DRAFT
Programmatic Environmental Impact Statement

Hawaiian Monk Seal Recovery Actions

August 2011

Prepared for:

This page intentionally left blank.

Hawaiian Monk Seal Recovery Actions
Programmatic Environmental Impact Statement

August 2011

Lead Agency:	United States Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service Pacific Islands Regional Office Division of Protected Resources Honolulu, Hawaii
Responsible Official:	Dr. Jeff Walters, Marine Mammal Branch Chief
For Further Information Contact:	Division of Protected Resources Pacific Islands Regional Office National Marine Fisheries Service 1601 Kapiolani Blvd., Suite 1110 Honolulu, HI 96814 (808) 944-2200

Abstract: 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 (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 management responsibilities, NMFS funds and conducts research and enhancement activities on endangered Hawaiian monk seals in the Northwestern Hawaiian Islands and Main Hawaiian Islands. 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 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 (Alternative 4) encompasses a broad scope of research and enhancement activities that would yield greater survival benefits to the species over the long-term than would be expected under the other alternatives.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

This page intentionally left blank.

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
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
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

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 (2009) best estimate of total abundance is 1,125 seals (Carretta *et al*., 2011 SAR draft). 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.

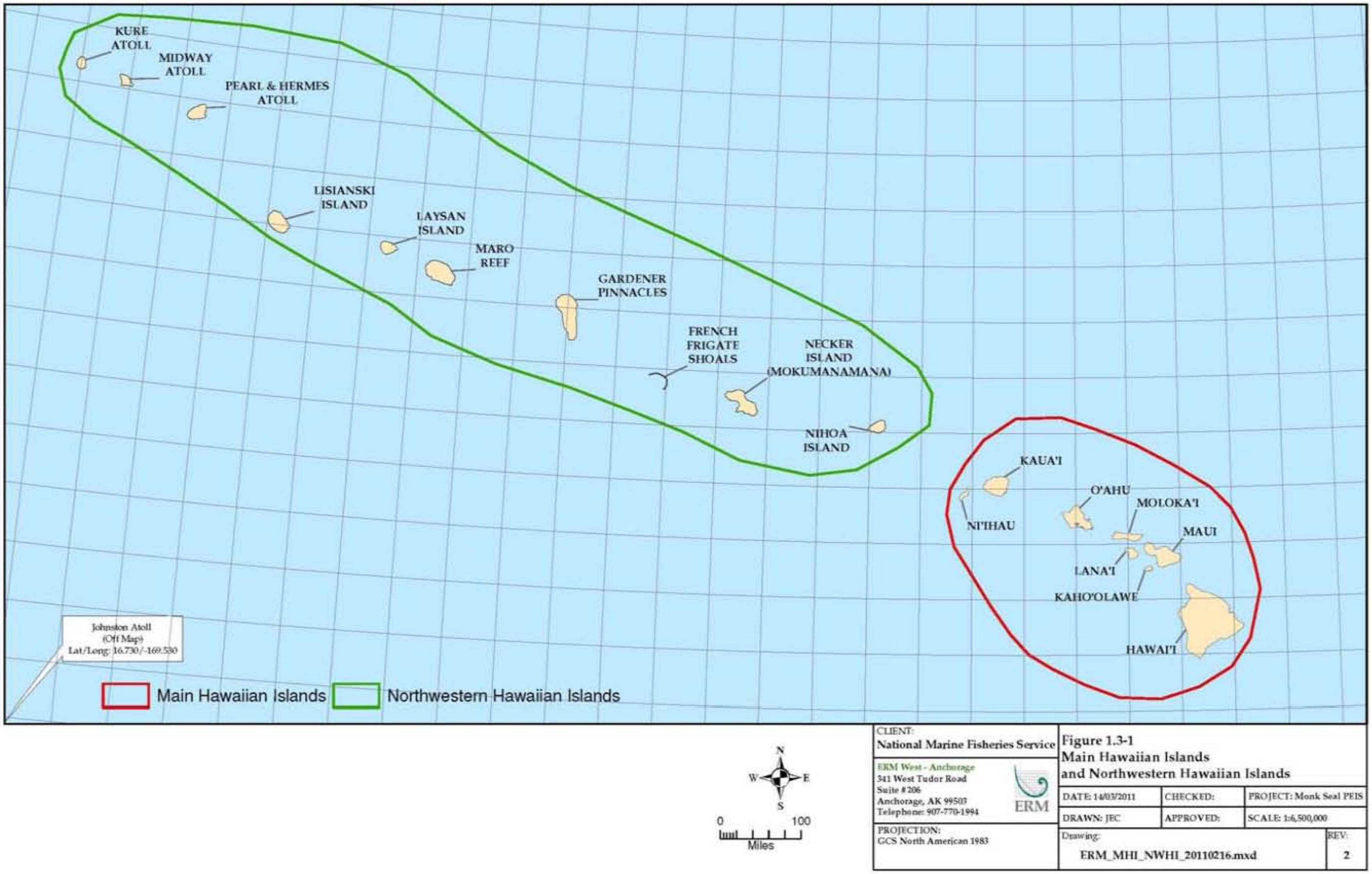
The need for this action is rooted in fundamental biological and ecological factors that are now limiting the population. A comprehensive research program enables NMFS to recognize, and possibly quantify, factors limiting the population in order to designate appropriate actions to minimize human-induced 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



This page intentionally left blank.

1.4 CURRENT RESEARCH AND ENHANCEMENT AND ASSOCIATED PERMITS

MMPA-ESA Permit No. 10137-05 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 each year through June 2014 when the permit will expire:

- **Harassment** 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, and vessel (includes photo-ID);
    - **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.
    - **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), measured, weighed, ultrasound measurements taken, and flipper tagged if necessary; of the

[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.

healthy seals, 60 may also be instrumented with external tagging 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.

    - Weaned pups and juvenile seals 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 and this activity requires approval on a case-by-case basis.

  - **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 (world-wide); location of necropsies and sample collection is the Hawaiian Archipelago and Johnston Atoll.

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 relocated, removed, 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, when the permit will expire.

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 include, but are 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 relocating 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 (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.

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. The procedural requirements under NEPA are provided in the CEQ's 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 the 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.

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 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. Permits to take ESA-listed species for scientific purposes, or for the purpose of enhancing the survival of the species, may be granted under Section 10(a)(1)(A) of the ESA. 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 2 of the ESA sets forth the purposes and policy of the Act. Purposes of the ESA 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. 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.

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 affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these consultation requirements. Section 7 requires federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. NMFS is further 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.

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.

1.5.3 *Marine Mammal Protection Act*

The MMPA (16 U.S.C. 136I *et seq*.) prohibits takes[2] of all marine mammals in the United States (U.S.) (including territorial seas) with few exceptions. Permits for *bona fide*[3] scientific research on marine mammals and permits to enhance the survival or recovery of a species, issued under section 104 of the MMPA, are two such exceptions. 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"[4] as defined in the MMPA. If lethal taking of a marine mammal is requested, the applicant must demonstrate that a using a non-lethal method is not feasible. For depleted species such as Hawaiian monk seals, NMFS must also determine the 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:

---

2 "Take" under the MMPA means to harass, hunt, capture, or kill a marine mammal, or attempt to do any of those. "Harassment" means any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal (Level A); or has the potential to disturb a marine mammal by causing disruption of behavioral patterns such as migration, breathing, nursing, breeding, feeding, or sheltering (Level B).

3 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."

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

- 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 seals 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 of scientific research and enhancement permits (50 CFR 216.41) are summarized in Sections 1.8 and 2.6.

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; nuisance animals may be taken if it is to enhance their survival (such as, if they may be harmed or killed by humans).

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 have federal agencies act as responsible stewards of our nation's resources when their 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 ACHP is the only entity with the legal responsibility to encourage federal agencies to factor historic preservation into federal project requirements. Under Section 106 of the NHPA, a consultation is required to take into account the effect of federal activities on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Section 106 also requires consultation with Indian tribes and Native Hawaiian organizations regarding properties of traditional religious and cultural importance that are listed in or eligible for the National Register.

Based on the analysis presented in this PEIS, NMFS has determined that the proposed action is a type of activity that does not have the potential to cause effects on historic or cultural properties, assuming such properties are present. Therefore, no further obligations are required under NHPA section 106. A letter documenting this determination will be sent to the Hawaii State Historic Preservation Division. In addition, a supplemental document has been prepared to satisfy the Section 106 Consultation required under this Act (see Appendix L, Draft Section 106 Analysis of the PEIS for the Hawaiian Monk Seal Recovery Program, April 2011).

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.

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 the preferred alternative:

- 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 will be sent to the State of Hawaii for comment.

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 activities would occur in or near a National Marine Sanctuary.

1.5.8 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) was enacted to ensure the protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, 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.

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 that 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 has to be authorized through a licensing system. In the U.S., the Fish and Wildlife Service is the Management Authority for CITES. Obtaining CITES permits is the responsibility of individual researchers.

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 adhering to other requirements of the AWA related to care and transport of marine mammals.

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 needs to maintain 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.

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.

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.

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.

1.5.12.4 Executive Order 13158 - Marine Protected Areas

EO 13158 requires Federal agencies to identify actions that affect natural or cultural resources that are within a marine protected area (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.

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 United States is a co-signatory, impose substantive obligations on the U.S. for the conservation of migratory birds and their habitats, and 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.

1.6 WHY IS A PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT 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 Council on Environmental Quality (CEQ) regulations encourages 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 detail in Chapter 5. Should NMFS need to evaluate potential effects of a new procedure that is 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)."

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. There are five NEPA documents that have recently been published that influence the scope (in other words, issues considered) of this PEIS and 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 the Effects of NOAA Fisheries Permitted Scientific Research and Enhancement Activities on Endangered Hawaiian Monk Seals	2003	Issuance of Scientific Research and Enhancement Permit Under Section 104 of the MMPA and Section 10(a)(1)(A) of the ESA to the NOAA Fisheries Marine Mammal Research Program, PIFSC, Honolulu Laboratory. A Finding of No Significant Impact (FONSI) for research and enhancement activities was signed in 2003.	NMFS Permit 848-1695
EA on Issuance of a Permit for Field Research and Enhancement Activities on the Endangered	2009	Issuance of Permit No. 10137 to the NMFS Pacific Islands Fisheries Science Center Marine Mammal Research Program (MMRP) to conduct field research and enhancement activities on Hawaiian monk seals to support recovery efforts.	NMFS Permit 10137 and associated amendments 01 - 05 (Current Permit Active through 2014)

Title	Year	Issues Evaluated	Associated Permit (if applicable)
Hawaiian Monk Seal		A FONSI for research and enhancement activities was signed in 2009.	
MMHSRP PEIS	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 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
Programmatic Environmental Assessment (PEA) of the Program for Decreasing or Eliminating Predation of Pre-weaned Hawaiian Monk Seal Pups by Galapagos Sharks in the NWHI	2009	NMFS PIFSC research activities to reduce predation by Galapagos sharks on Hawaiian monk seal pre-weaned pups. A FONSI for research activities to reduce shark predation was signed in 2009. http://www.pifsc.noaa.gov/nepa/documents.php	NMFS Permit PNMN-2009
Supplemental Environmental Assessment of the Program for Decreasing or Eliminating Predation of Pre-weaned Hawaiian Monk Seal Pups by Galapagos Sharks in the NWHI	2010	Supplement to the 2009 PEA on predation by Galapagos sharks on Hawaiian monk seal pre-weaned pups. Analyzed using a vertical 'surprise net' as a fishing method to reduce predation by sharks. A FONSI for the Use of 'Surprise Net' Technology was signed in May 2010. http://www.pifsc.noaa.gov/nepa/documents.php	NMFS Permit PNMN-2010-014

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 HEPA 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. The DLNR declined the invitation to be a cooperating agency. The USFWS accepted the invitation to be a cooperating agency. USFWS is in the process of coordinating with NMFS PIRO to determine their level of involvement in the PEIS. Cooperating agency correspondence is included in Appendix A.

1.8.2 Commenting Agencies

An invitation to an Agency Scoping Meeting was provided to multiple federal, state, and local agencies that were considered to have interest in the proposed action (Table 1.8-1 Agency Scoping Meeting Invitation List). The Agency Scoping Meeting was held at the NMFS PIRO offices on October 20, 2010 and 14 agency representatives attended. Coordination with these agencies will continue throughout the PEIS process.

Other agencies, such as the United States Coast Guard (USCG) D14, USFWS, NOS including NOAA Sanctuaries, National Park Service (NPS), NOAA Sanctuaries, and others, dedicate resources each year to assisting NMFS in protecting Hawaiian monk seals including coordinating with the Marine Mammal Stranding Response Network working under the MMHSRP permit when monk seals become entangled or stranded.

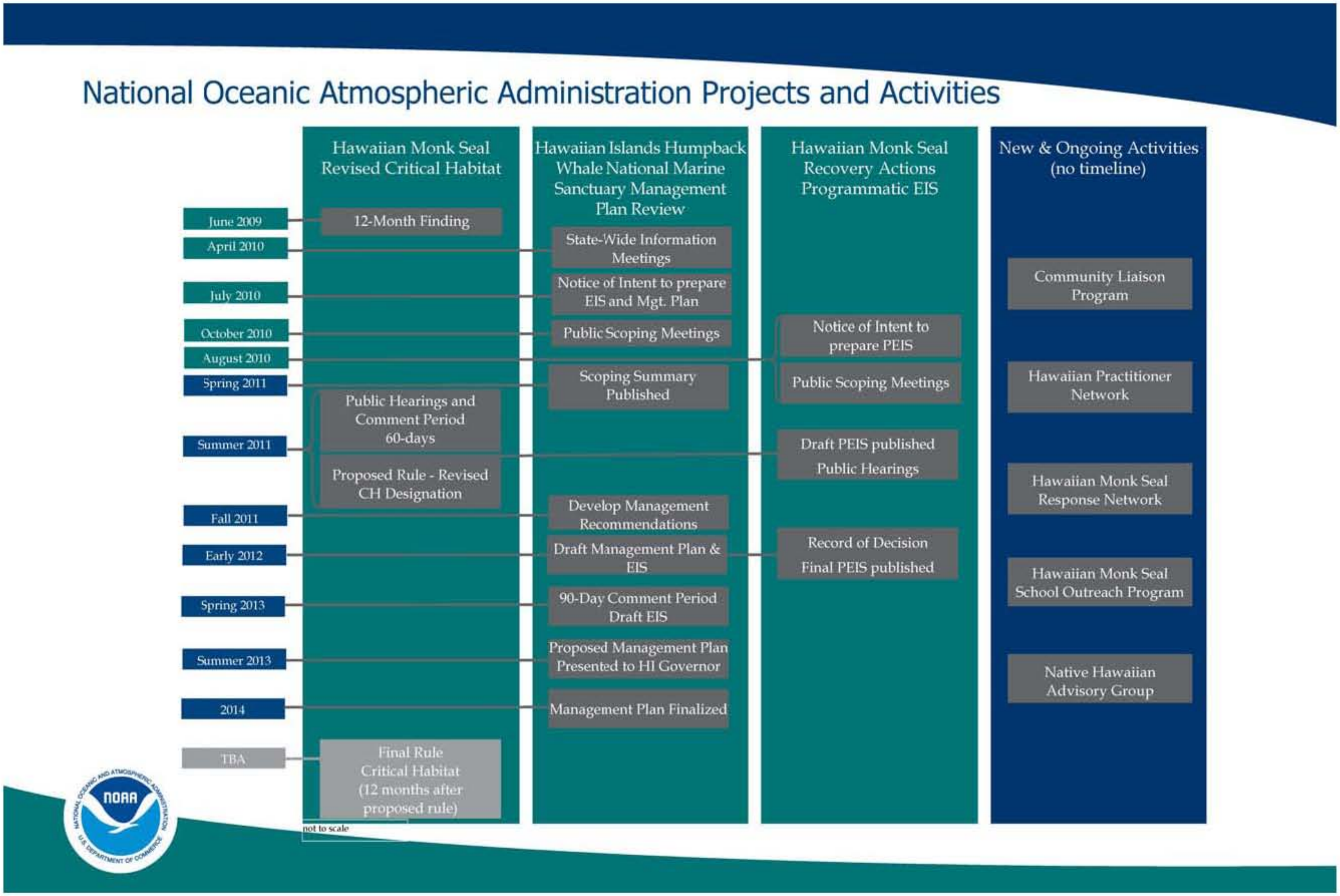
Table 1.8-1 Agency Scoping Meeting Invitation List

Agencies
Federal Agencies
USFWS Hawaiian & Pacific Islands National Wildlife Refuge Complex
USFWS Pacific Islands Ecological Field Services Office
Western Pacific Regional Fishery Management Council
USCG
U.S. Navy Region Hawai`i
U.S. Department of Defense
U.S. National Park Service Kalaupapa NHP
Environmental Review Office, U.S. EPA Region IX (CED-2)
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
State of Hawai`i Agencies
Department of Land and Natural Resources, Division of Aquatic Resources, ESA Section 6 Program
Department of Land and Natural Resources
Department of Health
Office of Environmental Quality Control
Department of Transportation
Office of Hawaiian Affairs
Department of Business, Economic Development, and Tourism, Office of Planning
County of Maui, Office of the Mayor
County of Kauai, Office of the Mayor
City and County of Honolulu, Office of the Mayor
County of Hawai`i, Office of the Mayor

1.9 NOAA ACTIONS NOT INCLUDED WITHIN THE SCOPE OF THIS PEIS

NOAA is currently undertaking other management actions within or near the Project Area that are not within the scope of this PEIS. These management actions and their general schedule are presented in Figure 1.9-1 and described in more detail below. 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.

Figure 1.9-1 Estimated Timeline of Ongoing NOAA Actions



This page intentionally left blank.

1.9.1 *National Marine Fisheries Service Hawaiian Monk Seal Critical Habitat Revision*

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. After reviewing this petition, in accordance with procedures outlined in the ESA (16 U.S.C. 1533), NMFS announced its decision 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 agency determines that the area itself is essential for conservation.

This revision will update critical habitat originally designated in 1986 (51 FR 16047; April 30, 1986), as revised in 1988 (53 FR 18988; May 26, 1988). Since 1988, a significant amount of new information about monk seal habitat has become available, prompting the current revision.

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 will be 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.

ONMS is required by law to periodically review sanctuary management plans to make certain sanctuary sites continue to conserve, protect and enhance nationally significant resources within their boundaries. Public information meetings on the management plan review began in April 2010 and will continue throughout the review process.

As part of the review process, HIHWNMS is considering adding Hawaiian monk seals to the list of resources managed by the Sanctuary. NMFS and the Sanctuary would coordinate closely on any issues related to Hawaiian monk seals should this change occur. The PEIS is currently coordinating with the HIHWNMS management review team to discuss details of the PEIS and Sanctuary Management Plan review in an effort to reduce potential confusion about project schedules, scope of actions covered and misconceptions about what these management actions mean in terms of resource use or protection.

While HIHWNMS management changes are separate from actions considered in this PEIS, the HIHWNMS is located within the PEIS Project Area. Therefore, 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 1.7, 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 this PEIS does not include 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 entanglement or other injuries.

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 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 this PEIS, NMFS is undertaking several new or enhanced community-based activities supporting monk seal recovery. This includes a Native Hawaiian liaison. The objectives of the liaison project are to:

- Increase levels of support among Native Hawaiians for Hawaiian monk seal recovery and co-existence in the MHI;
- Increase levels of participation by Native Hawaiians in Hawaiian monk seal recovery and management activities;
- Enhance collaboration on Hawaiian monk seal recovery efforts between NMFS staff and partners, and Native Hawaiian practitioners and community leaders;
- Enhance consideration of Native Hawaiian concerns and enhanced incorporation of Native Hawaiian practices and protocols in the NMFS Hawaiian monk seal recovery program;
- Convene and manage a Native Hawaiian Advisory Group for monk seal recovery;
- Conduct meetings with Native Hawaiians, NMFS, partner agencies, NGO's, and volunteers on various islands in the MHI to identify and discuss monk seal recovery issues and opportunities;
- Prepare an annual report identifying and describing opportunities and constraints to achieving project objectives; and
- Work in collaboration with other NMFS contractors and grantees working on Hawaiian monk seal recovery and response.

In addition to the Native Hawaiian Outreach Program for monk seals, NMFS regularly conducts outreach and education programs on several other marine–related topics. These activities are likely to continue into the future, separate from the research and enhancement program.

This page intentionally left blank.

2.0 ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the 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 ranging from Alternative 1 Status Quo (*e.g.,* what is currently permitted) to limited translocation (Alternative 3) to an expanded research program including new research and enhancement activities (Alternative 4).

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 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 1.8. 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 EIS. NEPA states that for alternatives eliminated from detailed study in the EIS, the agency must describe reasons for why alternatives were eliminated (Section 2.11). As previously stated, evaluation of the no action alternative is required in an EIS (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 SCOPING ISSUES CONSIDERED IN DEVELOPING ALTERNATIVES

The NEPA scoping process for this PEIS was initiated with the publication of the Notice of Intent (NOI) in the Federal Register (FR) 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 the purpose and need for the proposed action and preliminary alternatives.

The preliminary alternatives were initial concepts developed by the PEIS project team prior to scoping. They were to serve as the basis to begin a discussion, and collect comments and insight about potential effects of the proposed alternatives as well as ideas for different alternatives. Preliminary alternatives were based 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. The exact structure and components of alternatives were developed after completing the scoping process.

Substantive comments received during the scoping process raised issues that have been addressed or incorporated into this PEIS and the alternatives evaluated. Listed below are some examples of scoping comments specific to development of alternatives that have been considered in this PEIS. The complete Scoping Summary Report is included in Appendix B and is available on the project website (http://www.nmfs.noaa.gov/pr/permits/eis/hawaiianmonkseal.htm); it includes additional information about the scoping comments received.

- Statements in support of translocation, vaccination, and deworming.
- Immunization, deworming and translocation could do more harm than good for monk seals.
- Statements in support of ongoing monk seal recovery activities and of expanding the scope of recovery actions to include more direct actions such as deworming, translocation, and vaccinations to increase the monk seal population in the Northwestern Hawaiian Islands (NWHI) and Main Hawaiian Islands (MHI).
- Attaching instruments and devices to the Hawaiian monk seal poses unacceptable risks to seals. The presence of the device on the animal's back no doubt alters their behavior and poses risks such as snagging on fish nets and rock outcroppings. A study should be done to assess what happens to the instruments.
- Data collection should be as non-intrusive as possible. Techniques such as bleach marks and instruments are unnecessary and cause harm.
- There needs to be other alternatives and contingency plans that respond to changes in the environment. The government is failing at this. Even after designating the Papahānaumokuākea National Monument, the monk seals are still failing and starving.
- Concerns about the impacts of big factory fishing fleets and the potential effects on declining fish stocks thereby causing more shark predation on the Hawaiian monk seal.
- Biannual counts of seals are not necessary because a spot check does not really provide useful information.
- The PEIS should evaluate critical habitat designation, seal feeding programs and recommendations of the Marine Mammal Commission as tools for slowing the decline of the Hawaiian monk seal. Critical habitat designation will not only ensure there are adequate beach and reef areas but also help with public engagement. Likewise, feeding young Hawaiian monk seals (done in the 1990s) will have immediate, short-term benefits to prevent decline.
- At least three cycles of translocation are necessary to determine if that effort will be successful, so the proposed 10-year plan will not be very helpful.
- NMFS should build a nursery or aquarium where juveniles can mature. A sanctuary in the NWHI should be developed where Hawaiian monk seal can learn to forage for themselves and not have human distractions.

