency actions that enhance the recovery of the species.

NMFS expects that research and enhancement actions proposed in this PEIS will be considered by the HMSRT. NMFS recognizes that achieving successful Hawaiian monk seal conservation and implementation of the Hawaiian Monk Seal Recovery Plan, including the research and enhancement actions proposed in this PEIS, can be facilitated by considering a wide range of perspectives and knowledge held by a diverse group of people from Hawaii and elsewhere.

New HMSRT members will be selected to provide NMFS with knowledge, expertise, and experience that are otherwise not available within NMFS. HMSRT advice will represent the views of the team members and may not necessarily reflect the views and polices of NMFS or any other agency or organization.

5.6.3 Main Hawaiian Islands Management Plan

The Hawaiian Monk Seal Recovery Plan (NMFS 2007) directs NMFS to create a MHI Hawaiian Monk Seal Management Plan that addresses the full scope of monk seal management needs in the MHI. Considering this broad mandate, NMFS envisions a MHI Hawaiian Monk Seal Management Plan that will include roles for NMFS and partner government agencies, as well as non-government organizations (NGOs), communities, and individual stakeholders. Completing preparation of such a plan in a way that effectively engages our government and non-government partners and stakeholders is a high priority for NMFS.

The MHI Hawaiian Monk Seal Management Plan will be a strategic plan that presents management strategies and associated activities. These strategies are expected, in part, to facilitate successful implementation of the proposed research and enhancement actions, as well as to help mitigate potential adverse impacts associated with their implementation. The MHI management plan will play an important role in engaging communities, both in its preparation and implementation.

In preparing the MHI Hawaiian Monk Seal Management Plan, NMFS will continue to work collaboratively with partners, stakeholders, and communities to better define and elucidate threats to monk seals in the MHI and contributing factors. A specific planning methodology will be used to clarify the meanings of direct threats, indirect threats, and other terms used in discussing monk seal management in the MHI. In addition, the planning process will develop strategies and activities intended to reduce or eliminate the direct and indirect threats. Participatory development of the plan will allow for various groups and individuals to articulate their priorities for monk seal management, and shape a framework for how they would like to be engaged in the future.

NMFS and others have been developing management strategies and policies to address threats to monk seals in the MHI for more than 10 years. NMFS anticipates that all or most of the monk seal management activities currently underway or planned for near-term implementation, including many of the research and enhancement actions proposed in the PEIS, will be considered during development of the MHI Hawaiian Monk Seal Management Plan. The planning process will allow for the current efforts to be more systematically evaluated and integrated with additional management efforts (or "strategies" and "activities") that will be identified during the planning process.

In October 2002, The Workshop on the Management of Hawaiian Monk Seals on Beaches in the MHI was co-sponsored by the Marine Mammal Commission, NMFS, and the State of Hawaii, DLNR, Division of Aquatic Resources. Over a three-day period, stakeholders, including representatives from federal, state and city and county agencies, NGOs, and interested individuals discussed many issues of concern and importance. Comprehensive comments and suggestions were compiled in a final report. This report served as the first community-based scoping of management issues relevant to the creation of a comprehensive management approach for seals in the MHI.

In March 2006, NMFS PIRO sponsored a two-day MHI Hawaiian Monk Seal Management Workshop. Representatives from PIFSC, DLNR, HIHWNMS, and other agencies were in attendance. Areas of discussion included adaptive management approaches to high profile issues such as emerging disease concerns, pups born on popular beaches, techniques and issues dealing with conditioned or habituated seals, pups born near freshwater streams (with associated disease risk), captive care and rehabilitation of sick or injured seals, and volunteer network development and outreach. This was an important step in the continuing development of a MHI Hawaiian Monk Seal Management Plan.

Building on the results of the two workshops and other efforts, NMFS developed a Draft MHI Hawaiian Monk Seal Management Plan in 2010 and presented the draft plan to the Hawaiian Monk Seal Recovery Team in February 2011. The Recovery Team had significant concerns with the format of the draft management plan.

In response to these concerns, NMFS adopted a new planning approach, based on the Open Standards for the Practice of Conservation, which is described further below. Part of this new planning approach includes developing a comprehensive and effective management plan for monk seal in the MHI by engaging partners, stakeholders, and others with important knowledge and experience.

Meetings were held with an inter-agency working group in July 2012, as well as a workshop co-hosted by the Monk Seal Foundation to facilitate input from various partners, stakeholders, and community members with specific expertise, including recreational fishing, Hawaiian cultural practices, ocean-related tourism, etc. More meetings and engagement with fishermen, enforcement,

Ocean Safety, and other groups and individuals will continue as the plan development continues.

5.6.4 *Outreach Plan*

Hawaiian monk seals face many threats across their range, from direct threats (direct causes of mortality) to indirect threats and contributing factors. There are also opportunities, such as public interest in conservation, which can contribute positively to recovery. Public knowledge and attitudes are at the root of nearly all the threats facing monk seals in the MHI.