- NMFS should deal with the Hawaiian monk seal crisis within the NWHI only.
- Reactivate the Midway facilities, or some place that is already there, as research facilities for breeding, rearing, and feeding Hawaiian monk seals to improve their survival.
- Statements in support of the No Action alternative.
- Statements in support of the proposed action including translocation, as long as seals are returned to the NWHI.
- Comments in support of Alternative 3 (as presented during scoping); despite concerns over some of the activities, monk seals are no longer in a position for us to choose ideal solutions.
- NMFS should develop a "culture of co-existence" as part of their outreach program.
- Comments expressing concerns that more Hawaiian monk seals in the MHI will result in more sharks around the islands which could pose a public safety risk. NMFS should consider hunting sharks in the NWHI as an alternative to bringing seals to the MHI.

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. 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.

Some 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.

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 10 meters (m) (33 feet [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 typically 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 MHI, where aircraft and fuel are much more available as 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 500ft (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.

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. 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 morphometric measurements to determine body condition of individuals: Measurements of auxiliary 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 effect 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 morphometric 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, morphometric measurements 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 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. Seals captured for health screening are usually sedated with diazepam (valium or intramuscular injection of midazolum) administered intravenously in the extradural vein. 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. 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 C 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 C, 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 D.

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).

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). Thus far, two different drugs have been used (fendbendazole and praziquantel), administered either orally or via intra-muscular injection. Repeated treatments are given every few months to help ascertain the most effective regimen. To reduce the number of captures required to administer drugs, a topical de-wormer is being considered for subsequent field trials. 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 (conducted by the Marine Mammal Health and Stranding Response Program).

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. Some alternatives would allow for more flexible application of this tool to move seals anywhere within the monk seal range.

Also, Alternatives 3 and 4 allow for a return translocation of individuals back to their natal subpopulations once they have reached an age (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 E. The *Health Screening and Quarantine Protocols for Hawaiian Monk Seal Translocation Between Subpopulations* is presented in Appendix F.

Some alternatives would allow for the experimental translocation of MHI-born seals age 3 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 3 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 some alternatives. 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 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*., in review).

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 two 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 two 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 (less than 8 ft long x 4 ft wide x 4 ft high) may be used for transport and very short term 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, captive care is not an activity proposed in this PEIS. However, some alternatives 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 one 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.

In order 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. 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. These interactions can be dangerous for all participants and in the past have resulted in the seals being translocated from their natal areas or taken into permanent captivity. 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.

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 accidental research-related mortality has occurred.

In addition to accidental 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 that 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: As described above, the NMFS is permitted to mitigate adult male seal aggression by a variety of means. Males identified as aggressors may be 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 1990's, 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 aggressive behavior was reduced. Other drugs (*e.g.,* Desolorelin) have also been used in a variety of species to reduce testosterone production and aggression. Some alternatives of this PEIS 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.

2.6 ALTERNATIVES CARRIED FORWARD FOR ANALYSIS

The four alternatives carried forward for detailed analysis in Chapter 4 vary by management policy, 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. This section begins by describing the elements that are common to all alternatives and then provides a general description of the policy behind each alternative. Table 2.10-1 provides additional detail on the specific types of activities that would be allowed under each of the alternatives.

2.6.1 Elements Common to All Alternatives

Scientific research and enhancement permits issued by NMFS pursuant to the statutes and regulations described in Section 1.9 contain a number of conditions that are intended to ensure compliance of the research and enhancement with the purposes of the MMPA and ESA. In addition, some elements of the alternatives, such as the use of new technology, can be applied under any of the alternatives as appropriate. The following elements would be common to all research and enhancement permits:

- Protocols for capture and handling of monk seals;
- Duration of the permit (five year maximum by regulation);
- 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;
- Collection of samples from prey species for potential contaminant monitoring;
- How requests for amendments are addressed;
- 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; and
- Types of information required in annual and final reports.

2.6.1.1 *Institutional Animal Care and Use Committee*

Federal mandates, including the United States Department of Agriculture (USDA) Animal Welfare Act (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).

The IACUC must be composed of at minimum three members, one of which must be a doctor of veterinary medicine "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 anyway 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 seals 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 Co-Investigator 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 Co-investigators. 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 2000). The committee is responsible for:

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

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

2.6.2 *Research and Enhancement Activities That Require Permits*

There are two broad categories of research and enhancement activities that require permits. One consists of research and enhancement that does not involve capture, handling, or collection of tissue from live animals. The other consists of 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	**Activities that Require Capture, Handling, or Collection of Tissue**
• 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.	• Collection of morphometric measurements – includes external measurements of an animal (*e.g.*, length and girth). • Collection of tissue samples – including 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 – temporary holding for quarantine during translocation.

Please note: This table is meant to provide a general overview of these activities by category. Additional detail on the proposed alternatives is provided in Table 2.10-1.

2.6.3 Regulatory Requirements Applicable to Issuance of Research and Enhancement Permits Necessary for Implementation of the Preferred Alternative

General permit issuance requirements (50 CFR 216.34) include the following:

- The applicant must demonstrate that the proposed activity is:
  - Humane and does not present any 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 set forth in section 2 of the ESA.
  - By itself or in combination 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 accomplish successfully 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; and
- 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.

Specific scientific research and enhancement permit issuance requirements (50 CFR 216.41) include the following:

The applicant must demonstrate that:

- The proposed activity furthers a bona fide scientific or enhancement purpose.
- If the lethal taking of marine mammals is proposed:
  - Non lethal methods for conducting 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 Office Director.
- 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 the authority of an enhancement permit. Marine mammal parts include in this regard 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.

2.7 *ALTERNATIVE 1: STATUS QUO*

Under the Status Quo Alternative, 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, 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). 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 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 (except under the MMHSRP) would cease except for those activities covered under the MMHSRP permit as described in Sections 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 translocations to enhance survival could not be conducted under this program.

Disentanglements and de-hooking seals 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

Alternative 3 would build upon the status quo by allowing a suite of new research and enhancement activities not currently permitted but deemed necessary to implement some of the recommendations of the 2007 Recovery Plan for the Hawaiian Monk Seal. Under Alternative 3, all activities currently permitted would continue, and new permissions 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. The new activities that would occur under Alternative 3 are provided in more detail in Table 2.10-1 and include, but are not limited to:

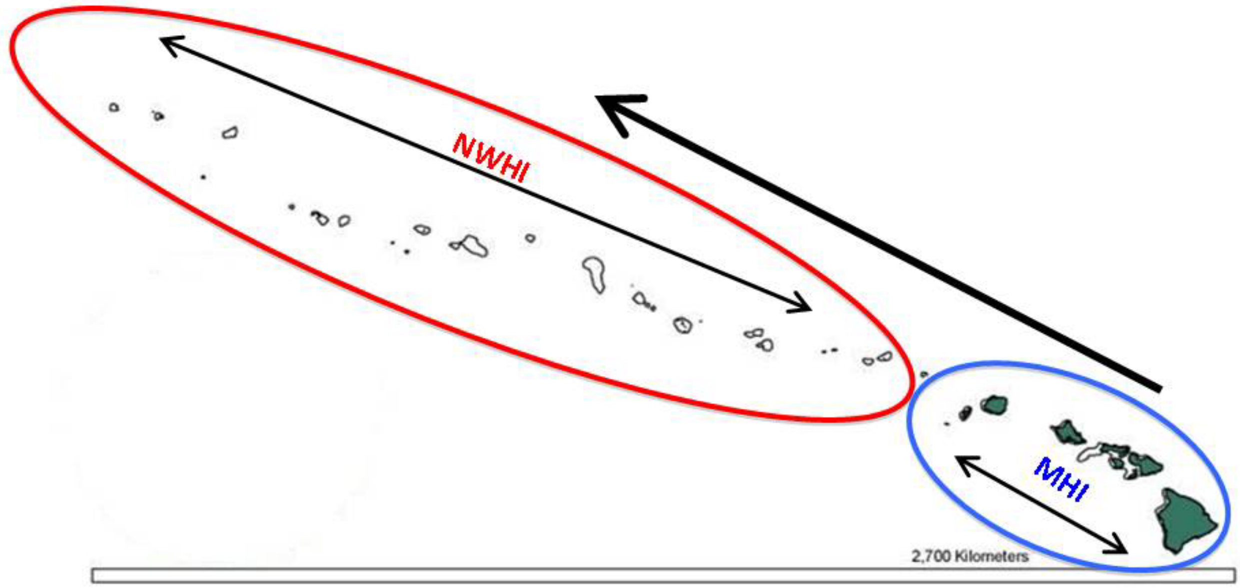
- Expanded surveys and use of new tools (remote cameras, unmanned remotely operated aircraft).
- Vaccination studies and potential implementation of vaccines to mitigate infectious disease.

- Potential implementation of de-worming as a tool to improve juvenile Hawaiian monk seal survival.
- Expanded scope and number of seal translocations, including:
    - Taking seals with unmanageable human interactions from the MHI to NWHI.
    - Taking age 3 years 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), with the option of returning them to their natal location or nearest appropriate site (excluding returning seals from the NWHI to the MHI) at age 3 years and older (see Figure 2.9-1). Details of the translocations would be determined by a decision framework as described in Section 5.3 and Appendix E.
- Supplement monk seal diet using feeding stations in NWHI locations where seals are released after being cared for in captivity.
- 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 testosterone agonist.

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.

One distinctive feature of Alternative 3 is that while translocation as a tool for conserving Hawaiian monk seals would be expanded, translocations of young animals from the NWHI to the MHI would not be permitted.

Figure 2.9-1 Alternative 3 Limited Translocation Options



Translocation options for weaned pups (from areas of low to higher survival):

- within NWHI
- within MHI
- from MHI to NWHI
- at age 3 and older, seals may be returned to their natal or nearest appropriate site
- no translocations from NWHI to MHI

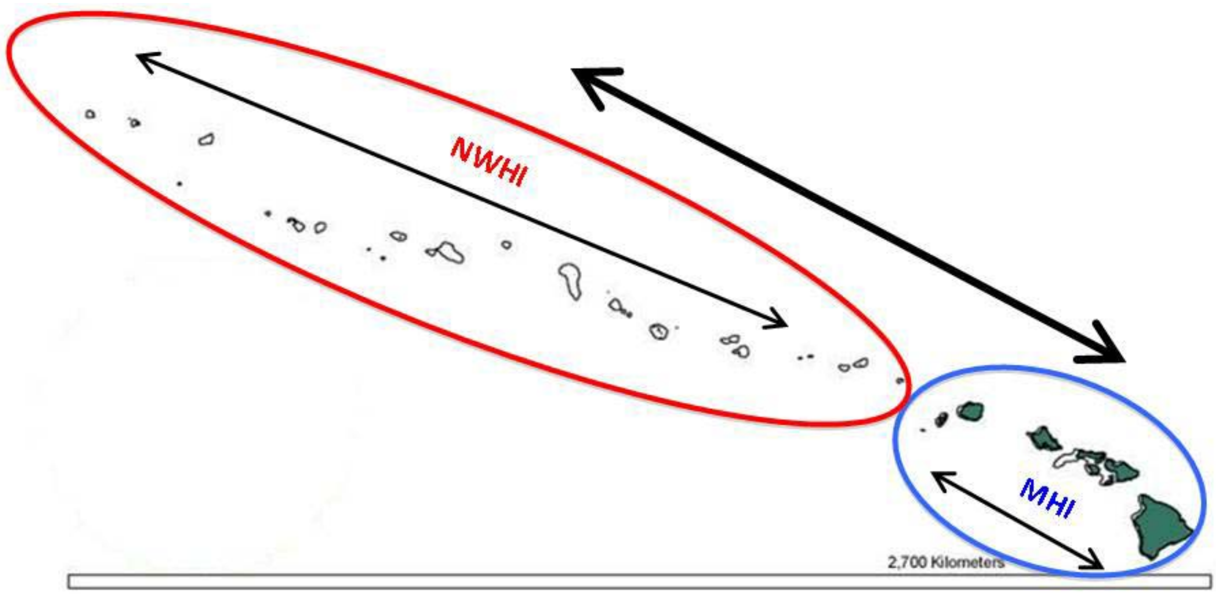
2.10 ALTERNATIVE 4: ENHANCED IMPLEMENTATION (PREFERRED ALTERNATIVE)

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. At age 3 years, any surviving translocatees would be returned to the NWHI (see Figure 2.10-1). The exact same decision framework for conducting translocations would be used as in Alternative 3, with the exception that there would be no prohibition against translocation of young seals from the NWHI to the MHI during the first few years of their lives.

Alternative 4 represents the current best assessment of steps that could be taken 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. Full implementation of this alternative would require more funding and additional support of new and existing partners in monk seal recovery. Full implementation will certainly not be immediately realized, and some elements of the alternative, being experimental and involving inherent risks, will be undertaken in a conservative and methodical fashion.

This alternative encompasses the range of actions considered most promising for fostering recovery in the foreseeable future. Past experience has shown that crises and threats to the monk seal are largely unpredictable in their nature, scope and timing. As the agency responsible for the species recovery, NMFS must therefore be forearmed to respond swiftly and effectively to changing circumstances. This alternative is designed to equip NMFS to best execute its responsibilities with regard to the Hawaiian monk seal.

Figure 2.10-1 Alternative 4 Translocation Options



Translocation options for weaned pups (from areas of low to higher survival):

- within NWHI
- within MHI
- from NWHI to MHI and vice versa
- at age 3 and older, seals may be returned to their natal or nearest appropriate site

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 (only MHI to NWHI or within each region)	Alternative 4 - Enhanced Implementation Alternative (Preferred 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.)	• 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. • Permits could be obtained to install, operate and maintain remote cameras to obtain photographs and video images of seals to augment data otherwise requiring researcher presence on site.	• 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.	• 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. • 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**: • Optimize survey techniques through new technology such as using quadracopters to conduct aerial surveys where access is limited. • 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
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 tags, PIT tags, 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.	• 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 (only MHI to NWHI or within each region)	Alternative 4 - Enhanced Implementation Alternative (Preferred Alternative
Activities that require capture, handling, or procedures on wild seals	*Collect morphometric 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.	• 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, and 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.	• Same as Alternative 3
	Infectious Disease Mitigation *(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. • Treat injured seals in situ 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.	• Same as Alternative 3
	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 "Crittercams". • 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.	• 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 (only MHI to NWHI or within each region)	Alternative 4 - Enhanced Implementation Alternative (Preferred Alternative
Activities that require capture, handling, or procedures on wild seals	*De-worming* *(Research and enhancement)*	• Currently permitted studies and treatment (through 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 wide-spread 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.	• 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 20 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 (pending approval on case-by-case basis). • 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 **plus:** • Translocate seals with unmanageable human interactions out of the MHI as needed. • Translocate ≥3-year-old seals from the MHI to NWHI to evaluate survival rates. • Additional translocations above number permitted in Status Quo could be authorized. • Translocate weaned pups 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. • 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 young seals from the NWHI to the MHI. • Option to return previously translocated seals ≥3 years old back to their original site or nearest appropriate alternative site, *excluding* returning seals from the NWHI to the MHI.	• Same as Alternative 3 **plus**: • Translocate weaned pups from areas with low prospective juvenile survival to areas with higher juvenile survival anywhere within the Hawaiian Archipelago, *including* between NWHI and MHI • NMFS will use a decision framework for determining the source and recipient sites as well as other aspects of translocations. • Option to return previously translocated seals ≥3 years old back to their original site or nearest appropriate alternative site.
	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.
	Mitigate Fishery and Human/Domestic Animal Interactions and alter aggressive male behavior *(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, and fishing gear in the MHI. • If research indicates that aversive conditioning or other methods are effective in reducing interactions with humans, domestic seals and fishing gear, then implement these tools, particularly in the MHI as needed • Chemically alter aggressive male monk seal behavior using a testosterone agonist. • Additional disturbances/harassment above number permitted in Status Quo could be authorized as needed.	• 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 (only MHI to NWHI or within each region)	Alternative 4 - Enhanced Implementation Alternative (Preferred Alternative
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 ALTERNATIVES NOT CARRIED FORWARD FOR ANALYSIS

2.11.1 *Reduction of Competition and Predation in the Northwestern Hawaiian Islands*

Comments were submitted during scoping 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 predation and direct or indirect competition with other predatory species (*e.g.*, sharks and jacks). This 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.

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. Potential undesirable changes in predator-prey dynamics could 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. Therefore, given the available information, this alternative is not practical or feasible and will not be carried forward for analysis.

2.11.2 *Build a Hawaiian Monk Seal Research Facility or Aquarium in the Northwestern Hawaiian Islands*

Comments were submitted during scoping 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. While the concept of developing a captive care facility for monk seals is being considered in the MHI as a separate action, 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.

2.12 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. While these activities are separate actions from this PEIS, they are considered in the analysis of cumulative effects presented in Chapter 4.

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	• Response, rescue, rehabilitation, and release of stranded seals; • Health-related research on captive and rehabilitating seals (excluding vaccination research); and • Hazing and translocation of seals from imminent harm
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	• Community liaison projects • Native Hawaiian Liaison in Support of Monk Seal Recovery • Native Hawaiian Advisory Group • Marine Mammal Response Network Outreach Projects
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

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 (*Monachus schauinslandi*) 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 2020. 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 2020, National Marine Fisheries Service (NMFS) will have 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 Environmental Impact Statement (EIS) document.

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

Island	Land area (miles²)	Shoreline (miles)	Max Elevation (feet) (location on island)	Lat/Long	Special Features
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 (mi²)	Area (mi²) < 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

Island/ Atoll	Area (mi²)	Area (mi²) < 10 fathoms	Max Elevation (feet)	Lat/Long	Special Features
					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 miles² (1,558 km²) 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 miles² (1,508 km²)
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 miles² (979 km²)
Pearl and Hermes Reef	<1	145.0	10	27° 51.37′N 5° 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 miles² (167 km²) (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.

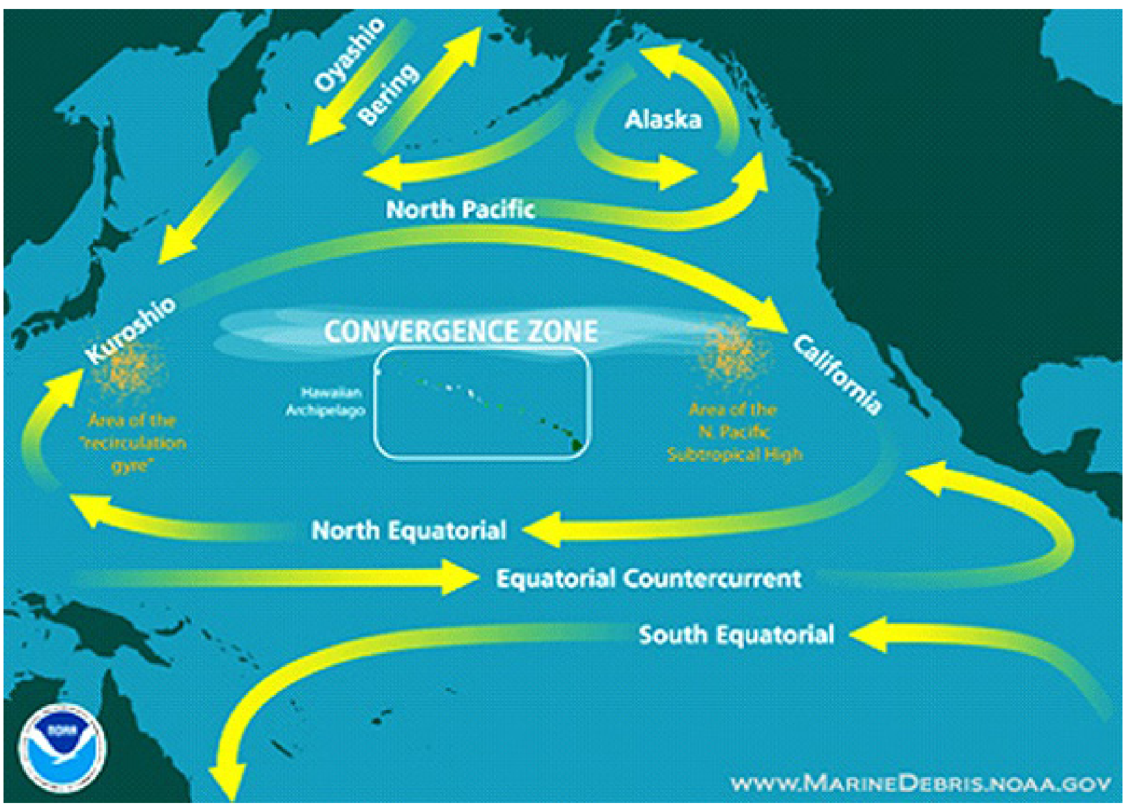
3.2.4.1 *Ocean Circulation and Currents*

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).

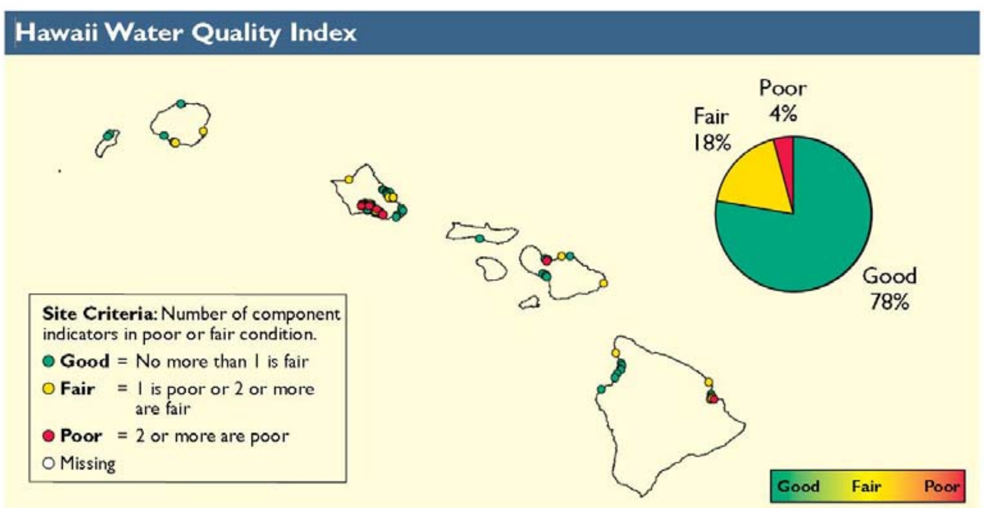
Hawai`i does not monitor all coastal areas. However, the Clean Water Branch (CWB) of the State of Hawai`i's DOH is responsible for monitoring the State's waters, identifying sources of water pollution, and evaluating the data (CWB 2011). The Polluted Runoff Control Program (PRCP) administers grant money 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 PRCP):

- 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 Environmental Protection Agency's (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+	Mesoscale ocean eddies
3-7	El Niño – Southern Oscillation (ENSO) events
6-7	Mid-latitude atmospheric events
10+	"Regime shift"
11	Sunspots
18.6	Lunar Declination
22	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 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 in (search for food) 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 K.

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 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.* 1993). Males have a penile opening, often have scars along their necks inflicted by other males (Hiruki *et al.* 1993), 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 *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 (2009) best estimate of total abundance is 1,125 seals (Carretta *et al.* 2011 SAR draft), and the number is declining at approximately 4.5% per year.

The general decline in total abundance since the late 1950's 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-1980's 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. While the other main subpopulations had their documented high counts in the late 1950's, 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 1980's, followed by a dramatic crash which continues to the present. Laysan and Lisianski Islands have demonstrated an overall declining trend since the late

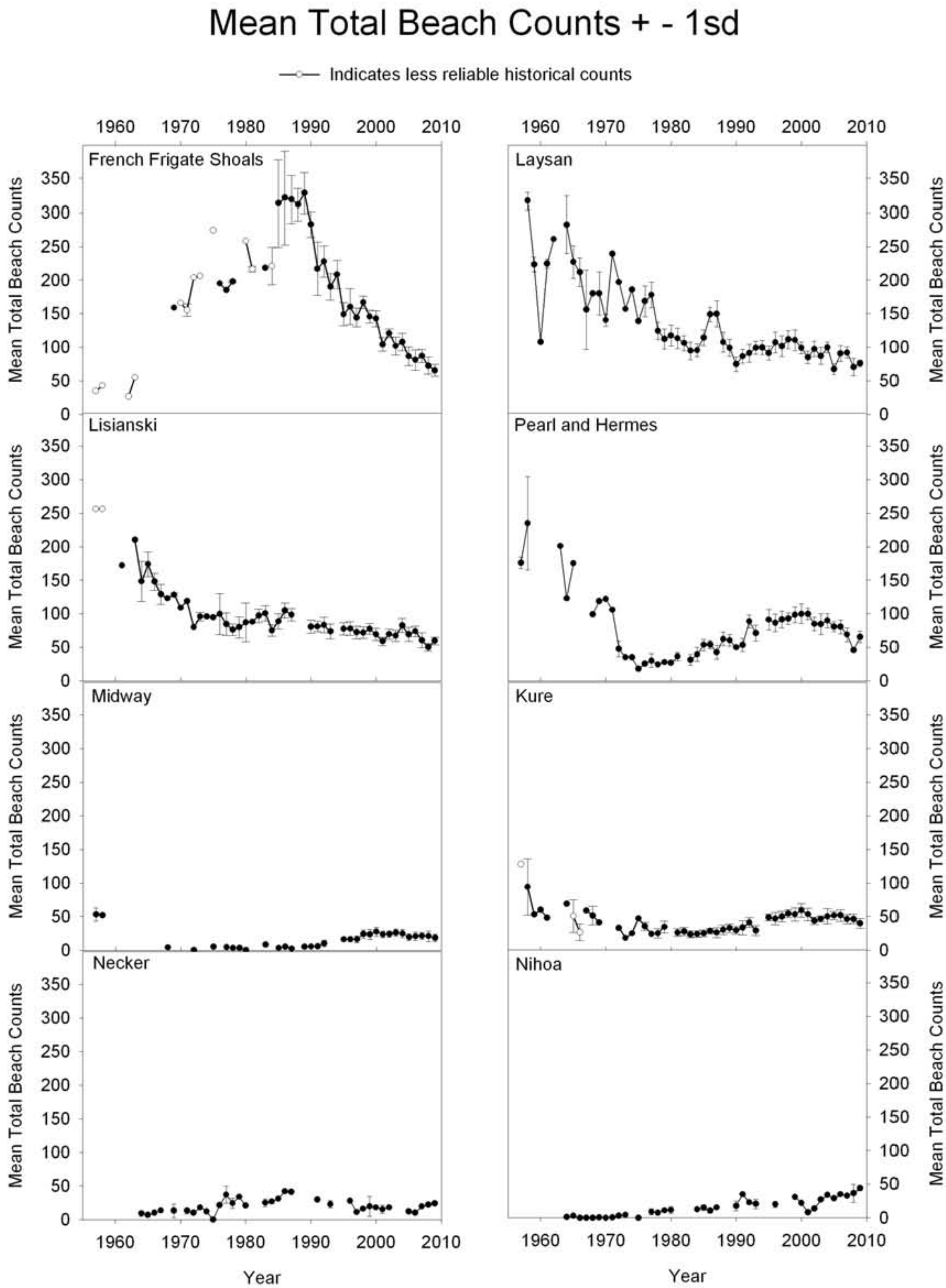
1950's, though the rate of decline was most rapid in the early part of the time series. The three western subpopulations (Pearl and Hermes Reef, Midway Atoll and Kure Atoll) all declined precipitously after the late 1950's and then at different time points ranging from the 1970's to the 1990's, each 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 1970's, 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.* 2011 SAR draft). Table 3.3-1 presents the most recent abundance estimates in the NWHI. The abundance of the six thoroughly monitored NWHI subpopulations has been falling 4.5% per year during recent years (Carretta *et al.* 2011 SAR draft).

Table 3.3-1 Abundance Estimates of Hawaiian Monk Seals in the NWHI in 2009 and Method Used to Estimate Abundance At Each Site As Indicated

Location	Abundance	Method
Kure Atoll	93	Capture-recapture
Midway Atoll	50	Minimum
Pearl and Hermes Reef	156	Minimum
Lisianski Island	159	Capture-recapture
Laysan Island	193	Total enumeration
French Frigate Shoals	198	Capture-recapture
Necker Island	51	Corrected counts
Nihoa Island	93	Corrected counts

Figure 3.3-1 Hawaiian Monk Seal Mean Total Beach Counts 1960 - 2010



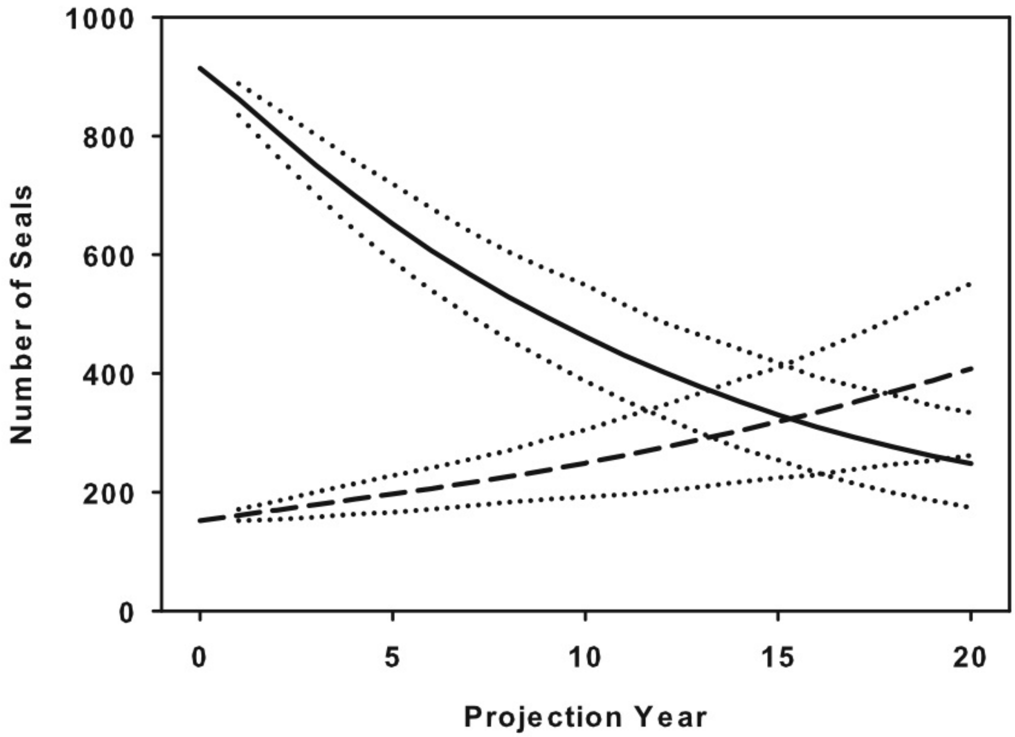
MHI Abundance and Trends

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. The earliest seal documented in the MHI was reportedly killed in Hilo Bay on the island of Hawai`i, and subsequently eaten (H.W. Henshaw in Dill and Bryan 1912), though Rosendahl (1994) reported finding monk seal remains dating to between 1400 and 1760 on the island of Hawai`i. Reports of seal sightings and births were increasing by the mid-1990's, 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.* 2011). A population model estimates that the MHI population may be growing at 7% per year (Baker *et al.* 2011). 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.* 2011).

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 0.42-0.57 in the NWHI (Baker *et al.* 2011). 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 annually to a single pup at most. 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.* 2011).

<u>Genetics, stock structure, site fidelity and movement among subpopulations</u>

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 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.

<u>Critical Habitat</u>

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).

On October 3, 2008, NMFS announced in its 90-day finding that the petition presented substantial scientific information indicating that a revision to the current critical habitat designation may be warranted (73 FR 57583; October 3, 2008). On June 12, 2009, in a 12-month finding, NMFS announced that a revision to critical habitat is warranted on account of new information available regarding habitat use by the Hawaiian monk seal and also announced the Agency's intention to proceed towards a proposed rule (74 FR 27988; June 12, 2009).

3.3.1.5 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, c; 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.

<u>Prey Species and Size</u>

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.

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 MSc thesis).

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 *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 carrying capacity 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 1990's. 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).

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*. 2011). 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*. 2011).

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). Through 2008, a total of 289 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*. 2011 SAR draft). 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 over 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.

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. 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*. in review). Following the 1998 translocations, a marked drop in pup losses to male aggression occurred (Baker *et al.* in review).

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*. 2005). 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 (Gilmartin *et al*. 1980; 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. 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, Pacific humpback whales, pilot whales, as well as killer whales 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 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 Even (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*. (2006) 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.

Contaminants

Persistent organic pollutants (POPs) originate from anthropogenic substances such as pesticides, industrial chemicals, and flame retardants, or occur as chemical byproducts (Bard *et al*. 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 (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in their tissues through nursing when young and through their diet later in life.

Two 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).

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*. 2005a 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 (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 (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 trends at several sites appear to have been determined by human disturbance from military or USCG activities (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. Three seals (including a pregnant female) were shot and killed in the MHI in 2009 (Baker *et al*. 2011). This level of intentional killing is unprecedented in recent decades and represents a disturbing new threat to the species.

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*. in review). 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 Hawai`i managed nearshore fisheries. Three seals have been found dead in nearshore (non-recreational) gillnets (in 1994, 2006, and 2007), and a seal was found dead in 1995 with a hook lodged in its esophagus. A total of 64 seals have been observed with embedded hooks in the MHI during 1989-2009 (including 12 in 2009, four of which resulted in serious injuries). Several incidents, including the dead hooked seal mentioned above, involved hooks used to catch ulua (jacks, *Caranx spp.*). Interactions in the MHI appear to be on the rise, as most reported hookings have occurred since 2000, and five seals have been observed entangled in nearshore gillnets during 2002-2009 (NMFS unpublished data). In addition, 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).

No mortality or serious injuries have been attributed to the MHI bottomfish handline fishery. 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 tunas 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*. 2011 SAR draft.).

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**

Action Number	Action Description
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

Notes:
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 (Papahānaumokuākea 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 G). The Monument permit General Terms and Conditions sets out protocols and procedures to ensure protection of the Monument and specified Best Management Practices (BMPs) 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 G. 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 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. None of these species (except green sea turtles) would 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. Researchers do not work at night so no nesting animals would be disturbed. If turtles 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 likely to be found in similar habitat as Hawaiian monk seals throughout the NWHI and may 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. Nesting in the MHI has occurred along the north shore of Molokai`i, the northwest shore of Lāna`i, and the south, northeast, and southwest shores of Kaua`i.

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 O`ahu, Molokai`i, Maui, Lāna`i, Hawai`i, 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 Hawai`i 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*	

Cetaceans		
Common Name	**Scientific Name**	**Status[a]**
Fraser's dolphin	*Lagenodelphis hosei*	
Pygmy killer whale	*Feresa attenuata*	
False killer whale	*Pseudorca crassidens*	
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 also occur within the HIHWNMS, humpback whales are discussed in more detail in this section. In addition, spinner dolphins (*Stenella longirostris*) in the NWHI may occur in close enough proximity to monk seals to be affected by certain proposed actions; thus, additional detail on this species is provided below.

<u>Humpback Whale (Megaptera novaeangliae)</u>

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 (NOAA 2003).

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; Carretta *et al.* 2005). 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, Molokai`i, Kaho`olawe, and Lāna`i, as well as Penguin Bank (Baker and Herman 1981; Mobley *et al.* 1999; Maldini 2003) and around Kaua`i (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 Hawai`i 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 O`ahu locations (known to provide wintering habitat) and the NWHI locations at Maro Reef, Lisianski Island, and French Frigate Shoals.

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 that may be affected by the proposed action are part of the Hawaiian stock, and are referable to the subspecies S. longirostris longirostris (Carretta et al 2008). The most current population estimate for the Hawaii stock is 2,805 based on a 2002 ship survey; however, this may be low since limited effort was given to near shore areas where spinners are common (Barlow 2006). In the NWHI, atoll-associated communities at Kure Atoll range from 120-180 individuals; at Midway Atoll from 260-320 individuals; and at Pearl and Hermes reef approximately 350-450 individuals (L. Karczmarski, pers. comm., January 14, 2009).

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

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).

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 3.3-6 (Mitchell *et al.* 2005).

Table 3.3-6 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

Common Name	Scientific Name	MHI	NWHI	State of Hawai`i	USFWS	IUCN
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; and the endangered short-tailed albatross (*Phoebastria albatrus*) are currently nesting on Midway Atoll and attempting to nest at Kure Atoll (NWHI USFWS 2005; USFWS, pers. comm. 2011). 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 3.3-7.

Table 3.3-7 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 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

Section 7 of the ESA provides protection for threatened and endangered bird species. Under these regulations, NMFS is required to analyze the potential impacts its actions may have on threatened, endangered, or candidate birds. This section addresses birds that are listed as endangered or threatened, or are considered as candidates for listing by USFWS within the Project area.

ESA-listed species identified within the Project area include: Laysan duck, Nihoa millerbird, Laysan finch, Nihoa finch, short-tailed albatross, 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). USFWS previously found NMFS monk seal activities were not likely to affect the Nihoa millerbird, Nihoa finch and Laysan duck because they primarily occur in the vegetated or interior areas of the NWHIs (USFWS 2010a). 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.

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) (USFWS 2008b). Recently, however, a pair began nesting on Eastern Island, Midway Atoll (USFWS 2010b). If successful, this will be the first confirmed hatching of short-tailed albatross outside of Japan in modern history (USFWS 2010b). Another pair is possibly incubating an egg at Kure Atoll, although this may be a female-female pair so the egg may not be fertilized (USFWS pers. comm.). Short-tailed albatross typically nest higher on sloping hillsides (USFWS 2008b).

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 2008c). 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 are listed as endangered; Laysan finches are listed as vulnerable; and Laysan albatross are 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 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 (NOAA 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 (NOAA 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 (NOAA 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 (NOAA 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 (NOAA 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) (NOAA 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 (NOAA 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 (NOAA 2008b).

3.3.7.2 *Deep Water Corals*

Deep water corals are found at depths of greater than 98 ft (30 m) (NOAA 2008b) in temperatures as low as 39 °F (NOAA 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 (NOAA 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) (NOAA 2008a). Deep water ecosystems are prevalent throughout the Hawaiian Archipelago (NOAA 2008a) extending from the big island of Hawai`i in the south (NOAA, 2008a) to the NWHI (NOAA 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 10137 concluded that any proposed activities would not affect any ESA-listed plant species (NOAA 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 2010). 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 2009; 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 Scientific Research 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) NOAA Fisheries Authorizations and Permits for Protected Species (APPS) for activities involving marine mammals and other marine and anadromous endangered and threatened species, and 2) the Papahānaumokuākea Marine National Monument Permitted Activities 2009 Report.

Permits authorized under the ESA and MMPA cover the following types of activities:

- Scientific research permits;
- enhancement permits;
- 4(d) research authorizations;
- incidental take permits;
- incidental take authorizations;
- photography permits;
- General Authorizations;
- 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.

Table 3.3-8 below presents a list of currently permitted research activities within the project area.

This page intentionally left blank.

Table 3.3-8 Current NMFS Permits and Authorizations for Federally Protected Species Under the ESA and MMPA

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
10018	Level B Harassment of Humpback Whales in the Near Shore Waters Around Maui, Hawai`i	Keiki Kohola Project	6/18/2008	6/30/2013	Waters of the Au-Au Channel and in the near shore waters off the Four Island region of Maui, Hawai`i. All research activities would be conducted within the 200 fathom contour encompassing the islands of Maui, Molokai`i, Lāna`i, and Kaho`olawe.	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	Pacific Islands Fisheries Science Center (PIFSC) Hawaiian monk seal field research and enhancement activities.	NMFS PIFSC, 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.	Monk Hawaiian Monk Seal, Hawaiian Islands (Adult; All; pup; Pup/ Juvenile)	Capture/Handle/Release; Harass; Harass/Sampling; Unintentional mortality	Hand and/or Dip Net; Other
1127-1921	Permit to conduct level B harassment and biopsy sampling of cetaceans in Hawaiian waters	Hawai`i Marine Mammal Consortium	6/18/2008	6/30/2013	The core study area is the leeward coast of the island of Hawai`i (Figure 1b), but activities might be conducted in any of the near shore waters of the main and northwestern Hawaiian Islands, from 18^0 to 29^0 North latitude (Figure 1a), including waters of the (cut off in original)	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); Humpback Whale, Western North Pacific Stock (Adult; Adult/ Juvenile; Calf); Killer 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); Sperm 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); Beaked Longman'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/ 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 / Turtles	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

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
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
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. Research may also take pl (cut off in original)	Humpback Whale (Adult/ Juvenile; All; Non-neonate); Sperm Whale (All); North Pacific Right Whale, Eastern North Pacific Stock (All)	Harass; Harass/Sampling	Survey, vessel

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
					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
1581	PR1 Permit #1581 scientific research	NMFS PIFSC	12/13/2006	12/31/2011	Hawaiian Islands	Sea Green sea Turtle (Adult/ Subadult/ Juvenile); Sea Hawksbill sea Turtle (Adult/ Subadult/ Juvenile)	Capture/Handle/Re lease	Other
587-1767	PR1 Permit #587-1767 scientific research	Hawai`i Whale Research Foundation	10/3/2005	9/30/2011 (will be replaced by File No. 15274)	Hawai`i and Alaska	Bottlenose Dolphin, Hawaiian Stock (All); Humpback Whale (All); Killer Whale (All); 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

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
731-1774	Baird - cetacean scientific research	Cascadia Research Collective	9/16/2005	8/31/2011 (will be replaced by File No. 15330)	Pacific Ocean (Hawaii, California, Oregon, Washington, Alaska, other U.S. territories and international waters of the Pacific Ocean)	Blue Whale (All); Bottlenose Dolphin (All); Bryde's Whale (All); California Sea lion, US Stock (All); Dall's Porpoise, California/Oregon/Washington Stock (All); Fin Whale (All); Fraser's Dolphin, Hawaii Stock (All); Gray Whale, Eastern North Pacific (All); Harbor Porpoise (All); Harbor Seal (All); Humpback Whale (All); Killer Whale (All); Killer Whale, Eastern North Pacific Southern Resident Stock (All); Melon-headed Whale, Hawaiian Stock (All); Minke Whale (All); Risso's Dolphin (All); Rough-toothed Dolphin, Hawaiian Stock (All); Sei Whale (All); Sperm Whale (All); Spinner Dolphin, Hawaiian Stock (All); Steller Sea lion (All);Beaked Baird's beaked Whale (All);Beaked Blainville's beaked Whale, Hawaiian Stock (All);Beaked Cuvier's beaked Whale (All);Beaked Ginkgo-toothed beaked Whale (All);Beaked Hubbs' beaked Whale (All);Beaked Longman's beaked Whale (All);Beaked Perrin's beaked Whale (All);Beaked Stejneger's beaked Whale, Alaska Stock (All);Elephant Northern elephant Seal (All);Killer False killer Whale, Hawaiian Stock (All);Killer Pygmy killer Whale, Hawaiian Stock (All);Long-beaked Common Dolphin, California Stock (All);Right whale Northern right whale Dolphin (All);Short-beaked Common Dolphin, California/Oregon/Washington Stock (All);Short-finned Pilot Whale (All);Sperm Dwarf sperm Whale (All);Sperm Pygmy sperm Whale (All);Spotted Pantropical spotted Dolphin, Hawaiian Stock (All);White-sided Pacific white-sided Dolphin (All)	Harass; Harass/ Sampling; Import/export/ receive only	Survey, vessel
727-1915	PR1 Permit #727-1915 scientific research	Scripps Institution Of Oceanography	2/6/2008	2/1/2013	Hawai`i / 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, Hawai`i 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

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
782-1719	PR1 Permit #782-1719 scientific research	NMFS National Marine Mammal Laboratory	6/30/2004	6/30/2011; will be replaced by File No. 14525	North Pacific and Arctic Oceans (including Hawai`i and Alaska), the Gulf of Alaska, Bering, Chukchi, and Beaufort Seas, Gulf of California, Southern Ocean (Antarctica), territorial waters of Canada, Russia, Japan and Philippines, territorial seas and international waters	Beluga Whale (All); Beluga Whale, Beaufort Sea Stock (Adult/ Juvenile; All); Beluga Whale, Bristol Bay Stock (Adult/ Juvenile; All); Beluga Whale, Cook Inlet Stock (Adult/ Juvenile; All); Beluga Whale, Eastern Bering Sea Stock (Adult/ Juvenile; All); Beluga Whale, Eastern Chukchi Sea Stock (Adult/ Juvenile; All); Blue Whale (Adult/ Juvenile; All); Blue Whale, Eastern North Pacific Stock (Adult/ Juvenile; All); Bottlenose Dolphin (Adult/ Juvenile; All); Bowhead Whale, Western Arctic Stock (Adult/ Juvenile; All); Dall's Porpoise (Adult/ Juvenile; All); Fin Whale, California/Oregon/Washington Stock (Adult/ Juvenile; All); Fin Whale, Northeast Pacific Stock (Adult/ Juvenile; All); Gray Whale, Eastern North Pacific (Adult/ Juvenile; All); Harbor Porpoise (Adult/ Juvenile; All); Humpback Whale, Central North Pacific Stock (Adult/ Juvenile; All; Calf); Humpback Whale, Eastern North Pacific Stock (Adult/ Juvenile; All); Humpback Whale, Western North Pacific Stock (Adult/ Juvenile; All); Killer Whale (Adult/ Juvenile; All); Killer Whale, Eastern North Pacific Southern Resident Stock (All); Melon-headed Whale (Adult/ Juvenile; All); Minke Whale (Adult/ Juvenile; All); Risso's Dolphin (Adult/ Juvenile; All); Rough-toothed Dolphin (Adult/ Juvenile; All); Sei Whale (Adult/ Juvenile; All); Sperm Whale, North Pacific (Adult/ Juvenile; All); Spinner Dolphin (Adult/ Juvenile; All); Striped Dolphin (Adult/ Juvenile; All); Beaked Baird's beaked Whale (Adult/ Juvenile; All); Beaked Cuvier's beaked Whale (Adult/ Juvenile; All); Beaked Stejneger's beaked Whale (Adult/ Juvenile; All); Beaked Unidentified beaked Whale (Adult/ Juvenile; All); Long-beaked Common Dolphin (Adult/ Juvenile; All); North Pacific Right Whale, Eastern North Pacific Stock (Adult/ Juvenile; All); Right whale Northern right whale Dolphin (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); Spotted Pan	Capture/Handle/Release; Harass; Harass/Sampling; Unintentional mortality	Net; Survey, aerial; Survey, aerial/vessel; 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	ESA-listed Cetacea, all ESA-listed Pinnipedia under NMFS jurisdiction	Capture/Handle/Release; Harass; Harass/Sampling; Unintentional mortality	Net; Survey, aerial; Survey, aerial/vessel; Survey, vessel; captive
978-1791	Auditory research on stranded and rehabilitating cetaceans	Marine Mammal Research Program, Hawai'i Institute of Marine Biology	2/9/2006	2/28/12; will be replaced by File No. 16053	U.S. waters and rehabilitation facilities; primary location is Hawai`i	Any cetacean species that strands; excluding mysticetes	Captive animals (rehabilitating)	Captive
898-1764	PR1 Permit #898-1764 - enhancement permit for maintenance of captive Hawaiian monk seals	Sea Life Park Hawai`i captive facility	5/15/2006	5/31/2011	Sea Life Park Hawai`i captive facility	Monk Hawaiian monk Seal, Hawaiian Islands (Adult)	Captive animals (research, enhancement, public display)	Captive

Permit/File Number	Project Title	Organization	Date issued	Date Expired	Location	Species	Take Actions	Capture Methods
1071-1770	Long-term population studies of cetacean species in the Eastern, Western and Central North Pacific Ocean	The Dolphin Institute	6/9/2006	6/30/2011	Main study area is Hawaii; permit includes waters along the rim of the Pacific from CA northward to southeast AK, westward through the Gulf of AK, Aleutian Islands and regions of the upper Pacific.	Blue Whale, Eastern North Pacific Stock (All); Bottlenose Dolphin, Hawaiian Stock (All); Fin Whale, Hawaiian Stock (All); Humpback Whale, Eastern North Pacific Stock (Adult/ Juvenile;All); Killer Whale, Hawaiian Stock (All); Melon-headed Whale, Hawaiian Stock (All); Rough-toothed Dolphin, Hawaiian Stock (All); Sperm 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; Harass/ Sampling	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, University of Hawai`i	Application in process; FR published 1/27/11	N/A; will replace Permit No. 455-1760 (exp. 5/31/11)	Waikiki Aquarium, University of Hawaii 2777 Kalakaua Avenue Honolulu, HI 96815	Hawaiian monk Seal, Hawaiian Islands (Adult)	Captive animals (research, enhancement, public display)	Captive
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.	George Balazs, NMFS Pacific Islands Fisheries Science Center	Application in process; FR notice published 2/14/11	N/A; will replace Permit No. 1581 (exp. 12/31/11)	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
978-1857	PR1 Permit #978-1857 scientific research	Marine Mammal Research Program, Hawai`i Institute of Marine Biology	5/17/2007	5/31/2012	Hawai`i; floating pens on the leeward side of Coconut Island in Kaneohe Bay at the Hawai`i Institute of Marine Biology, O`ahu Hawai`i.	Bottlenose Dolphin (Adult; Adult/Juvenile); Killer False killer Whale (Adult)	Captive animals (research, enhancement, public display)	Captive

Source:

NMFS Authorizations and Permits for Protected Species Website : https://apps.nmfs.noaa.gov. Date Accessed: January 11, 2011

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 of this document.