While many people in Hawaii value the endangered and indigenous animals with which we share our ocean and beaches, there is also a lack of knowledge, sometimes leading to potentially unsafe interactions between seals and humans, and even animosity toward Hawaiian monk seals from some people and ocean user groups, often due to differing attitudes about seals. This underscores the need for improving and increasing outreach and effective flow of accurate information to the public.

For several years, NMFS has created an internal Hawaiian Monk Seal Recovery Program Outreach Plan. In the plan (usually updated annually), the Recovery Program identifies goals, objectives, and outreach strategies and messages for NMFS outreach efforts. However, because of the significant role that outreach can play in management, the internal outreach plan is being modified and adapted to fit within the MHI Hawaiian Monk Seal Management Plan discussed in Section 5.6.3.

The primary goal of the Outreach Plan is to use outreach and education to inform citizens and thus enable them to think critically, and make decisions about Hawaiian monk seals based on sound science and cultural information, to facilitate monk seal population recovery. By effectively using outreach and education in both overarching and targeted strategies, we can widely broadcast the messages of the recovery program, while addressing community concerns and building public support (social and political) to reduce specific threats and achieve our recovery goals.

As part of the development of the outreach strategies related to the MHI Management Plan, significant input will be obtained from partners, stakeholders, and other individuals with expertise in conservation outreach and education. In the "Outreach Plan" section of the MHI Management Plan, NMFS will identify current overarching issues that are necessary to broadly influence threats to monk seals, and then use the Management Plan to determine where targeted outreach strategies can reduce or eliminate a specific threat.

5.6.5 *Partnership Grants*

Subject to available funding, NMFS PIRO has and will solicit competitive applications for partnerships supporting specific programmatic activities related

to Hawaiian monk seal recovery, in particular activities related to recovery in the MHI. NMFS anticipates that priority will continue to be given to community-based and community- integrated projects or projects with an educational or outreach component geared to elevate public awareness and build capacity from the community level for Hawaiian monk seal recovery. This priority includes projects designed to achieve the following outcomes:

- Improve awareness and understanding among local residents regarding Hawaiian monk seal biology, endangered species status, and recovery issues and opportunities.
- Improve local resident understanding of, and participation in, activities that promote Hawaiian monk seal recovery, including community education and outreach, monk seal haul-out responses, seal behavior modification, seal relocation within the MHI, and mitigation of fishery interactions and other human-seal interactions.
- Facilitate productive communications between the NMFS Hawaiian monk seal recovery program and local residents, especially Native Hawaiian communities and fishermen.
- Host meetings with Hawaiian monk seal recovery program staff, volunteers, partners, fishermen, and other ocean users to help build and maintain productive working relationships and facilitate effective implementation of the Hawaiian Monk Seal Recovery Plan (2007), including development of the Main Hawaiian Islands Hawaiian Monk Seal Management Plan.
- Identify and describe constraints to, and opportunities for, enhanced collaboration between the NMFS Hawaiian monk seal recovery program and the local residents.
- Conduct all of the above in close collaboration with the NMFS Hawaiian monk seal recovery program and consistent with the NMFS Hawaiian Monk Seal Recovery Plan (2007).

Under this grant program, NMFS anticipates funding projects as grants or cooperative agreements. NMFS will be substantially involved in the management or operation of the program if a project is funded through a cooperative agreement. This substantial involvement may include, but is not limited to, partnering in collaborative efforts or re-direction of activities to meet regional interests. Substantial involvement may also include NMFS staff assisting in development of outreach materials and activities, development of meeting agendas and participant lists, conduct and facilitation of meetings, and recruitment, training and management of volunteers.

Funding for this program is contingent upon Congressional appropriations. Applicants are selected by NMFS on a competitive basis. More information about this program will be available via announcements of federal funding opportunities posted at: http://www.grants.gov.

Another opportunity for partnership grant funding is through the NMFS Protected Species Cooperative Conservation program. Through this program, NMFS has awarded a grant (under Section 6 of the Endangered Species Act) to DLNR to support Hawaiian monk seal (and sea turtle) conservation activities, including outreach and response coordination activities with local fishers. Continued implementation of Hawaii's Section 6 grant program could help enhance understanding and support of Hawaiian monk seal recovery actions within the fishing community and help NMFS further mitigate potential associated adverse impacts on fishing activities.

5.6.6 *Incorporating Community Feedback into Research and Enhancement Activities*

To support activities proposed in Alternative 3 (Preferred), coordination with community members should continue to draw on extensive two-way communication and information sharing between NMFS and the key stakeholders and community members as discussed above. This would be facilitated by continuing and expanding programs, such as those discussed above, that entail participatory planning and implementation, education and outreach, and other interactive and participatory activities.