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 Permitted Activities Annual Report 2009 (NOAA 2009d). BMPs for activities permitted within the Monument are presented in Appendix G. Table 3.3-9 lists the number of 2009 active permits by category. Table 3.3-10 provides basic information about each activity - permit type, permittee affiliation and project title/description.

Table 3.3-9 Number of Active Permits by Permit Type 2009

Permit Type	2009 Permits
Research	26
Conservation and Management	6
Education	2
Native Hawaiian Practices	3
Recreation	1
Special Ocean Use	9
TOTAL	47

Adapted from: Monument Permitted Activities Report 2009 (NOAA 2009d)

Table 3.3-10 Papahānaumokuākea Marine National Monument Permitted Activities 2009

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
Research	NOAA National Marine Fisheries Service PIFSC	3	Hapu'upu'u (*Epinephelus quernus*) Growth Studies on Kure Atoll and Midway Atoll; Lobster and Bottomfish Monitoring Activities in Federal Waters at Mokumanamana and Maro Reef; Juvenile Hawaiian Monk Seal Enhancement Activities
	NOAA National Ocean Service, Office of National Marine Sanctuaries (ONMS)	2	Northwestern Hawaiian Islands Reef Assessment and Monitoring Program; Use of Conventional and Technical SCUBA Diving Technology to Document the Biodiversity and the Presence or Absence of Alien/Invasive Species in Deep Reef Areas
	University of California, Santa Cruz	3	Study on the Foraging Ecology of Red-footed and Masked Boobies at Tern Island, French Frigate Shoals and Midway Atoll; Research and Monitoring of Hawaiian Albatrosses from Tern Island, French Frigate Shoals and Midway Atoll National Wildlife Refuge; Investigations of Black-lipped Oyster (*Pinctada margaritifera*) Recruitment and Abundance at Midway Atoll

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
	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
	University of Hawai`i Hawai`i Institute of Marine Biology	8	Quantifying the Movements of Sharks at French Frigate Shoals; Coral Genetics Research of Temperature in Coral Health and the Physical Environments of Coral Reefs at French Frigate Shoals and Pearl and Hermes Reef; Coral Endosymbiont Research; Quantifying the Movements of Top Predators Within Papahänaumokuäkea; Support for Activities to Quantify Shark Movements at French Frigate Shoals; Comparison of the Biological Community Structure and Diversity of Maritime Heritage Resource Sites with Surrounding Areas; Reef Fish Genetic Survey Research; Reef Invertebrate Genetic Survey Research

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
	University of Hawai`i Hawai`i Undersea Research Laboratory	2	Support for Permitted Activities Using the Pisces IV and Pisces V Submersibles and RCV-150 Remotely Operated Vehicle; Multi-beam Mapping, Deep Water Surveys, and Voucher Specimen Collection in Papahänaumokuäkea Marine National Monument
	Hawai`i Pacific University	2	Quantification of the Amount and Types of Marine Debris Ingested by Albatross Species at French Frigate Shoals, Midway Atoll, and Kure Atoll; Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems within Papahānaumokuākea Marine National Monument
	University of Lisbon, Portugal	1	Genetics Comparison of Pacific and Atlantic Bulwer's Petrels
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 Service , PIFSC	1	Galapagos Shark Predatory Monitoring and Mitigation Efforts on Hawaiian Monk Seal Pups
	University of Hawai`i, Marine Center	1	Support for Permitted Research Activities Using the University of Hawai`i Research Vessel *Ka'imikai-o-Kanaloa* as a Support Platform

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
Education	NOAA National Ocean Service, ONMS	1	Papahänaumokuäkea ʻAhahui Alakaʻi (PAA) Educator Program at Midway Atoll
	Waikiki Aquarium, University of Hawai`i	1	Selected Reef Fish and Coral Collection Activities to Produce Educational Exhibit
Recreation	USFWS, National Wildlife Refuge System	1	Administering the Visitor Services Program at Midway Atoll
Special Ocean Use	Conservation International	1	Participation in Wildlife Observation, Photography, Historical Tours, and Limited Recreational Activities on Midway Atoll
	Photo Safaris	1	Photo Documentary Activities on Wildlife, Cultural, and Historic Features of Midway Atoll
	Current TV	1	Production of a Short Film on Midway Atoll About the Effects of Marine Debris on Marine Life and Ecosystems
	Oceanic Society	1	Educational and Volunteer Activities on Midway Atoll
	Freelance Photographer	1	Marine and Terrestrial Photography Activities Within the Monument
	Chukyo T.V. Broadcasting Co.	1	Filming and Photography Activities of the PLASTIKI Sailing Vessel on Midway Atoll
	Telluride Institute / Reel Thing Productions	1	Filming Activities on Midway Atoll to Support a Documentary on the Impacts of Plastic Debris on the Environment
	Chris Jordan Photography	1	Establishing a Collection of Multimedia Art About Marine Plastic Pollution on Midway Atoll
	Amateur Radio Operator	1	Filming Ham Radio Activities on Midway Atoll

Permit Category	Permittee Affiliation	Number of Permits Issued	Permitted Project Titles
Native Hawaiian Practices	University of Hawai`i, Hawai`i Community College; Edith Kanaka'ole Foundation	1	Winter Solstice Cultural Research and Native Hawaiian Practices on Mokumanamana
	NOAA ONMS; Na Mamo O Mu'olea; The Nature Conservancy	1	Examination of the Basic Ecology of 'Opihi' Populations from a Cultural Perspective within Papahänaumokuäkea
	OAA ONMS; University of Hawai`i, Hawai`i Institute of Marine Biology	1	Continuation of the Cultural Health Index (CHI) Project within Papahänaumokuäkea

Notes:
Permitted projects with activity in 2009.
Source:
Adapted from: Monument Permitted Activities Report 2009 (NOAA 2009d)

This page intentionally left blank.

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 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 Population and Population Change

Area	Population			Population Change (%)			Population Density in 2010 (People per Square Mile)
	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

Notes:
* 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 861,789 jobs in November 2008 (BEA 2010) (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 2008 the state and its counties.

Table 3.4-2 Employment by Industry in 2008

	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	100,921	100%	626,137	100%	43,987	100%	102,704	100%	873,749	100%
Farm employment	6,067	6%	2,108	0%	1,061	2%	2,724	3%	11,960	1%
Nonfarm employment	94,854	94%	624,029	100%	42,926	98%	99,980	97%	861,789	99%
Private employment	80,857	80%	473,274	76%	37,869	86%	89,277	87%	681,277	78%
Forestry, fishing, and related activities	(D)		1,116	0%	(D)		(D)		3,471	0%
Mining	(D)		573	0%	(D)		(D)		892	0%
Utilities	517	1%	2,074	0%	249	1%	501	0%	3,341	0%
Construction	(D)		32,672	5%	(D)		6,841	7%	50,787	6%
Manufacturing	2,270	2%	14,298	2%	692	2%	1,848	2%	19,108	2%
Wholesale trade	(D)		17,787	3%	(D)		2,026	2%	22,831	3%
Retail trade	11,747	12%	60,126	10%	5,192	12%	11,891	12%	88,956	10%
Transportation and warehousing	(D)		23,468	4%	(D)		3,357	3%	30,971	4%
Information	932	1%	9,795	2%	386	1%	1,156	1%	12,269	1%

	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**
Finance and insurance	(D)		23,980	4%	(D)		2,024	2%	29,286	3%
Real estate and rental and leasing	(D)		26,755	4%	(D)		6,628	6%	42,091	5%
Professional, scientific, and technical services	(D)		36,316	6%	(D)		4,289	4%	46,679	5%
Management of companies and enterprises	(D)		6,694	1%	(D)		482	0%	7,594	1%
Administrative and waste services	5,552	6%	40,891	7%	3,638	8%	7,530	7%	57,611	7%
Educational services	(D)		14,781	2%	(D)		1,488	1%	18,408	2%
Health care and social assistance	8,035	8%	54,523	9%	2,864	7%	6,434	6%	71,856	8%
Arts, entertainment, and recreation	(D)		12,900	2%	(D)		4,711	5%	23,003	3%
Accommodation and food services	(D)		58,824	9%	(D)		20,588	20%	99,939	11%
Other services, except public administration	(D)		35,701	6%	(D)		6,877	7%	52,184	6%
Government and government enterprises	13,997	14%	150,755	24%	5,057	11%	10,703	10%	180,512	21%
Federal, civilian	1,334	1%	29,483	5%	549	1%	878	1%	32,244	4%
Military	1,390	1%	52,918	8%	582	1%	1,155	1%	56,045	6%
State and local	11,273	11%	68,354	11%	3,926	9%	8,670	8%	92,223	11%
State government	8,518	8%	56,046	9%	2,698	6%	6,090	6%	73,352	8%
Local government	2,755	3%	12,308	2%	1,228	3%	2,580	3%	18,871	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 2010). *CA25N Footnotes*. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N

Between 2001 and 2008, employment in Hawai`i increased by 14% (see Table 3.4-3). The highest gain is in the mining industry at almost 62%, followed by construction. Jobs in the tourism-related sectors of accommodation and food services and arts, entertainment, and recreation increased by over 9% and over 16%, respectively. Three sectors that experienced job losses during this period include forestry, fishing, and related activities; information; and manufacturing.

Table 3.4-3 Industry Employment Growth, 2001 to 2008 (% Change)

	Hawai`i County	City and County of Honolulu	Kaua`i County	Maui & Kalawao Counties	State of Hawai`i
Total employment	23.7%	11.8%	16.8%	18.3%	14.0%
Farm employment	14.3%	-26.1%	-20.2%	-2.7%	-2.7%
Nonfarm employment	24.3%	12.0%	18.2%	19.0%	14.3%
Private employment	26.6%	13.6%	20.3%	19.6%	16.2%
Forestry, fishing, and related activities		-38.6%			-13.3%
Mining		70.0%			61.9%
Utilities		22.4%		26.8%	23.2%
Construction		50.4%		41.5%	50.5%
Manufacturing		-3.3%		-14.4%	-2.8%
Wholesale trade		8.9%		25.4%	11.4%
Retail trade	16.5%	1.8%	6.0%	11.1%	5.0%
Transportation and warehousing		3.6%		14.2%	6.9%
Information	13.9%	-13.4%	-16.3%	-1.4%	-10.8%
Finance and insurance		17.4%		40.6%	21.3%
Real estate and rental and leasing		33.0%		32.4%	34.0%
Professional, scientific, and technical services		19.5%		27.2%	21.0%
Management of companies and		22.5%		20.2%	22.0%

	Hawai`i County	City and County of Honolulu	Kaua`i County	Maui & Kalawao Counties	State of Hawai`i
enterprises					
Administrative and waste services	34.3%	17.2%	39.8%	45.5%	23.1%
Educational services		17.2%		60.2%	24.2%
Health care and social assistance	20.0%	19.5%	12.6%	23.0%	19.5%
Arts, entertainment, and recreation		6.1%		20.6%	16.3%
Accommodation and food services		10.0%		7.3%	9.1%
Other services, except public administration		12.8%		22.7%	17.5%
Government and government enterprises	12.4%	7.1%	4.5%	13.5%	7.8%
Federal, civilian	37.5%	7.5%	46.8%	65.7%	10.1%
Military	-3.9%	5.2%	-10.3%	-6.9%	4.5%
State and local	12.3%	8.5%	2.9%	13.2%	9.1%
State government	10.1%	9.7%	-0.7%	10.1%	9.4%
Local government	19.7%	3.4%	11.5%	21.3%	8.2%

Source:
Regional Economic Information System, Bureau of Economic Analysis (BEA), US DOC. (April 2010). *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 ($39,242) is slightly higher than that of the nation as a whole , with the annualized growth rate of 6% between 2001 and 2007 (DBEDT 2009a) (see Table 3.4-4). Among the counties, the City and County of Honolulu has the highest per capita personal income in 2007 of $42,015, while Hawai`i County has the lowest at $29,702. 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 2007

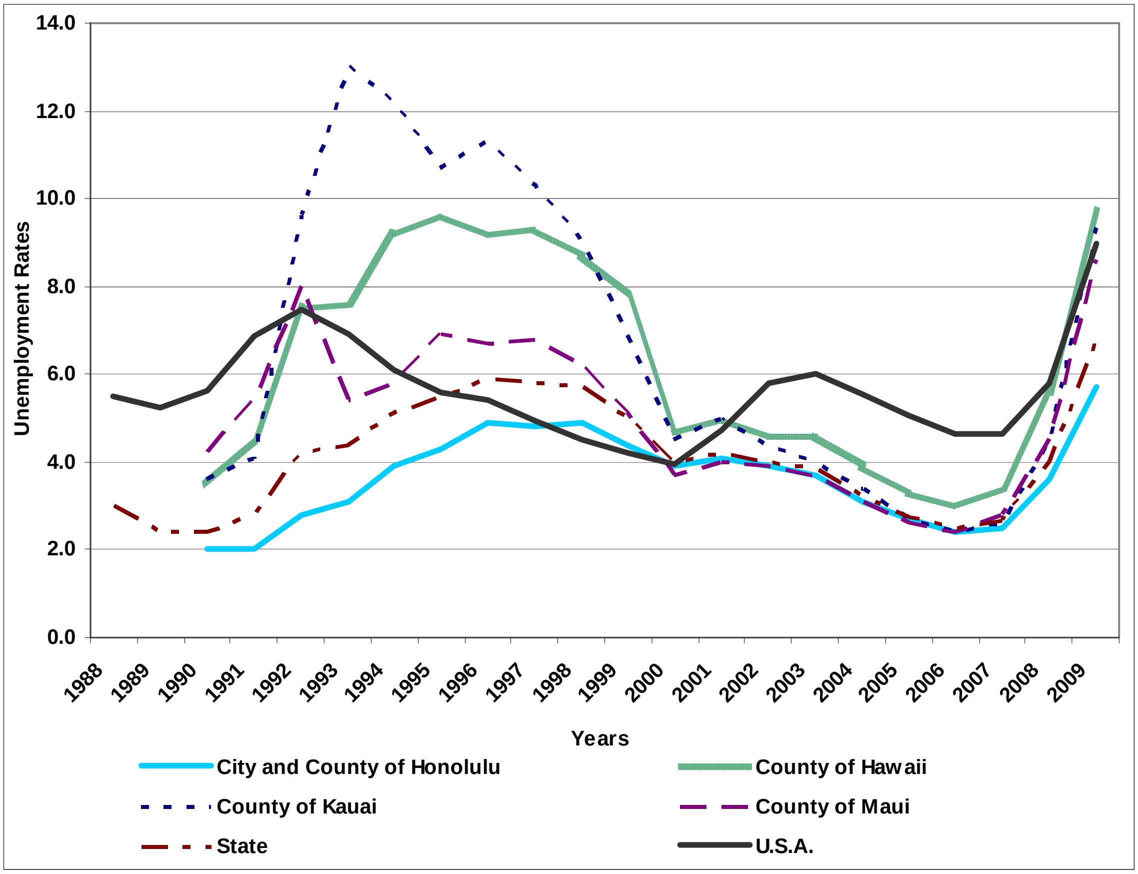
Area	**Per Capita Personal Income ($)**		
	2001	**2007**	**Annualized Rate of Change (%)**
City and County of Honolulu	30,759	42,015	6.1%
Hawai`i County	22,355	29,702	5.5%
Kaua`i County	24,421	33,356	6.1%
Maui County	25,456	35,835	6.8%
State of Hawai`i	28,840	39,242	6.0%
U.S.A.	30,582	38,615	4.4%

Source:
DBEDT (2009). *County Social, Business and Economic Trends in* Hawai`i*: 1990 – 2008.*

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 current recession, Hawai`i and its counties have faced high unemployment. As of 2009, the unemployment rate in Hawai`i is 6.8%, up from 4.0% in 2008. Among the counties, the highest unemployment rate is in the County of Hawai`i at 9.7%, followed by county of Kaua`i at 9.3% and County of Maui at 8.6% (see Figure 3.4-1). Despite these high rates, the national unemployment rate has grown faster than in the State of Hawai`i.

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 2009, about 27 million pounds of fish were caught for commercial purposes in the state, worth over $71 million (WPacFIN 2009) (see Table 3.4-5). The average value of commercial landings between 1990 and 2009 exceeds $63 million (WPacFIN 2009). The overall price per pound (based on amount paid to commercial fishers by dealers) for all commercial fish in 2009 was approximately $2.65. 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 2009

Year	Quantity (Millions of Pounds)	Value (Millions of Dollars)	Price per Pound (Dollars)
1990	17.95	$48.05	$2.68
1991	26.68	$64.38	$2.41
1992	26.83	$67.98	$2.53
1993	29.39	$73.45	$2.50
1994	23.23	$62.67	$2.70
1995	25.99	$59.22	$2.28
1996	24.10	$57.70	$2.39
1997	27.53	$61.60	$2.24
1998	28.52	$61.04	$2.14
1999	28.99	$62.91	$2.17
2000	28.62	$68.21	$2.38
2001	23.48	$48.08	$2.05
2002	23.97	$52.38	$2.19
2003	23.74	$52.75	$2.22
2004	24.46	$57.68	$2.36
2005	28.14	$71.04	$2.52
2006	25.66	$66.12	$2.58
2007	28.94	$75.70	$2.62
2008	30.68	$85.12	$2.77
2009	26.91	$71.17	$2.65

Source:

WPacFIN. (2010). 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 almost 96% of commercial landings with 25.7 million pounds of pelagic fish caught commercially in 2009 (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 2009 (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 2%of commercial landings in 2009 (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 in lieu of 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 to 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 2009

Year	Pelagic Fishes	Bottomfishes	Reef Fishes	Other Fishes
2000	26.74	0.72	0.20	0.95
2001	22.00	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	0.20	0.51
2007	27.73	0.44	0.23	0.54
2008	29.57	0.43	0.27	0.41
2009	25.70	0.45	0.27	0.49

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 2006 HMRFS data, it is estimated that 396,413 recreational fishermen brought in 17.6 million pounds of fish (HIPA 2009). The USFWS estimates the total number of recreational fishermen in Hawai`i at 158,000 in 2006, a significantly lower number compared to HMRFS. This discrepancy in the two sources of data may be due to different survey methodologies and accuracy of data, and also the lack of licensing and reporting requirements for recreational fishermen (HIPA 2009).

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 (Marine Recreational Information Program

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, 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

Native Hawaiians have a rich, traditional history of cultural and customary practices. These practices are acknowledged in the Hawai`i State Constitution, under Articles IX and XII.

Traditional Hawaiian customary practices are based on the kinship between Native Hawaiians and the land or `āina. Native Hawaiians see them as both children and stewards of their native lands. Traditional Hawaiian stewardship is based on a resource management system known as the "ahupua'a" system. The traditional ahupua'a system was a geo-political system that allowed for equitable and sustainable use of natural resources. Most ahupua'a extended from the highest mountain ridge (*i.e.*, the top of the watershed system) through the forests and low-lying areas out to the submerged reef. While not part of local ahupua'a systems, open ocean areas were nonetheless essential to cultural and customary practices as deep sea fishing was regularly practiced by Native Hawaiians.

NMFS PIRO commissioned a research project in 2010 to study the historical and cultural significance of the Hawaiian Monk Seal (Appendix K). The study included a review of existing and known research on the monk seal, the collection of information from the Hawaiian language archives and conducting ethnographic interviews with individuals from across the state. Over one dozen kūpuna (elders), practitioners, and other experts were interviewed or consulted for the study.

The results of the study showed that while individuals may have varied perspectives on the cultural significance of the Hawaiian monk seal, archival documentation shows that the monk seals were known to Hawaiians in the 19th century. Numerous names were discovered for the monk seal, including `īlioholoikauaua, hulu, he-`īlio-o-ke-kai and others. It was also discovered that there are many places throughout Hawaii that may be named for the monk seal, including `Īlio-pi`i (Moloka`i), Kalaeoka`īlio and others. References to monk seals were also found in traditional mo'olelo (stories) and genealogies.

Despite the archival documentation discovered, ethnographic interviews revealed that some Native Hawaiians do not believe the monk seal to be a native species. Whereas other interviews identified the monk seal as being associated with the Hawaiian god Lono or being `aumākua (ancestral guardians). Interviews also revealed current cultural practices associated with the monk seal that occur within the project area.

3.4.7 Cultural Resources and Historic Properties

Cultural resources include material remains of past human activities, both from historic and Pre-European contact. In addition, cultural resources include traditional cultural properties, such as areas used for ceremonies or other cultural activities that may leave no material traces, and may have on-going use important to the maintenance of cultural practices. Cultural resources management seeks to identify and protect all of these types of cultural resources with the goals of enhancing understanding of human behavior and protecting cultural practices. For cultural resources qualifying as historic properties, protection is afforded under the National Historic Preservation Act (NHPA).

NHPA defines an historic property as follows:

> …any Pre-European contact or historic district, site, building, structure, or object included in, or eligible for listing on the National Register, including artifacts, records, and material remains related to such a property or resource (46 CFR 800, as amended 2006, Title III, Section 301, #5).

The term "historic property" is used in the sense defined here throughout this chapter.

The criteria for evaluating eligibility for listing on the National Register of Historic Places (NRHP) are as follows:

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:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives of persons significant in our past; or
- 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
- That have yielded, or may be likely to yield, information important in prehistory or history (National Parks Service [NPS] 1997).

To qualify for protection under NHPA, a cultural resource must meet the rigorous criteria for National Register eligibility, thereby qualifying as an historic property.

If a cultural resource can be demonstrated to meet the criteria for listing on the NRHP, it qualifies as an historic property, and impacts to that historic property must be avoided or mitigated appropriately. Historic properties are protected from both indirect and direct effects. Indirect effects diminish some significant aspect of the historic property, but do not physically alter it. Direct effects physically alter the historic property in some way. The Area of Potential Effect (APE) is the area within which the proposed undertaking has the potential to either directly or indirectly impact historic properties that may be present. If an effect on an historic property is identified within the APE, consulting parties must agree on whether the effect is adverse. If an effect is adverse, either avoidance of the effect or mitigation for the effect is required under NHPA. Historic properties that are not in the APE are identified but excluded from further analysis because there is no potential effect on those properties from any of the alternatives.

This section describes cultural and historic resources located within the direct APE, both on and offshore, within and adjacent to areas where research and enhancement activities may occur. As determined by NMFS, 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. More specifically, the APE includes portions of the open ocean and near shore environment where monk seals may be found as well as the shore zone of the islands, islets, and atolls that make up the Hawaiian Archipelago and Johnston Atoll. For the purposes of this project, the direct APE includes areas within 25 m of the shoreline. In addition, secondary use areas, such as research field camps in the NWHI, are also included in the direct APE. Known shipwrecks or navigational hazards within 300 meters from shore will also be evaluated.

The Hawai`i State Historic Preservation Division's Statewide Historic Preservation Plan suggests several themes important in the history and development of Hawai`i. The following cultural resources could offer insight into traditional Hawaiian life and history:

- Traditional agricultural fields;
- Dwellings;
- Fish ponds;
- Trails;
- Petroglyphs;
- Heiau (religious structures); and
- Burials.

Important Euro-Historic themes include missionary and religious endeavors, sugar and pineapple plantations, whaling and other maritime pursuits, and military activities. Also important in the history of Hawai`i is the multi-ethnic society, reflected by varied religious institutions and cemeteries (SHPD 2001).

3.4.7.1 *Cultural and Historic Resources in the Northwestern Hawaiian Islands*

A variety of cultural resources may be found within the NWHI. Offshore, sunken vessels including World War II military ships, historic cargo ships, whaling and fishing vessels, and recreational boats could potentially be present, though data on the presence and the location of these are limited. Other offshore archaeological resources that could be found include submerged aquaculture ponds, junked land vehicles, and submerged harbor and shoreline features. In addition to archaeological sites and traditional cultural properties, the potential exists in the NWHI for historic structures, including harbor and other ocean related facilities, as well as military structures. Stone walls, terraces, platforms, wells, heiau, cultural artifacts, and mounds representing cultural activity could also be found in the NWHI. The NWHI also includes numerous sites significant to traditional Hawaiian navigation and seafaring traditions.

A recently discovered shipwreck is representative of whaling activity in the NWHI. The whaling ship Two Brothers, which sank off of French Frigate Shoals in 1823, was identified. The potential for shipwrecks within the NWHI is confirmed by this find. The Two Brothers shipwreck is the subject of on-going study by NOAA researchers (ScienceDaily 2011).

Several historic properties listed on the NRHP are located in the NWHI. The National Historic Landmark (NHL) World War II Facilities site is located on Midway Atoll, a nationally significant historic site. This historic property's significance is based on the role the atoll played in the pivotal battle of the Pacific War. Several ammunition magazines, a concrete pillbox, and gun and battery emplacements are the features related to this historic event that are included in the NHL listing (NPS 2011). However, this historic property is not located within the APE and will not be affected by the proposed project.

As described in NOAA 2008b, all documented Native Hawaiian archaeological sites in the NWHI are on Nihoa Island and Necker Island (also known as Mokumanamana)), although the cultural significance of the entire NWHI chain has been documented in more recent publication (Kikiloi 2010). Both the Necker Island and Nihoa Island Archaeological Districts were listed on the NRHP in 1988. The period of significance for the Necker Island Archaeological District is 1500 to 1749 A.D.; this District includes agricultural fields, domestic remains, and ceremonial sites. The Nihoa Island Archaeological District period of significance is 1000 to 1749 A.D.; this District includes agricultural and domestic remains, as well as ceremonial sites (NPS 2011).

Nihoa and Necker Islands hold 45 heiau (shrines) between them (NOAA 2008b). Among the recorded sites on Nihoa and Necker Islands are religious and ceremonial features (cairns, terraces, stone platforms, upright stones, and burial sites; Emory 1928; TenBruggencate 2005; U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007 as cited in U.S. Department of Navy 2008a). These historic properties are not located within the APE and although the entire Monument was named UNESCO's first mixed use (natural and cultural) World Heritage Site in the United States in 2010, sites would not be affected by the alternatives.

While relatively few historic properties are identified within the NWHI as compared to the MHI, the potential for significant archaeological and structural historic properties clearly exists. In addition to land-based historic properties, shipwrecks and other submerged cultural resources could be present off-shore in the NWHI. On land, cultural resources in the NWHI include burial sites, temples, campsites, house sites, sites related to the Plantation Period, Department of Defense facilities, sites including evidence of stone tool manufacture, and aquaculture ponds. No historic properties are recorded within the APE in the NWHI.

3.4.7.2 *Cultural and Historic Resources in the Main Hawaiian Islands*

Historic and cultural sites found within the APE in the MHI include shipwrecks, historic structures, burials, fishing shrines, heiau (religious structures), leina (cultural sites from which spirits leapt into the next world), cultural structures related to Hawai`i's traditional navigation and other seafaring traditions, and fishponds. This chapter will focus on cultural resources within approximately 300 m of the shoreline offshore and 25 m from shore inland, within the APE (see Figures 3.4-2-3.4-6 for Historic Sites within the project area). Many of the cultural and historic sites within the MHI are documented on the NRHP website (http://www.nps.gov/nr/). In addition, many cultural and historic resources have been summarized (including maps documenting known resources) in the recent Hawai`i Range Complex Final EIS/Overseas EIS (http://www.govsupport.us/navynepaHawaii/Hawaiirceis.aspx; U.S. Navy 2008a) and that information has been incorporated here by reference. The State of Hawai`i Office of Planning maintains a Geographic Information System (GIS) database that can be used to map shorezone features including fishponds (http://Hawai`i.gov/dbedt/gis/) (see Figures 3.4-7 through 3.4-9, Fishponds within the Project Area in the MHI). In addition, the University of Hawai`i at Manoa manages a database of identified Hawaiian saltwater fishponds (U.S. Navy 2008a).

Some aquaculture ponds date back to A.D. 1000, and some are still in use. Extant fishponds could be visible along the shoreline, or could be submerged. Several fishponds on O'ahu are listed on the NRHP, including Heeia (address restricted), Huilua (Kahana Bay), Kahaluu, and Molii. In addition, on March 14, 1973, Loko Okiokiolepe, also on O'ahu, was officially listed in the NRHP (Hawai`i State Historic Preservation Office, 2006; U.S. Department of the Navy, Commander Navy Region Hawai`i, 2002, as cited in U.S. Navy 2008a). Most of the interior of Loko Okiokiolepe has been filled, but the seaward coral wall still remains intact (Naval Facilities Engineering Command, 2006, as cited in U.S. Navy 2008a). Menehune fishpond in Kauai County is another NRHP-listed fishpond. The island of Moloka`i has numerous NRHP-listed fishponds, including Moloka`i Fishponds Multiple Property. The islands of Hawai`i, Maui, and Lāna`i also include fishponds located adjacent to the shoreline (Figures 3.4-10 through 3.4-13).

Offshore, shipwrecks are known within the MHI waters. Shipwrecks in shallow water close to shore that could present hazards to navigation are reported off almost all of the NHI, including Kaua`i, Lāna`i, O`ahu, Moloka`i, and Maui (OIRC 2011). Maps of known shipwrecks or navigational hazards within 300 m off shore are provided as Figures 3.4-7 through 3.4-9. While these shipwrecks do not necessarily have cultural significance, the potential exists. There are several shipwrecks off the coast of O`ahu that are listed on the NRHP, many of which are located in Pearl Harbor, including the U.S.S. Arizona, visible from the memorial constructed over the wreck, U.S.S. Bowfin, and U.S.S. Utah.

In Maui County, several NRHP listed properties are close to the shoreline. The NRHP-listed Wo Hing Society Building, in Lahaina, attests to the multi-cultural history of Hawai`i. Two NRHP-listed churches, Maui Jinsha Mission in Wailuku, and Wananalua Congregational Church in Hana, are located near the shoreline. Keanae School in Keanae, and the Moloka`i Lighthouse in Kalaupapa, are also listed on the NRHP and are located near the shoreline. Numerous archaeological sites in Maui County are listed on the NRHP, but the locations of these sites are protected; therefore their proximity to the shoreline cannot be determined (NPS 2011). The historic properties for which locations could be determined within Maui County are not located within the APE and are therefore excluded from further analysis.

The Na Pali Coast Archeological District located on Kaua`i, was listed on the NRHP in 1984 and includes 65,000 acres on the coast near Hanalei. Also in Waimea is the Yamase Building. Hanalei Pier and Hanalei Elementary School are NRHP-listed properties in and near Hanalei that are near the shoreline (NPS 2011). Only Hanalei Pier falls within the APE.

In Hawai`i County, a variety of historic property types are included on the NRHP. Some of the residential structures listed on the NRHP, such as the James M. Hind House and the J.A. Williamson House, are near the shoreline. Some government buildings are also located at or near the shoreline, such as the District Courthouse and Police Station and the U.S. Post Office and Office Building (NPS 2011). Moku'aikaua Church, Kailua-Kona, represents the first missionaries to work in Hawai`i. The extant stone structure, with an interior featuring native woods, was completed in 1837 on the site of the original thatched roofed structures, constructed in 1820 and 1825 (Fischer 2011). Moku'aikaua Church is located adjacent to the shoreline. Also in Hawai`i County is the residence of King Kamehameha I, and the Birthplace of Kamahameha III (NPS 2011). None of the historic properties in Hawai`i County are located within the APE.

Honolulu County (the island of O`ahu, and excluding the NWHI) includes numerous historic properties listed on the NRHP in the vicinity of the shoreline. Several residential structures in Honolulu, including Bartlett Cooper House, six houses on Kalakaua Drive, and C.W. Dickey House, are NRHP listed, and located within the APE. Two NRHP-listed U.S. Coast Guard lighthouses, Makapuu Point and Diamond Head, are located very close to the shoreline; only the lighthouse on Makapuu Point is located within the APE. Other military facilities on the NRHP in Honolulu County include War Memorial Natatorium, Battery Hawkins and Battery Hawkins Annex, and CINCPAC Headquarters and sunken vessels in Pearl Harbor, discussed above. Other buildings within the APE listed on the NRHP include the U.S. Immigration Office, C. Brewer Building, Dillingham Transportation Building, Aloha Tower, and Kakaao Pumping Station. Two fishponds, Kahaluu and Okiokilepe, and a heiau, Puu o Mahuka Heiau, are also NRHP listed. In addition, Honolulu includes several NRHP-listed historic districts that include areas near the shoreline (NPS 2011).

Traditional cultural properties that may be present in the MHI include archaeological sites such as ceremonial and burial sites, as well as natural resource areas employed for traditional cultural practices, such as dunes, water sources, and plant-gathering areas. Burial sites could also represent non-Native Hawaiian cultures, such as Japanese, Korean, Portuguese, Chinese, and Filipino. Known cemeteries representing these cultures are located in the Kekaha, Hanapepe, and Waimea areas. Traditional cultural properties recognized to be potentially eligible for listing on the NRHP include Kawaiele Ditch, Nohili Dune, and Elekuna Heiau. Another example of a traditional Native Hawaiian cultural property is Mana, an area believed to launch spirits of the deceased into the spiritual realms (U.S. Department of Navy 2008a).

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 2008, over 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 showing signs of recovery since September of 2010, with total visitor spending increasing by double digits for all islands between September and November.

Total spending by visitors to Hawai`i between January and November of 2010 was $10.3 billion, an increase of 16% 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 21.3%, while O`ahu topped the list in terms of total spending at $5.1 billion. Per person per day spending increased by 6.5% and reached $172.2. Approximately 6.5 million people visited Hawai`i in the first 11 months of 2010, an increase of 8.6%from the same period in 2009. About 4 million of these visited O`ahu, while almost 2 million visited Maui. Overall, the total visitor days increased 8.9% to 59.8 million in Hawai`i (HTA 2010) (see Table 3.4-7).

Figure 3.4-2 National Register of Historic Places Within the Project Area - Hawai'i

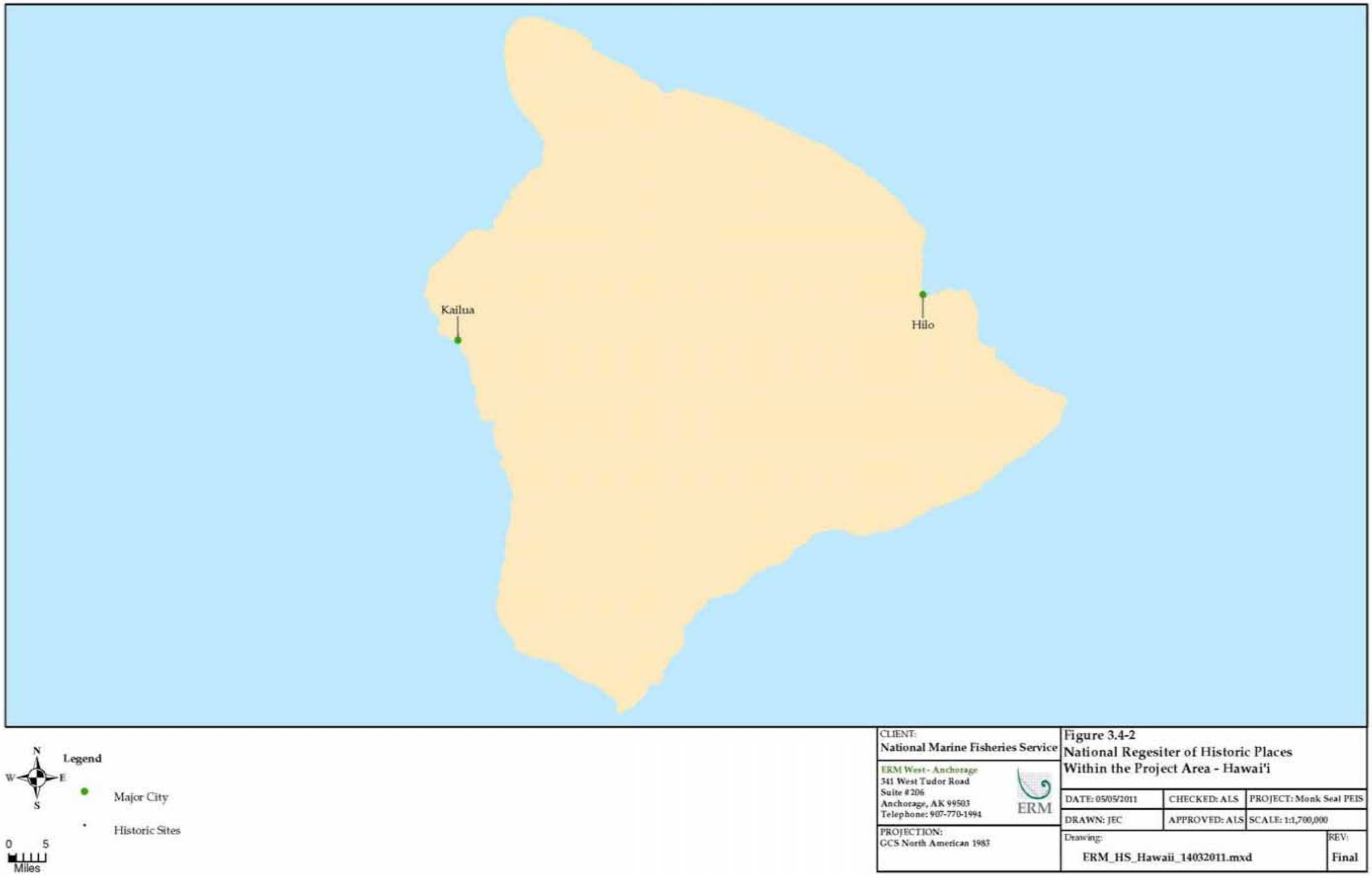


Figure 3.4-3 National Register of Historic Places Within the Project Area – Moloka'i, Lāna'i, Kaho'olawe, and Maui

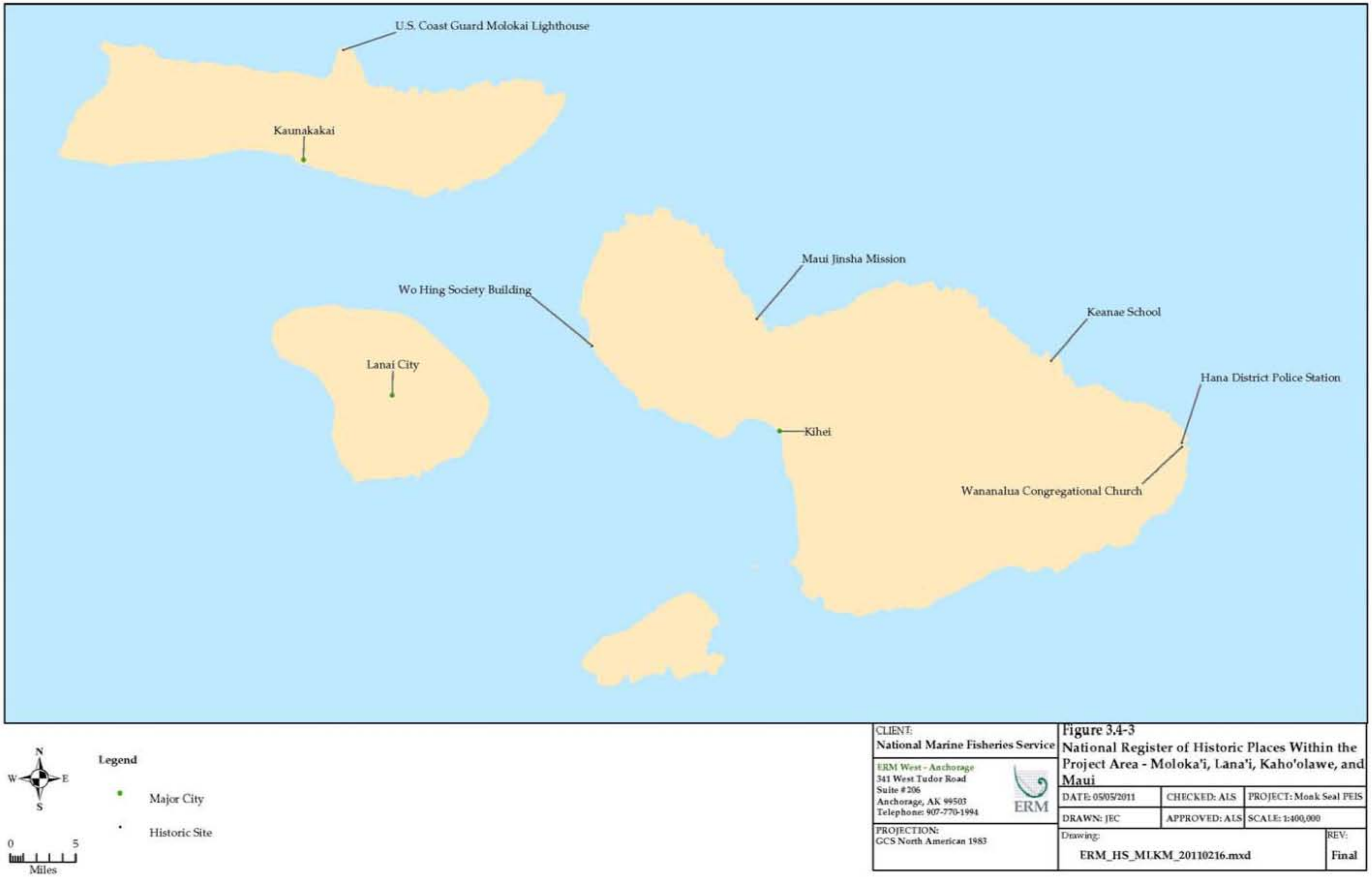


Figure 3.4-4 National Register of Historic Places Within the Project Area – O'ahu

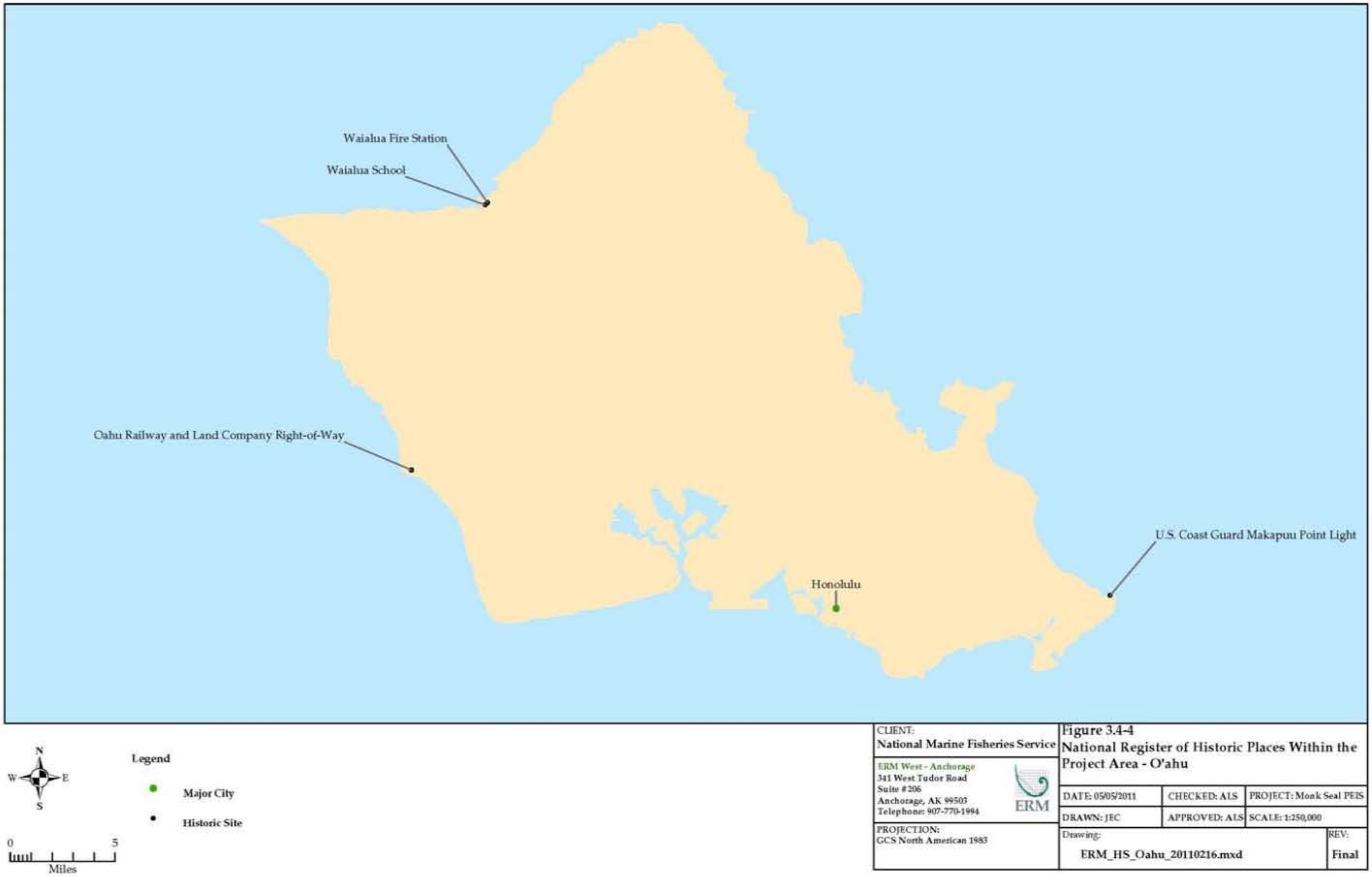


Figure 3.4-5 National Register of Historic Places Within the Project Area – O'ahu (Pearl Harbor and Waikiki)