If adequately engaged and motivated, local community members can support monitoring and reporting of location-specific and historical information that could be especially valuable before, during and after translocation within the MHI, behavior modification, and vaccination activities. This support could include monitoring and reporting of monk seals and assessment of various local environmental factors. For instance, with NMFS support and coordination, community members could monitor and report on the behavior of seals before and after behavior modification techniques are applied. In another example, community members could use their local environmental knowledge to help NMFS assess and select appropriate sites for the release of seals translocated within the MHI. The various types of community-based support can be summarized as follows:

Monk Seal Monitoring and Reporting:

- Detecting and reporting seal presence or absence;
- Documenting and confirming individual seal identification;
- Observing and reporting seal behaviors;
- Observing and reporting seal health and body condition; and
- Observing and reporting human-seal interactions, and fishery interactions.

Environmental and Habitat Assessment:

- Observing and reporting human uses – types and levels of shoreline use, fishing, etc.; and

- Observing and reporting monk seal uses – frequency of foraging, pupping, resting, molting, etc.

Community-based programs and activities, such as those described above, can be used to build capacity within local communities to conduct monitoring on temporal and spatial scales that would otherwise be extremely difficult to achieve. In addition to supporting wide spread coverage and timely monitoring and reporting, these programs could also help NMFS and its partners be more aware of, and responsive to, emerging opportunities and constraints to monk seal recovery throughout the MHI.

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7.0 *LIST OF FEDERAL AND STATE AGENCIES, ELECTED AND APPOINTED OFFICIALS, NATIVE ORGANIZATIONS AND OTHER NATIVE GROUPS, ADVOCACY GROUPS, AND OTHER POTENTIALLY INTERESTED PARTIES*

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Hinaikamalama Joaquin	Thea Johanos	Ray Johnson
Millie Johnston	Dana Jones	Nathan Kaai
Shyneese	Makaala Kaaumoana	Greg Kahn
Hope Kallai	Kamoho'alii Kama	Kuhaapono Akio Kanakaole
Daniel Kanehola	Kimokeo Kapahulehua	Ke'eaumoku Kapu
Angie Kaufman	Kiana Kauwe	Joan Kealaliv
Kekahuna Keaweiwi	Keith Kenyon	Cheryl King
Faith Kinimaka	John Klein	Joyce Klein
Warmen Koga	Wulani Kohler	Kipukai Kualii
Frances Kweramurn	Ke Ana La'ahana	Gordon Labedz
Pita Lata	Leimoni & Marvin Lau	Michael Kumukauoha Lee
Princess Lehuanani	Quintin Leong	Bill Lewis
Jerrie Louis	Cheryl Lovell-Obatade	Marvin Lum
Gregory Macias	Lesley Macpherson	Thomas Makanani
George Matsuda	Mark Matsunaga	George Matsupa
Jane McClaran	Laura McCue	Joe McDonald
Mytrea McKeague	Ryan McKeague	Susan McMaki
Frank Medeirios	John Mestor	Scott Mijares

Name	Name	Name
Kevin Millett	Joel Miyahiro	Mary Frances Miyaoshiro
Lloyd Miyashiro	Lloyd Miyashiro	Mary Miyashiro
Jen Miyosho	Isaac Moon	Shyla Moon
Yasu Morikawa	Roy Morioka	Roy Morioko
Bill Mossman	Mary Musacchio	Layne Nakagawa
Walter Naki	David Nichols	Marjorie Niegler
Amy Nordin	Jerry Norris	Akira Obatake
Dean Ogoshi	David Okamoto	Mimi Olry
Patrick Opay	Basil Oshiro	Keith Oshita
Tina Owens	Mark Oyama	Ke Kane Pa
Aimoku & Lehua Pali	Frank Parrish, PhD	Linda Paul
Jeffrey Pawloski	Randall Perez	Sharon Pomroy
Keoki Puaoi	Tineal Puaoi	Barbara Public
Darrell Rapozo	Walter Ritte Jr.	Justin Rivera
Wayne Riverea	Darron Roberts	Kim Rogers
Kimo Rosa	Lauren Roser	Rebecca Rogers
Dale Sarver	Victor Sasaki	Season Sakuiantay
Sharon Schiller	Robert Schmidt	Jace Schaefer
Callie Schwab	Sophia Senter	Jennifer Schultz, PhD
Tad Sheldon	Ray Shirakawa	Craig Severgace
Kitty Simonds	Colleen Sindzinski	Dennis Silva
Alice Smith	Caitlin Snyder	Rene Siracusa
Gregory Spencer	Kathryn Stanaway	William Snyder
Cheryl Sterling	Goldie Stewart	Stacey Stella
Mark Sullivan	Joel Sumida	Roxanne Stewart
Reid & Debbie Takayawa	Randall Takenala	Mahelani Sylva
Calvin Tani	Phillip & Elizabeth Tanner	Lane Tamuru
Teresa Tico	Heather Tipon	Ken Taylor
David Tsunehiru	Jason Turner, PhD	Erik Tong
Poola Villarimo	Duane Wakutle	Malie Unabia Verka
Nappes Watoya	Heide Joy Weber	Patrick Wardell
Barry & Mary Werthwine	Don White	Drake Wells
Robert Winter	Anita Wintner	Sue White
James Yamamoto	Naomi Yamamoto	Tracy Wurth
Lance Ymatsumoto	George Young	Clay Yamauces

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