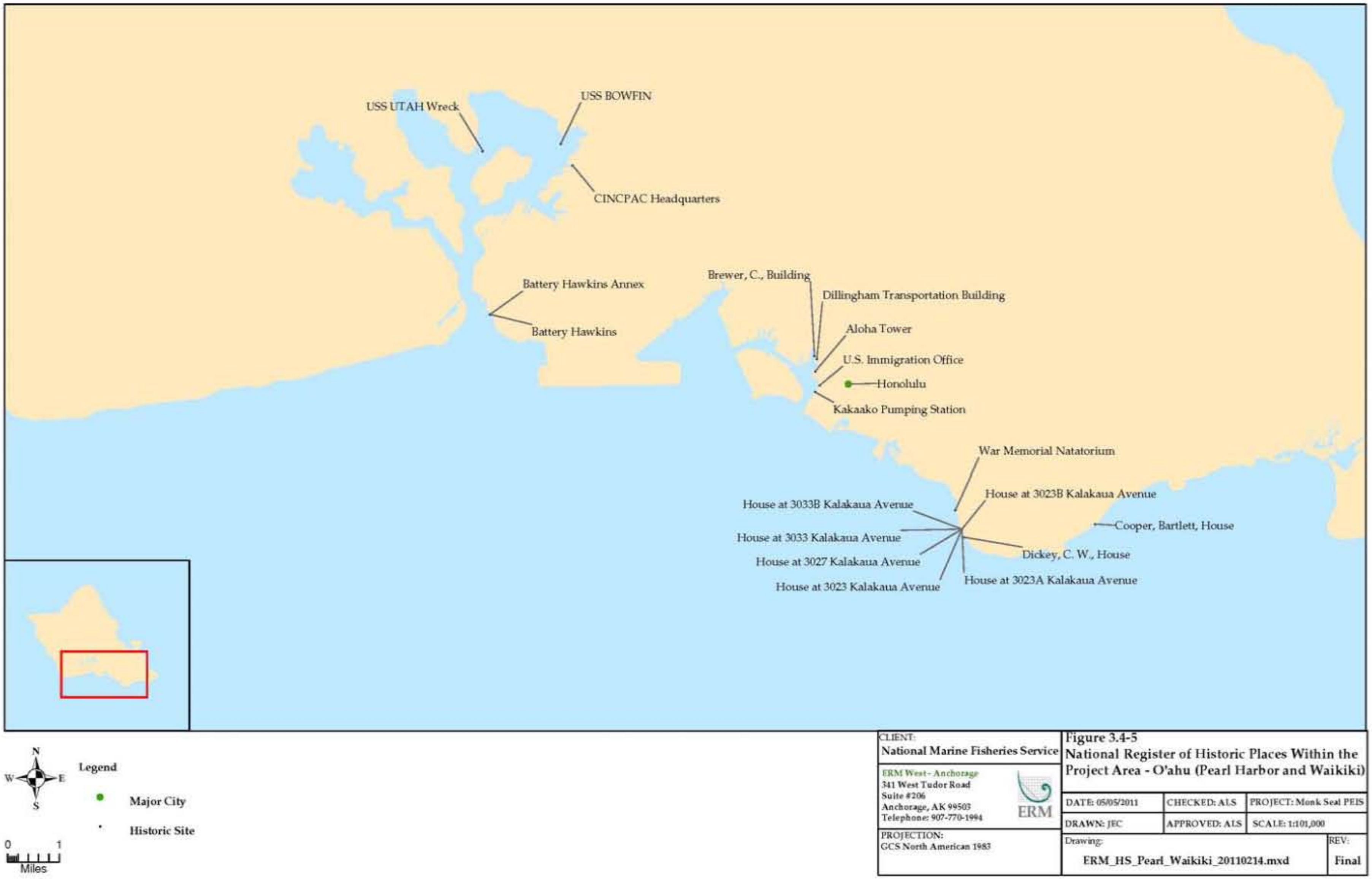


Figure 3.4-6 National Register of Historic Places Within the Project Area - Kaua'i and Ni'ihau

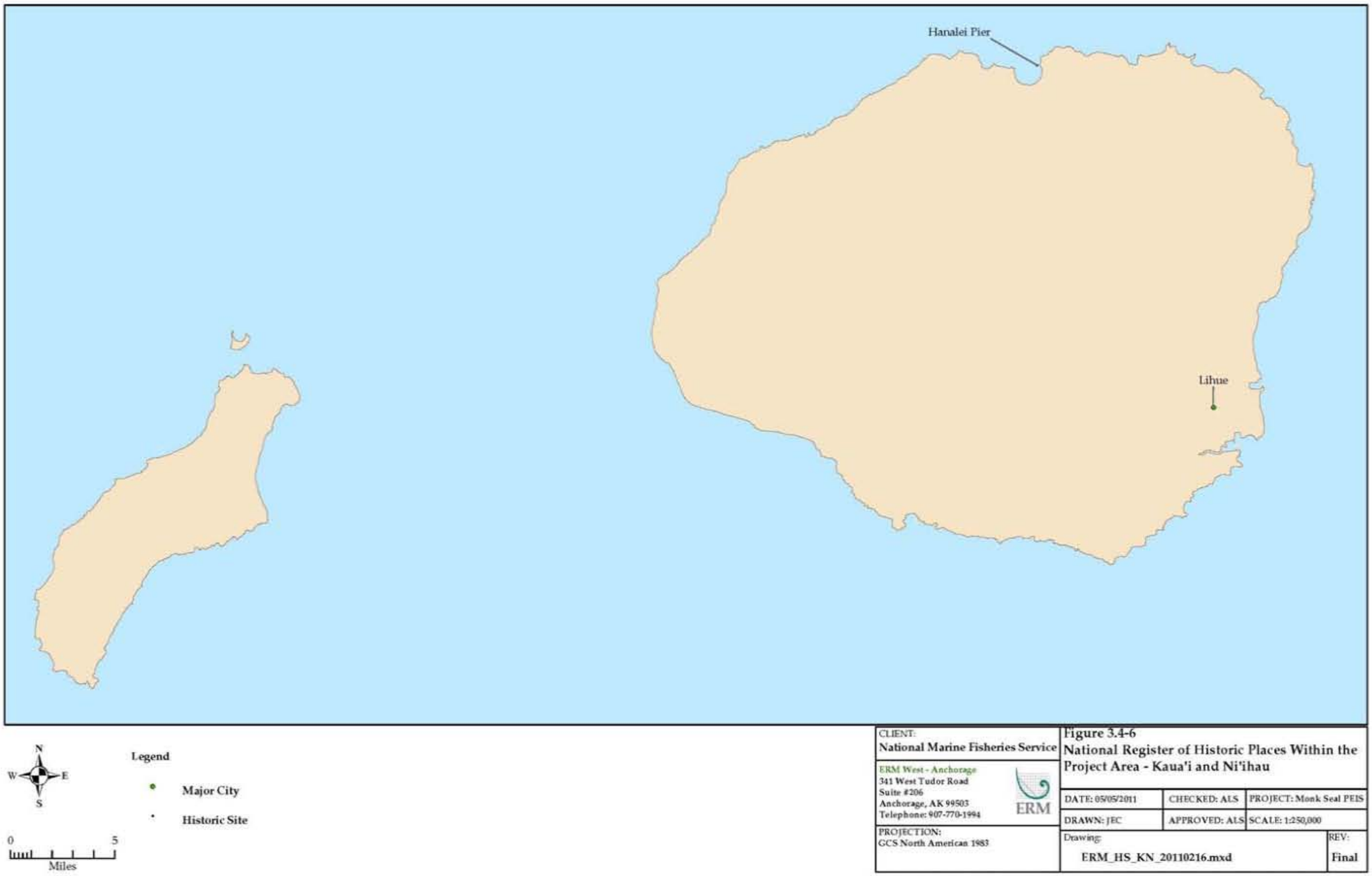


Figure 3.4-7 Shipwrecks Dangerous to Surface Navigation - Kaua'i

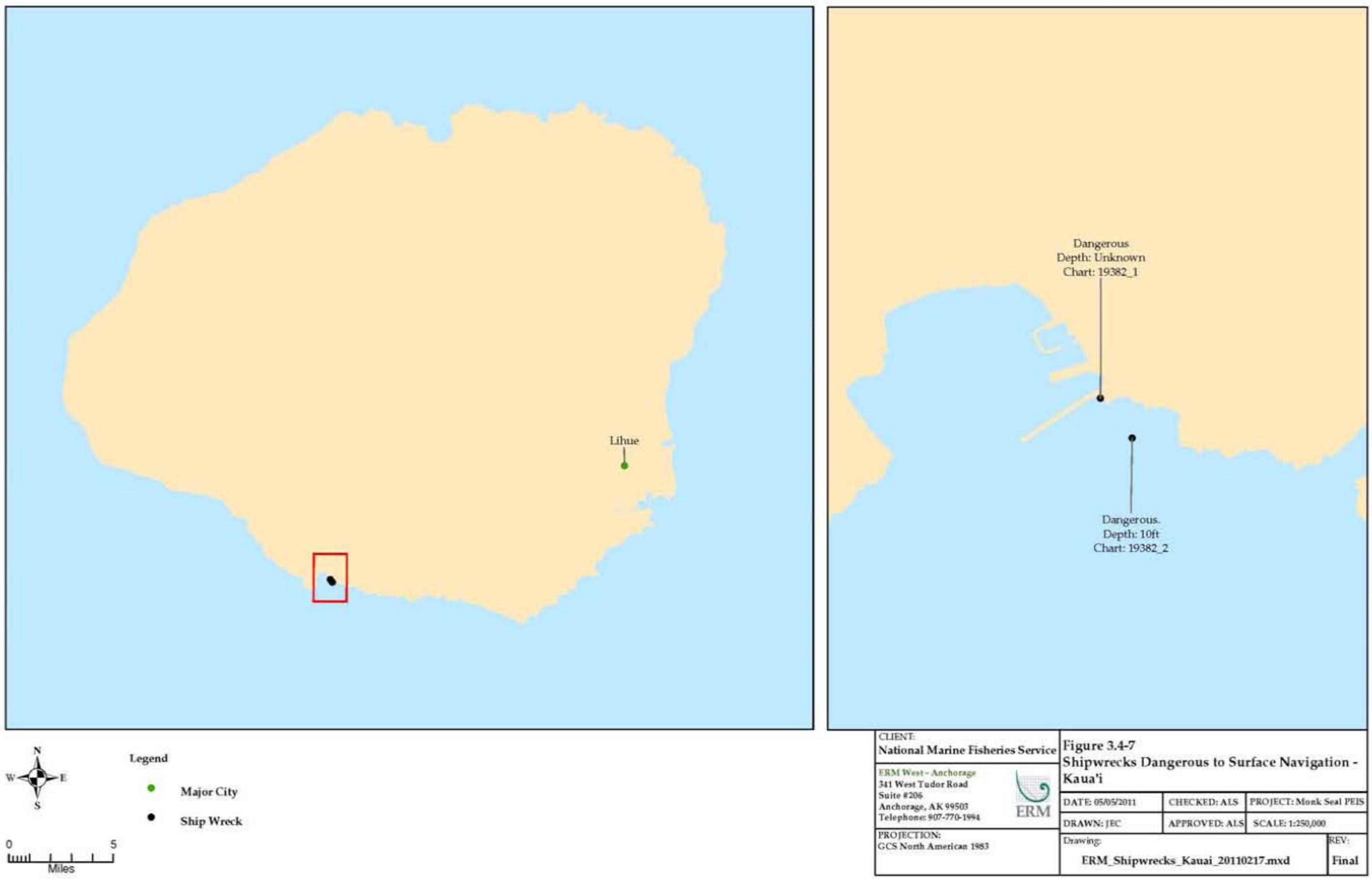


Figure 3.4-8 Shipwrecks Dangerous to Surface Navigation – O'ahu

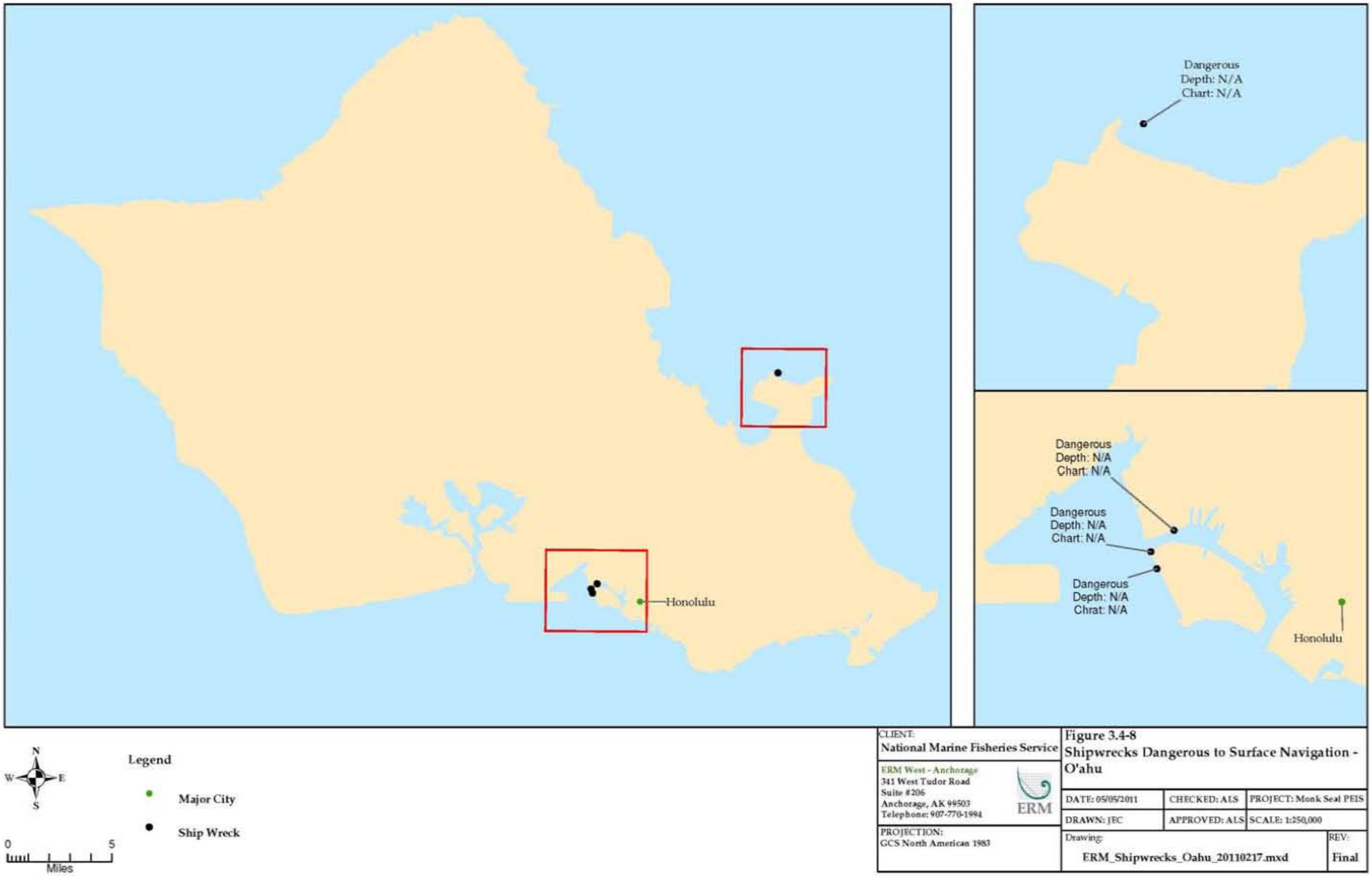


Figure 3.4-9 Shipwrecks Dangerous to Surface Navigation - Moloka'i, Lāna'i, Kaho'olawe, and Maui

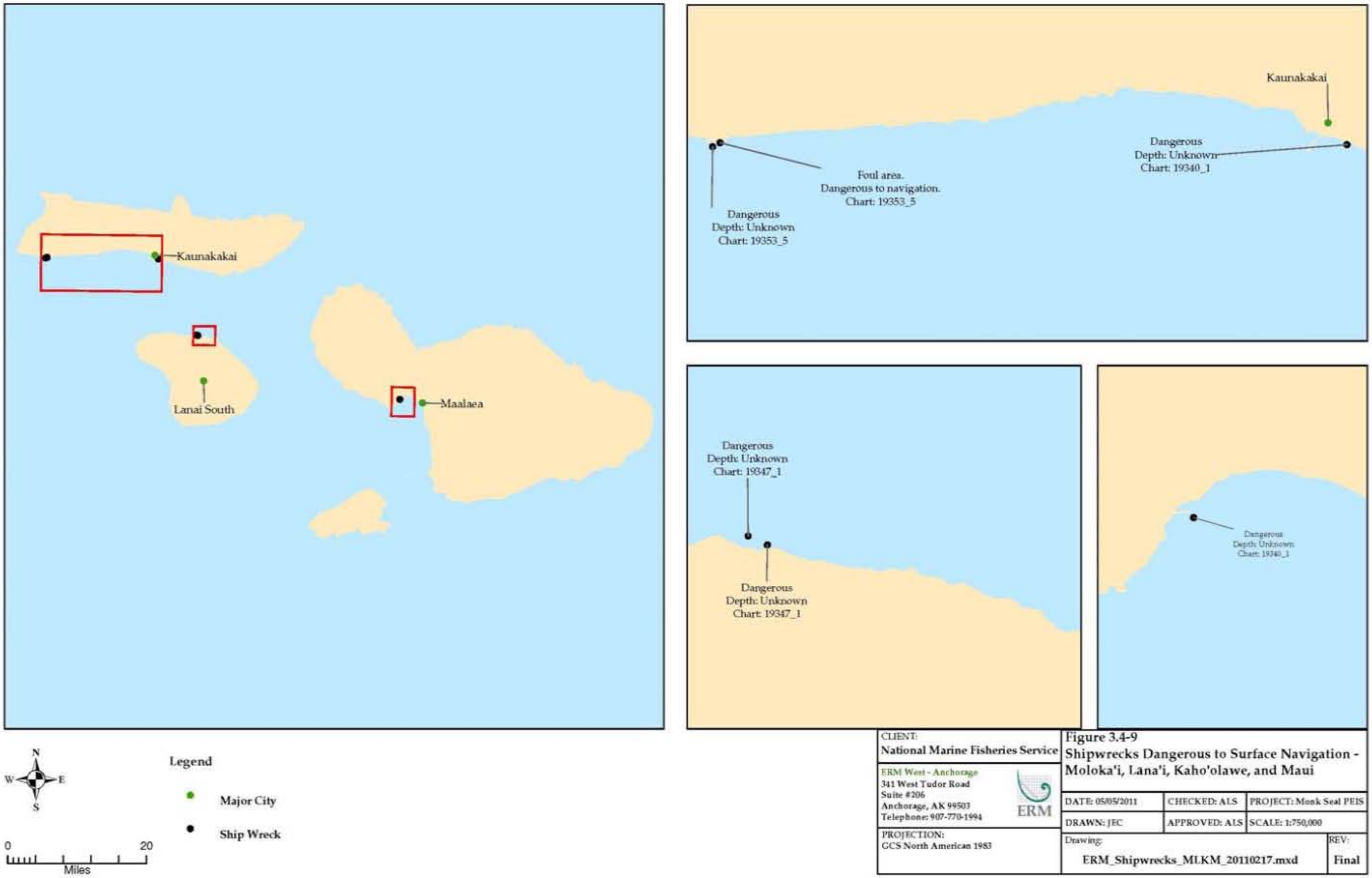
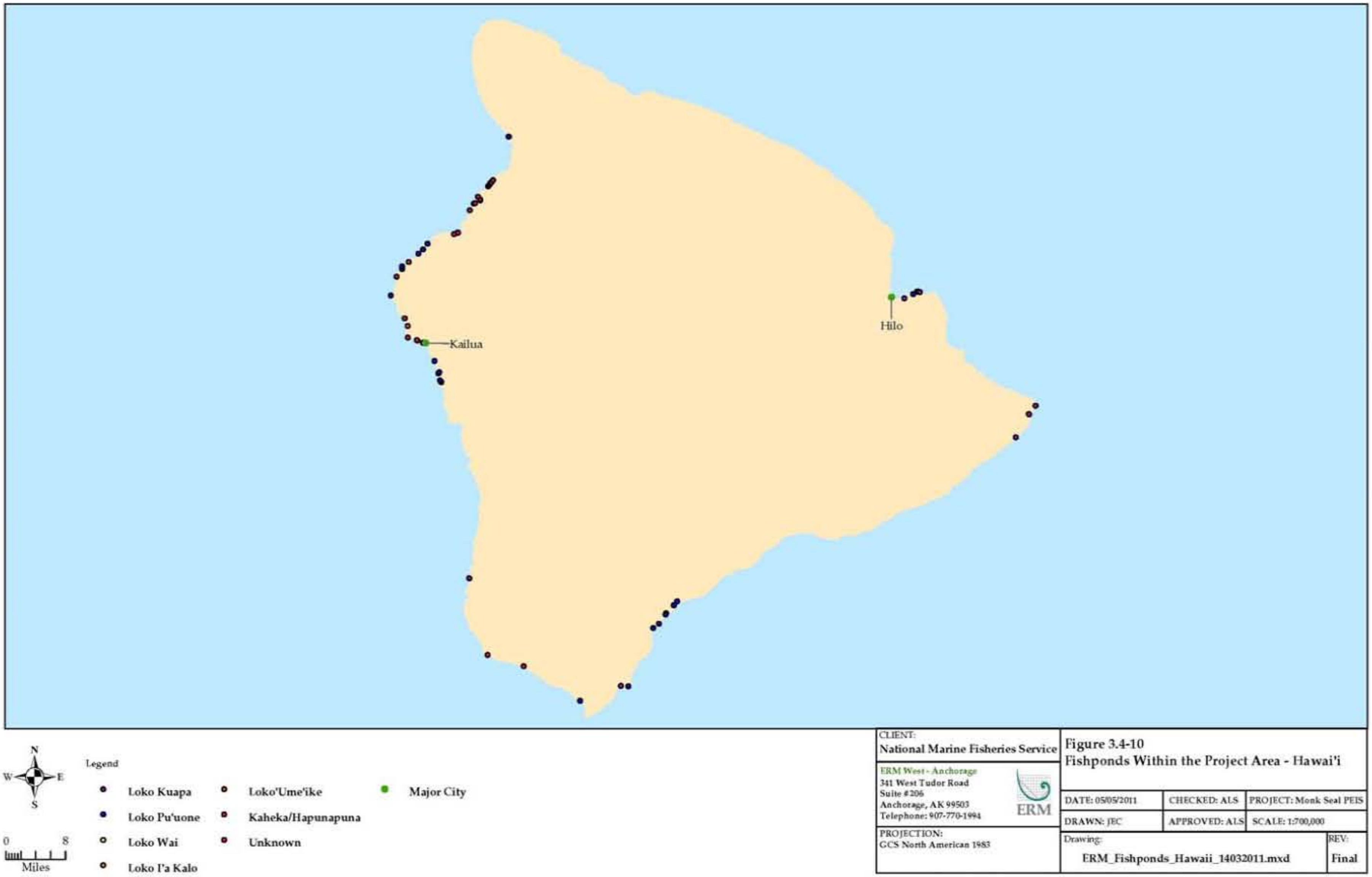


Figure 3.4-10   Fishponds Within the Project Area - Hawai'i



CLIENT: National Marine Fisheries Service	Figure 3.4-10 Fishponds Within the Project Area - Hawai'i		
ERM West - Anchorage 341 West Tudor Road Suite #206 Anchorage, AK 99503 Telephone: 907-770-1994 ERM	DATE: 05/05/2011	CHECKED: ALS	PROJECT: Monk Seal PEIS
	DRAWN: JEC	APPROVED: ALS	SCALE: 1:700,000
PROJECTION: GCS North American 1983	Drawing: ERM_Fishponds_Hawaii_14032011.mxd		REV: Final

Figure 3.4-11   Fishponds Within the Project Area - Kaua'i and Ni'iahu

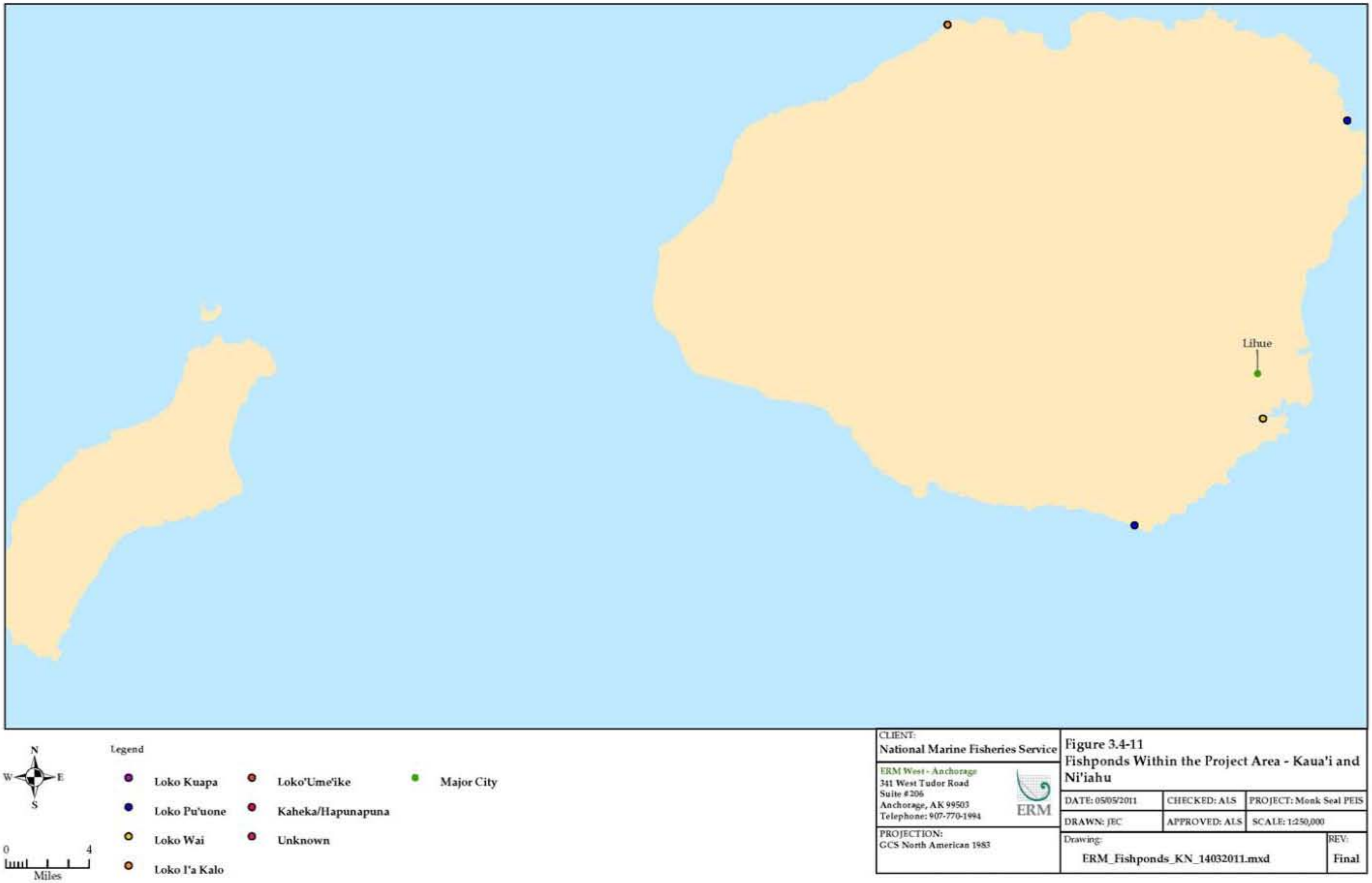


Figure 3.4-12 Fishponds Within the Project Area - Moloka'i, Lāna'i, Koho'oawe, and Maui

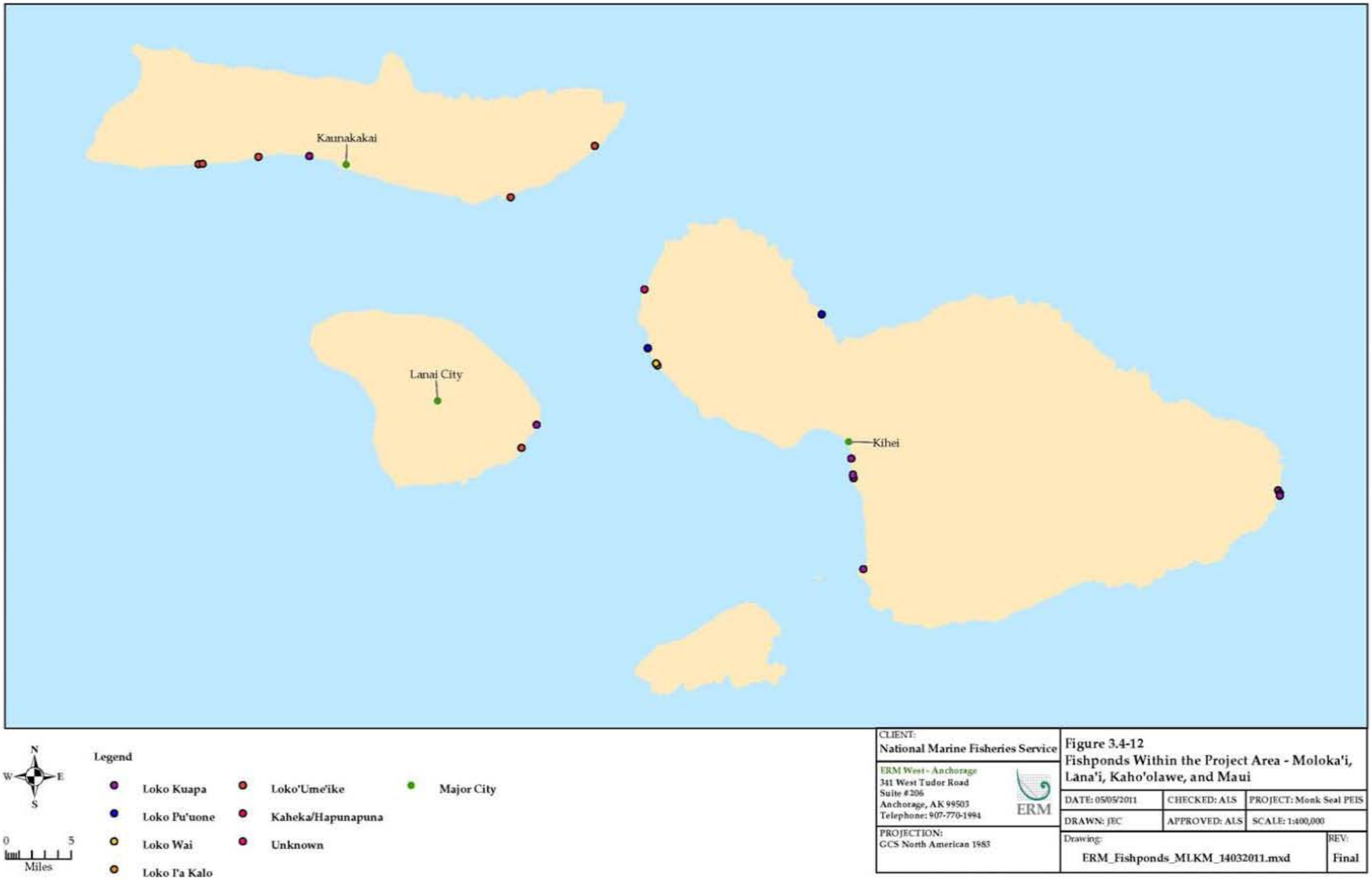


Figure 3.4-13 Fishponds Within the Project Area – O'ahu

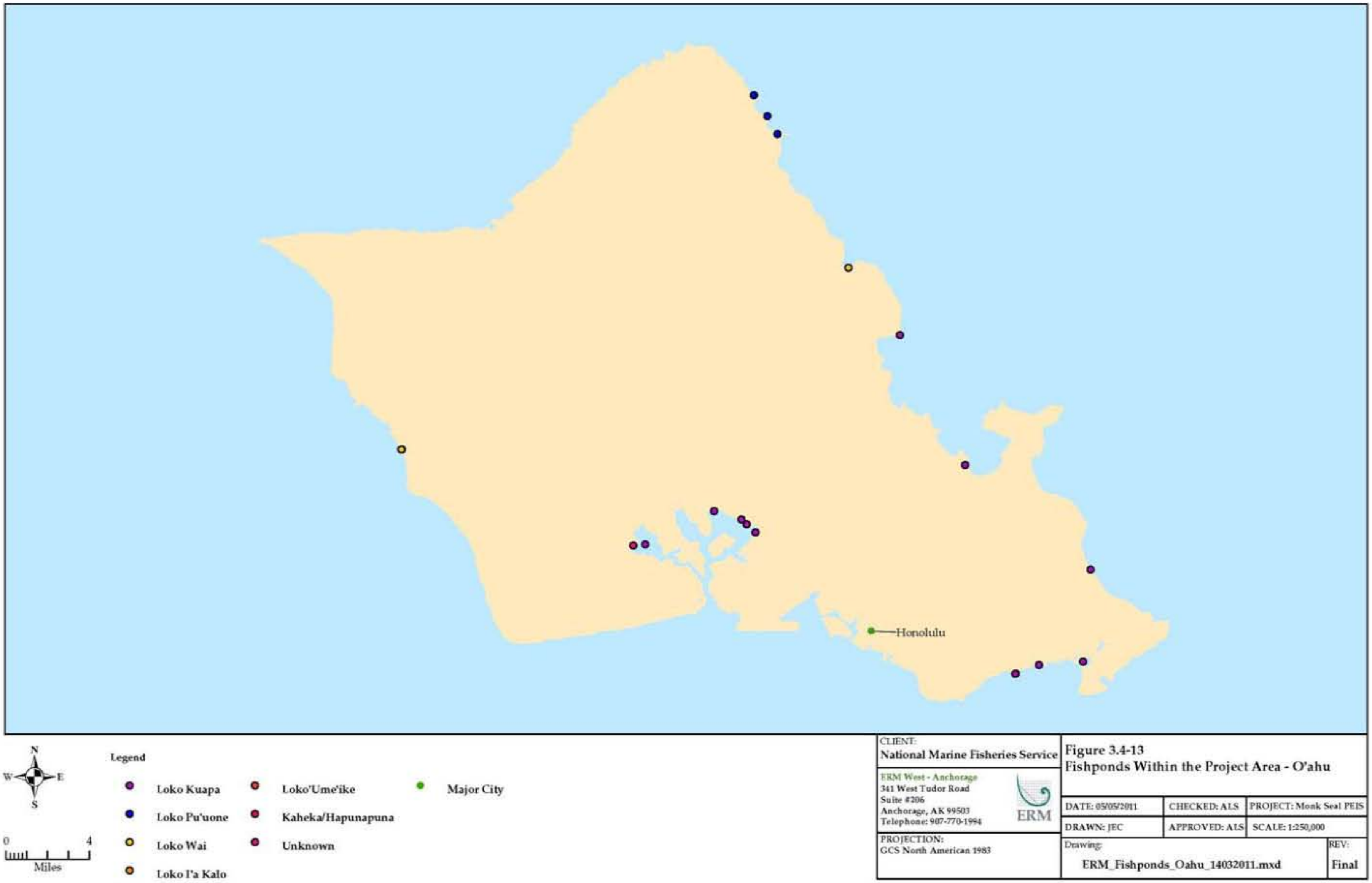


Table 3.4-7 Key Tourism Statistics for the State of Hawai`i and its Counties – January to November 2010 and Percent Change from January to November 2009

YTD thr Nov 2010	Hawai`i	% Change	Maui	% Change	Lāna`i 1/	% Change	Moloka`i 1/	% Change	O'ahu	% Change	Kaua`i	% Change	State Total	% Change
Total Arrivals	1,175,668	6.3%	1,904,904	10.3%	61,688	11.5%	45,710	4.3%	3,943,244	7.6%	883,841	4.0%	6,450,795	8.6%
Total Visitor Days	8,190,873	7.5%	15,182,809	10.7%	221,179	11.1%	218,005	4.3%	28,929,138	9.4%	6,559,176	5.3%	59,848,716	8.9%
Total Expenditures ($mil.)	1,299.1	18.1%	2,721.3	21.3%	62.2	11.1%	23.9	6.6%	5,146.9	13.7%	1,025.9	13.1%	10,304.8	16.0%
PPPD[2] Spending ($)	158.6	9.9%	179.2	9.5%	281.3	0.0%	109.4	2.1%	177.9	3.9%	156.4	7.4%	172.2	6.5%
Domestic Arrivals	898,806	3.7%	1,647,232	8.7%	52,409	9.6%	37,807	1.2%	2,359,802	5.4%	808,545	2.4%		
Int'l Arrivals	276,862	15.8%	257,672	21.6%	9,279	23.8%	7,903	22.6%	1,583,442	11.0%	75,296	24.0%		

Notes:

1/ Sample sizes for Moloka`i and Lāna`i are relatively small.

2/ PPPD - Per Person Per Day.

Source:

Hawai`i Tourism Authority, DBEDT-Research and Economic Analysis Division (2010). *November 2010 Visitor Spending Climbed 30.4 Percent.* December 28, 2010 (10-32).

This page intentionally left blank.

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 610 county parks extend over 8,553 acres, most of which are in O`ahu.

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	19	8		2	30	10	69
Acreage of State Parks and Historic Sites	7,536.0	332.7		236.7	11,985.0	13,851.6	33,942
Developed Acreage of State Parks and Historic Sites	258.3	38.4		10.0	279.8	130.6	872.6
Recreation Visits per Year to State Parks and Historic Sites [4/]	1,237,000	1,069,000		8,000	2,745,000	2,271,000	7,330,000
Wildlife Sanctuaries and Refuges, by Island, 2009							
Number of Wildlife Sanctuaries and	8	11	4	6	19	7	55

Recreation Resources	Hawai`i	Maui	Lāna`i	Moloka`i	O`ahu	Kaua`i	Total
Refuges (excluding hunting areas)							
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	112	4	13	288	67	610
Acreage of County Parks	1,734	1,070	14	100	5,148	487	8,553

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] Data represent the total number of visitors in 2008 per island with a year-to-date decrease by island for out-of-state visitors.
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 369,111. In 2009, there were over 4.3 million visitors to these parks. The Hawai`i Volcanoes National Parks is the largest in terms of acreage and was visited by 1.2 million people. The most popular national park remains the U.S.S. Arizona Memorial, which got almost 1.3 million visitors in 2009.

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	-	1,233,105
Haleakala National Park	33,223	33,222	0.15	1,109,104
Pu'uhonua o Honaunau National Historical Park	420	420	-	397,665
Kaloko-Honokohau National Historical Park	1,161	616	545	166,380
Pu'ukohola Heiau National Historic Site	86	61	25	99,042
U.S.S. Arizona Memorial	11	11	-	1,276,868
Kalaupapa National Historical Park	10,779	23	10,756	30,654
Total	**369,111**	**357,784**	**11,326**	**4,312,818**

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 (2009b). 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 2009, 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[3] 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	304,456
Ahupua'a'O Kahana State Park	5,256.5	26.0	75,437
Kokee State Park	4,345.0	55.0	218,681
Waimea Canyon State Park	1,837.4	10.0	309,925
Kekaha Kai State Park	1,745.5	5.0	178,099
Sacred Falls (Kaluanui) State Park 2/	1,374.2	10.0	NA
Wailua River State Park	1,217.2	37.4	639,063

Notes:
1/ The total number of visitors by park was derived using the 2008 figure and decreasing it with an year-to-date percentage decrease by island in out-of-state visitors (2008 number calculated using 2007 HTA survey data).
2/ Park closed since May 1999.
3/ Parks having at least 500,000 recreation visits or 1,000 acres.
DBEDT (2009b). The State of Hawai`i Data Book 2009. Retrieved from http://hawaii.gov/dbedt/.

3.4.9 *Public Safety*

Since 1991, NMFS has documented 10 high profile cases of human-seal interactions involving habituated seals in the MHI (NMFS 2009). Of the 10 cases:

- Five involved seals that actually bit swimmers or divers (2003 – 2009);
- Two involved habituated seals conditioned by people through feeding and interactive play; and
- Three involved 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.

This page intentionally left blank.

Table 3.4-11 Prevention, Mitigation and Documented Human-Seal Interactions in the MHI (1991-2009)

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
The following 2 seals remain 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 Larsen'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.
The following seal remains 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.
The following 6 seals have since died or disappeared, but had no reported deleterious human-seal interactions post NMFS intervention to prevent socialization.					
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.

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
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 4 seals remain in the MHI with no further reported human-seal interactions post NMFS intervention.					
3/1/2003	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 on Kaua`i2008. No reports of interaction with humans since translocation.
3/1/2003	RH40	Poipu, Kaua`i	Three juvenile seals (2 male, 1 female) socializing among swimmers at Poipu	Seals were tagged, instrumented with VHF transmitters and epidemiologically sampled. Seals	Seen on Kaua`i2009.

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
			Beach, Kauai.	were translocated to the north shore Kāuaʻi.	No reports of interaction with humans since translocation.
3/1/2003	R1AQ	Poipu, Kauaʽi	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 Kāuaʻi.	Seen on Oʽahu and Kauaʽi2009. No reports of interaction with humans since translocation.
September 1991	RZ22	Haena Pt., Kauaʽi	Female seal began socializing with swimmers post weaning.	Seal was translocated to Niʽihau in and re-sighted in 1994.	RZ22 was reported killed by a boat propeller prior to 1999.
The following 2 seals remain in the MHI but with continued human-seal interaction post NMFS intervention.					
10/1/2005	RV18	Kiahuna, Kauaʽi	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 Kauaʽi in 2011.
11/1/2007	RB24	Maha'ulepu, Kauaʽi	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 Kauaʽi in 2011.
The following 2 seals exhibited deleterious human-seal interactions but do not remain in the MHI due to death or disappearance. NMFS did not intervene in these					

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
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.
9/1-17/1997	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.
8/1/1999	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.
The following 4 seals do not remain in the MHI post NMFS intervention due to translocation out of the MHI, death, or placement into captivity.					
10/15/2003 – 12/1/2003	RM34	South Point, Hawai`i	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, Hawai`i.	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.
10/15/03 – 01/15/04	RK07	Nawiliwili Harbor, Kaua`i	Adult male approaching people at Nawiliwili Harbor to be fed. The first record of feeding was on 15 October 2003.	Observations of the seal were conducted and educational outreach for the community was provided in an effort to stop people from feeding	Last reported human interaction on

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
			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.	the seal.	15 January 2004. Found dead January 22, 2004. Cause of death systemic Toxoplasma gondii infection.
09/7/06 – 02.27 09	RO42	Black Point, Hawai`i	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 Lāna`i. 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.
February 2009 – Present	RW46 (KP2)	Kaunakakai Warf, Moloka`i	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 8 months old to Kalaupapa, Molokaʻi on 15 December 2008. Two months post release reports of socialization with people at Kaunakakai Wharf.	Volunteers monitored area and used a palm frond and a loud voice to displace the seal when hauled out at the Kaunakakai Pier or other locations where interactions with humans occur. Seal was initially tracked by NMFS via satellite tag data and VHF location. Seal translocated 12 June 2009 back to Kalaupapa, Molokaʻi. Volunteers attempted educational outreach for the community in an effort to stop people from interacting with the seal. Veterinary exam during translocation attempt in October 2009 resulted in seal being held for	Held in captivity.

Date	SEAL ID	Location	Type of Interaction Requiring Intervention	NMFS Response	Current Status
				permanent captivity due to animals near blindness.	
Seal interactions with humans that involved biting and other aggressive behavior 2003-2009					
December 2009	N/A	Mahalepu'u, Kaua`i	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 with woman	N/A
January 2009	R042	Kaumalapau, Lāna`i	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
May 2007	N/A	Rabbit Island, O`ahu	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	N/A
September 2005	N/A	Poi'pu Beach, Kaua`i	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
October 2003	Temp700	Kealakakua Bay, Hawai`i	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

Note:
N/A = Data Not Available

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 2009) 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 and/or pups (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. most closures are up during daylight hours and removed when seals enter the ocean at night to feed;

- 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 Sections 2.6-2.10. An evaluation of potential impacts of human-seal interactions is provided in Sections 4.8.1 and 4.9.5.

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 4.9.6.

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 2009 population estimates for the racial categories mentioned above were used, rather than 2000 census data. The Census Bureau's Population Estimates Program publishes population numbers annually between censuses to keep population data by age, sex, race, and Hispanic origin current. These data were deemed more meaningful for the purposes of this analysis.

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 2009 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 population 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 91.4% and 86.6% respectively. These proportions are significantly higher than Hawai`i in total, which has a minority population of 69.8%.

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 on the Island of Moloka`i, in Maui County, is 16.7% which is notably higher than other islands or counties which range from 8.3 percent to 13.3%. The State of Hawai`i proportion of people below the poverty level is 9.3%.

Table 3.4-12 Study Area Race and Ethnicity, 2009

	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	144,444	7,255	3,102	90	185,079	1,360,301
White	22,159	198,732	51,708	1168	435	24	62,348	336,599
	33.0%	20.8%	33.0%	16.1%	14.0%	26.7%	33.7%	24.7%
Black / African American	278	19,256	837	28	5	0	1,020	21,424
	0.4%	2.0%	0.4%	0.4%	0.2%	0.0%	0.6%	1.6%
American Indian / Alaska Native	254	2,438	581	20	2	0	869	4,164
	0.4%	0.3%	0.4%	0.3%	0.1%	0.0%	0.5%	0.3%
Asian	21,016	418,410	41,719	1,131	1,737	7	41,050	525,078
	31.3%	43.9%	31.3%	15.6%	56.0%	7.8%	22.2%	38.6%
Native Hawaiian / Other Pacific Islander	6,060	90,878	13,967	1,879	205	44	22,389	135,422
	9.0%	9.5%	9.0%	25.9%	6.6%	48.9%	12.1%	10.0%
Two or More Races	16,716	213,036	32,609	3,006	713	1	54,535	263,985
	24.9%	22.3%	24.9%	41.4%	23.0%	1.1%	29.5%	19.4%
Total Minority	**44,324**	**744,018**	**44,324**	**2,491**	**2,662**	**52**	**119,863**	**950,073**
	66.1%	**78.1%**	**66.1%**	**83.6%**	**85.8%**	**57.8%**	**64.8%**	**69.8%**
Hispanic / Latino*** (of any race)	6,315	77,433	14,960	496	254	1	21,383	120,842
	9.4%	8.1%	9.4%	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, 2008

	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	64,529	907,574	145,157	2,726	3,164	83	177,835	1,295,178
Persons Below Poverty Line	9.9%	8.50%	9.0%	16.7%	8.3%	0%	13.3%	9.3%

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.
**Kaua`i County includes the Island of Ni`ihau
Source:
U.S. Bureau of Census: 2008 Estimate.

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

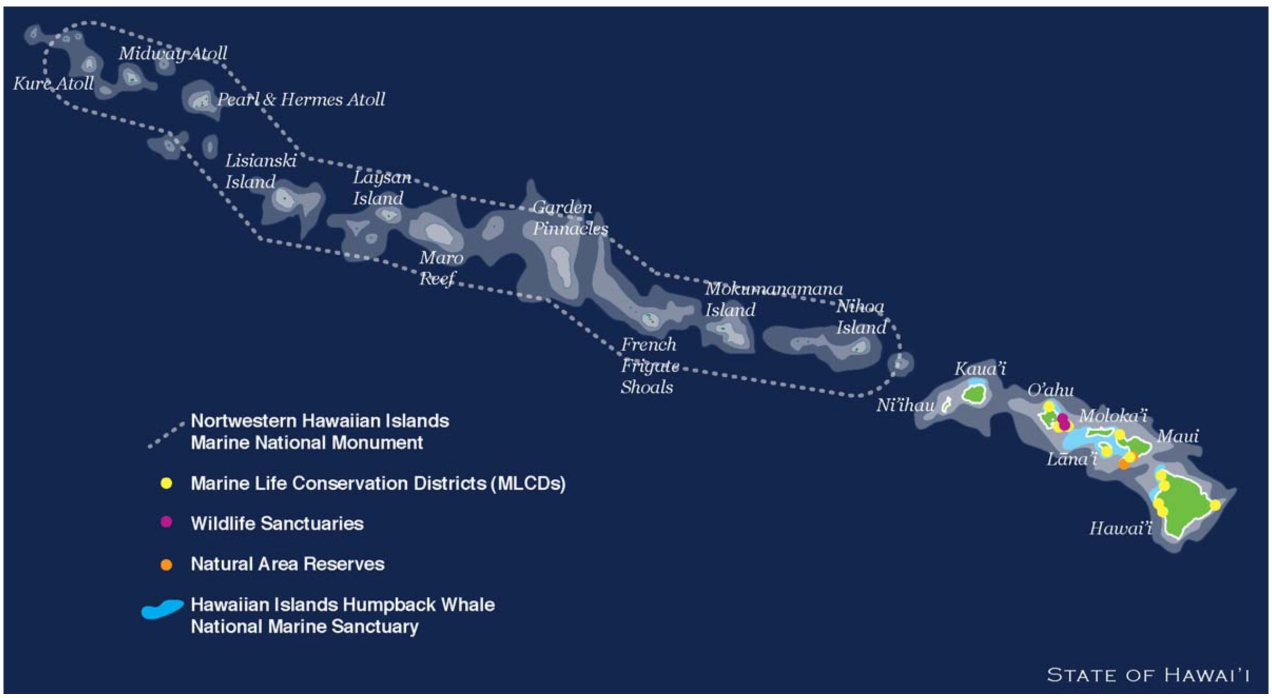
The HIHWNMS was established in 1992 by the Hawaiian Islands National Marine Sanctuary Act and is managed by the NOAA National Ocean Service (NOS), ONMS in co-management partnership with the State of Hawaii, Department of Land and Natural Resources. The primary purpose of the HIHWNMS is to protect humpback 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, the addition of monk seals (and other species) 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 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 authorities 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 resulting from 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 and 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 pers. comm. 2011). These translocation activities are conducted under the MMHSRP permit 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 Corp*

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 20, 2011 and expires on January 12, 2012. This permit allows for the take of 121 monk seals through level B harassment (NMFS 2001).

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).

This page intentionally left blank.

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, while Section 4.7 characterizes elements common to all alternatives. Sections 4.8 and 4.9 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 2020. 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 2020, 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.
- Reasonably Foreseeable Future Actions – this term is used in concert with the Council on Environmental Quality (CEQ) definitions of indirect and cumulative impacts, but the term itself is not further defined. Based on existing guidance, we can assume that reasonably foreseeable future actions (RFFAs) 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.

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 4.9, 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. The initial estimates of direct and indirect effects are based on qualitative discussions of experienced economists who have worked directly with NMFS to determine the best methods for assessing potential effects of the proposed alternatives.

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; however, where data gaps still exist, the implication is that these areas qualify for the CEQ guidelines above.

4.4 STEPS FOR DETERMINING LEVEL OF IMPACT

Federal agencies are required under National Environmental Policy Act (NEPA) to prepare an Environmental Impact Statement (EIS) or PEIS for any action that may significantly affect the quality of the human environment. 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.

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, all of the subpopulations in the NWHI have 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.

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.

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.

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.

V_{pop} is ideally suited for assessing potential affects 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.

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.

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 3.3.1.7.

Table 4.4-1 Impact Criteria for Hawaiian Monk Seals

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Direct and indirect 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
Direct and indirect 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

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Beneficial 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
	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 4.8.2 through 4.8.6 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
	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 (<u>other</u> 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
	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

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Altered survival or reproduction of Laysan Finch	Magnitude or Intensity	Disturbance of more than 200 Laysan finch and/or more than 2 Laysan finch are incidentally injured per year.	Disturbance of 200 Laysan finch and/or incidental injury or mortality of two Laysan finch per year.	Disturbance of less than 200 Laysan finch and/or incidental injury or mortality of less than two Laysan finch.	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 4.9 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. There are no recognized communities on these islands. Further, there are restrictions on commercial fishing in the NWHI. 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**
Effects on 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
Effects on	Magnitude or	More than 10%	3% - 10%	Less than 3%	No

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
subsistence fishing	Intensity	change in quantity of fish consumed for subsistence	change in quantity of fish consumed for subsistence	change in quantity of fish consumed for subsistence	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	Likely	Likely	Somewhat unlikely	Unlikely
Effects on recreational fishing	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
	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

[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%.

Impacts to cultural resources, including historic structures, archaeological sites, and traditional cultural properties, would be considered significant if they result in adverse effects to historic properties that are eligible for listing on the NRHP. Once a cultural resource is identified, the historic significance of the property must be evaluated in terms of its ability to meet the National Register criteria (36 CFR 800.4 [c][1]).

A cultural resource that meets the criteria is considered an historic property entitled to the consideration afforded by Section 106 of the NHPA, as outlined in the Advisory Council on Historic Preservation's implementing regulations (36 CFR 800). Impact to a traditional cultural property would be evaluated in terms of the specific significance of the resource, and the potential for the proposed project to detract from that significance.

Table 4.4-7 Impact Criteria for Cultural and Historic Resources

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Effects on 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
Effects on 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
Effects on 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

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	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 1997a). Analysis of potential impacts may rely on available demographic data from credible sources such as the U.S. Census.

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 4.9.7.

Table 4.4-8 Impact Criteria for Military Activities

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Effects on military training and 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*

To meet the requirements of NEPA, an EIS must include an analysis of the cumulative effects of a proposed action and its alternatives and consider those cumulative effects when determining environmental impacts. 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.

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 and 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.

- *Identify issues, characteristics, and trends within the affected environment that are relevant to assessing cumulative effects of the alternatives*. Include lingering effects from past activities and demonstrate how they have contributed to the current baseline for each resource. This information is summarized in Chapter 3.

- *Describe the direct and indirect effects of the research and enhancement alternatives.* This information is presented in Chapter 4.

- *Define the spatial (geographic) and temporal (time) frame for the analysis.* This timeframe may vary between resources depending on historical data available and the relevance of past events to the current baseline. The reasonably foreseeable future has been established as the next 10 years (through 2021) for the purposes of this PEIS.

- *Identify past, present, and reasonably foreseeable external actions such as other types of human activities and natural phenomena that could have additive or synergistic effects.* Summarize past and present actions, within the defined temporal and spatial timeframes, and also identify any RFFAs that could have additive or synergistic effects on identified resources. The cumulative effects analysis uses the specific direct and indirect effects of each resource alternative and combines them with these identified past, present, and reasonably foreseeable effects of the identified external actions.

- *Use cumulative effects tables to screen all of the direct and indirect effects, when combined with the effects of external actions, to capture those synergistic and incremental effects that are potentially cumulative in nature.* Both adverse and beneficial effects of external factors are assessed and then evaluated in combination with the direct and indirect effects to determine if there are cumulative effects.

- *Evaluate the impact of the reasonably likely cumulative effects using the criteria established for direct and indirect effects and assess the relative contribution of the action alternatives to cumulative effects.*

- *Discuss rationale for determining the impact rating, citing evidence from the peer reviewed literature, and quantitative information where available.* The term "unknown" can be used where there is not enough information to determine an impact level.

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	Source
Natural Events (Tsunami, Volcano, Earthquake, Hurricane)	Entire Project Area	Ongoing	NOAA
Climate Change	Entire Project Area	Ongoing	Hare and Mantua 2000; Friedlander *et al*. 2009; Minobe 1997; etc.
Research, enhancement and public display permits issued since 2000 (HMS only)	Entire Project Area	Ongoing	NMFS (APPS)
Research, enhancement and public display permits issued since 2000 (All species)	Entire Project Area	Ongoing	NMFS (APPS)
Whaling	Entire Project Area	19th Century	DLNR 2005
Guano mining	NWHI	19th and 20th Century	Rauzon 2001
Building islands using dredge and fill	NWHI	Mid 20th Century	Rauzon 2001
Feather poaching	NWHI	20th Century	Rauzon 2001
Military activities	Entire Project Area	Ongoing	DLNR 2005
LORAN station	NWHI	Mid 20th Century	DLNR 2005
Whale watching (tour boats)	MHI	On going	USN
Makaha 242-foot Reservoir No. 2	Wai`anae	Completed	HRC FEIS/OEIS 2008
Nānākuli 242-foot Reservoir	Wai`anae	Unknown	HRC FEIS/OEIS 2008
Wai`anae Wastewater Treatment Plan Modification	Wai`anae	Completed	HRC FEIS/OEIS 2008
Wailupe Stream Flood Control	East Honolulu	Underway as of 2008	HRC FEIS/OEIS 2008
Advanced Wastewater Treatment Upgrade	SBMR	2005	HRC FEIS/OEIS 2008

Action / Event	Region	Status	Source
Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	Lā`ie (adjacent to KTA)	2004	HRC FEIS/OEIS 2008
Kamehameha Highway Bridge Replacements	Kawela Camp Road, Kaukonahua Road (near SBMR)	Funded Through 2004	HRC FEIS/OEIS 2008
Waimanalo Treatment and Disposal System	Koolaupoko	Underway as of 2008	HRC FEIS/OEIS 2008
P-302 Dry Dock Ship Support Services	Dry docks 1 and 2, Bravo piers 1 and 2	2012	HRC FEIS/OEIS 2008
P-639 Construct Advanced SEAL Delivery System/SEAL Delivery Vehicle (ASDS/SDV) Operations Wharf	Wharf Victor 2	2013	HRC FEIS/OEIS 2008
FY09 MCON P-422 Advanced Radar Detection Laboratory (ARDEL)	PMRF	2009 and beyond	HRC FEIS/OEIS 2008
Rim of the Pacific (RIMPAC) Exercise	HRC	Ongoing	HRC FEIS/OEIS 2008
Long-range missile tests	HRC Temporary Operating Area, Department of Defense Test Ranges	Ongoing	HRC FEIS/OEIS 2008
Undersea Warfare Exercise (USWEX)	HRC	2007	HRC FEIS/OEIS 2008
Overseas Environmental Assessment (OEA) for MK 48 Advanced Capability Torpedo Service Weapons Tests in Hawaii	Hawaii	September 2008	HRC FEIS/OEIS 2008
Kailua Beach Park Improvements	Koolaupoko	Unknown	HRC FEIS/OEIS 2008
Queen's Beach Park	East Waikiki	Completed	HRC FEIS/OEIS 2008
Ka Iwi Shoreline Park	East Honolulu	Land acquisition complete	HRC FEIS/OEIS 2008
Banzai Rock Beach Support Park	North Shore	Underway as of 2008	HRC FEIS/OEIS 2008
Kaunala Beach Park	North Shore	Underway as of 2008	HRC FEIS/OEIS 2008
Kahawai Beach Support Park (including	North Shore	Underway	HRC FEIS/OEIS

Action / Event	Region	Status	Source
Sunset Beach Recreation Center)		as of 2008	2008
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA)	Authorized (NOAA) for 6 missions within HRC	August 16 2008 - August 15, 2009	SURTASS
Introduction of Invasive species	Ongoing	Ongoing	HISC
Entanglement of Hawaiian monk seals in marine debris or fishing gear	Hawaiian Archipelago	Ongoing	NMFS
Intentional shooting, maiming, injury or other harm of Hawaiian monk seals	MHI	Ongoing	NMFS
National Historic Preservation Act	United States	1966	U.S. Government
A Bill for an Act Relating to Environmental Impact Statements (Act 50; "Hawai`i Cultural Impact Assessment Bill"; House Bill 2895; 20th Legislature; 2000)	Hawai`i	HB 402 (26th legislature) to take effect January 1, 2012	State of Hawai`i
A Bill for an Act Relating to the Environment (Act 294; "Hawai`i Environmental Justice Bill"; Senate Bill 2145; 23rd Legislature; July 10, 2006)	Hawai`i	2006	State of Hawai`i
Hawai`i Environmental Policy Act (HRS 343)	Hawai`i	1974	State of Hawai`i
EO 12898, Environmental Justice	United States	1994	U.S. Government

4.5.2 *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 1.2 (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.

This page intentionally left blank.

Table 4.5-2 Reasonably Foreseeable Future Actions Within the Project Area

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Commercial							
Grid Upgrades	MHI (O`ahu, Moloka`i, Lāna`i, Maui)	Planning	Scoping (PEIS)	NA	Medium	9, 11	HIREP
Undersea transmission cables	MHI (O`ahu, Moloka`i, Lāna`i, Maui)	Planning	Scoping (PEIS)	NA	Medium	1, 2, 3, 4, 5, 6, 8, 9, 10	HIREP
Wind farm	MHI (O`ahu, Moloka`i, Lāna`i, Maui)	Planning	Scoping (PEIS)	NA	Medium	7, 12	HIREP
Hawai`i Superferry	Interisland (MHI)	Suspended	Unknown	NA	Low	2, 3, 4, 10, 12	Hawai`i Department of Transportation
Kalaupapa NHP General Management Plan and EIS	Moloka`i	In development	Draft	NA	High	11, 12	NPS
Pilot Aquaculture Project (Tuna cultivation)	In state marine waters off N. Kohala, Big island	Under review	Permitting	5 years after permitted	High	2, 6, 10	USACE
Permit to Authorize the Culture	Island of Hawai`i	Recently	Permitting	5 years	High	10	NMFS

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
and Harvest of a Managed Coral Reef Fish Species (Seriola rivolialla) in Federal Waters off the West Coast of the Island of Hawaii		permitted					
Residential & Commercial construction (beach, near shore)	Various	Ongoing		NA	High	1, 2, 3, 9, 10, 11, 12	DBED (Hawai`i) CIP List
Whale watching (Tour boats)	MHI	Ongoing		NA	High	1, 3, 4, 12	
Other Government Actions							
Draft Supplemental Environmental Impact Statement: Measures to End Bottomfish Overfishing in the Hawaiian Archipelago - March 30, 2006	Hawaiian Archipelago	Complete		Current	High	6, 8, 10	WPRFMC
Final Environmental Impact Statement Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (2005).		Complete	FEIS, ROD	Current	High	6, 8, 10	WPRFMC
Fishery Ecosystem Plan for the Hawai`i Archipelago	Hawaiian Archipelago	Complete	FEP	Current	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14	WPRFMC
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions	Hawaiian Archipelago		Development of Draft Revisions	2010 - 2014	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Hawaiian Spinner Dolphin Human Interaction	MHI	Ongoing	DEIS/Proposed Rule	Current	High	1, 3, 4, 12	NOAA
Hawaiian Monk Seal Critical Habitat Revisions	Throughout Hawaiian monk seal range	Ongoing	Proposed Draft Rule	Current	High	1	NOAA
Maritime Heritage Conservation and Management Activities	NWHI (Monument)	Ongoing		Summer/Fall 2011	High	11	PMNM
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	Various	Ongoing		Ongoing	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	USACE
Military Activities							
15806 MMPA Small Take Letter of Authorization: U.S. Navy Training in the Hawai`i Range Complex	Pacific Ocean; State/Territory: HI; Pacific (235,000 nm2 around the Main Hawaiian Islands	Current		Jan. 2011-Jan. 2012	High	4, 14	USN
Hawaii-Southern California Training and Testing EIS/OEIS	Within Hawai`i Range Complex	ongoing NOI July 2010	DEIS	2011	High	1, 2, 3, 4, 5, 6, 9, 10, 12, 14	SURTASS
Joint High Speed Vessel (JHSV)	Proposed home port: Pearl Harbor	Planning	EIS	NA	Medium	1, 3, 4, 10, 12, 14	USAEC, Sierra Club
Supplemental EIS Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA)	NA	NOI January 2009	DEIS	Current	High	4, 5, 14	USN

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
US PAC COM naval exercises (RIMPAC)	Hawai`i	Ongoing	NA	Biennially even numbered years (June - July)	High	1, 2, 3, 4, 5, 6, 9, 10, 12, 14	USN
Natural Events							
Climate Change	Entire Project area	Ongoing		Ongoing	High	All	Various
Natural Events (Tsunami, Volcanic eruption, Earthquake, Hurricane)	Entire Project area	Ongoing		NA	Medium	All	Various
Introduction of Invasive species		Ongoing		Ongoing	Medium	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	HISC
UNESCO World Heritage Site Monument	NWHI (Monument)	Ongoing		Designated 2010	High	11	UNESCO
Scientific Research							
10653 Measuring the hearing of stranded cetaceans in U.S. waters, beaches and rehabilitation centers using the evoked auditory potential procedure	U.S. beaches and rehabilitation centers; primary location is Hawaii	Permit Application		FR notice published May 17, 2011; will replace Permit No. 978-1791	High	4	NOAA
15330 Studies of population size, population structure, habitat use, movements, behavior and ecology of cetaceans in the Pacific Ocean	Pacific Ocean including U.S. states (AK, WA, OR, CA, HI), territories (*e.g.*, Palmyra, American	Permit Application		Application in process; FR pub. 2/25/11 will replace Permit No. 731-1774 (exp. 8/31/11)	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	Samoa, Guam, Wake), and International waters)						
15409 MMPA General Authorization for Scientific Research: Population and photo-id studies of small cetaceans in the Pacific Islands	Pacific Ocean; States/Territories: AS, HI (Nearshore waters of HI islands EEZ and American Samoa)	Permit		June 2010 - June 2015	High	4	NOAA
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, University of Hawai`i 2777 Kalakaua Avenue Honolulu, HI 96815	Permit Application		Application in process; FR published 1/27/11; will replace Permit No. 455-1760 (exp. 5/31/11)	High	1, 3, 7, 12	NOAA
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.	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,	Permit Application		Application in process; FR notice published 2/14/11; will replace Permit No. 1581 (exp. 12/31/11)	High	3	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	hotel and resort beaches, and State and National Parks are used.						
16163 Studies of movements, habitat use, ecology, behavior, and risk factors of cetaceans in the Pacific Ocean	Pacific Ocean: WA, OR, CA, HI, AK, High Seas North Pacific Ocean	Permit Application		Application in process; received 1/25/11 (FR notice not published yet)	High	4	NOAA
Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island	Nihoa Island	Permit Application		2011-2012	High	1, 3, 6	PMNM
Amendment 14 and Final Supplemental Environmental Impact Statement; Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (Dec 2007)		Permit Application		Current	High	6, 8, 10	NOAA
Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems	NWHI (Monument)	Permit Application		July-August 2011	High	2	PMNM

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems	NWHI (Monument)	Permit Application		July- Aug 2011	High	2	PMNM
Application for a Permit for Scientific Research or to enhance the survival or recovery of a stock *(sic: whales and dolphins)* under the Marine Mammal Protection Act and the Endangered Species Act	Off the western end of O`ahu, and in the Au Au Channel, in the Four-Island Region of the Hawaiian Main Islands.	Permit Application		2010-2015	High	4	NOAA
Assessing distribution and abundance of marine mammals on Navy operational area A, instrumented ranges and adjacent waters using surface vessel surveys, photo identification, videography, and acoustic recording	Federal and state waters around the main Hawaiian Islands and Northwest Hawaiian Islands, including the Hawaiian Islands Humpback Whale National Marine Sanctuary and Monument	Permit Application		2010-2015	High	1, 3, 4, 5	NOAA
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge	Necker Ridge to Hawaiian Ridge	Permit Application		Scheduled to end early summer 2011	High	3, 4, 5, 6	PMNM
Behavior and biology of humpback whales in the Pacific Ocean,	Hawaiian Islands Exclusive	Permit Application		2010-2015	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
primarily off Hawai`i and Alaska	Economic Zone; waters off Hawai`i (main study area						
Behavior, social organization and communication in humpback and gray whales in Hawaii, Alaska and Washington	Coastal waters of the main Hawaiian Islands	Permit Application		2010-2014	High	4	NOAA
Comparison Study of the Biological Community Structure and Diversity of Maritime Heritage Resource Sites	NWHI (Monument) (Exact itinerary not set)	Permit Application		June- Aug 2011	High	11	PMNM
Coral Reef Bioerosion Rates as Indicators of Community Response to Ocean Acidification	Shallow water reefs with NWHI / Monument - exact locations not set	Permit Application		May 2011 - Nov 2011	High	8	PMNM
Determine prevelance of disease on coral reefs in shallow waters	Shallow waters throughout NWHI (Monument)	Permit Application		May - Sept 2011	High	8	PMNM
Efforts to Increase Juvenile Monk Seal Survival	NWHI (Monument)	Permit Application		2011-2012	High	1, 3, 7, 12	PMNM
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems	NWHI (Monument)	Permit Application		May-Oct 2011	High	1, 2, 3, 4, 5, 6, 7, 8	PMNM
Humpback whale research	Maui, Molokai, Lanai, and	Permit		2008-2013	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	Kahoolawe.	Application					
Incidence and Effects of Coral and Fish Disease within Shallow Water Reefs	Shallow water reefs throughout NWHI (Monument)	Permit Application		May-Sept 2011	High	6, 8	PMNM
Installation and maintenance of four infrasound elements on Midway Atoll National Wildlife Refuge to monitor the Comprehensive Test Ban Treaty	Sand island Midway Atoll	Permit Application		Sept 2009 - Sept 2014	High	7, 9	PMNM
Long term monitoring Laysan & black footed albatross	Midway, French Frigate, Laysan	Permit Application	renewal	2011-2012	High	7	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
Monitoring shark activity on selected monk seal pupping sites	French Frigate Shoals	Permit Application	renewal	Spring/Summer 2011	High	1, 5	PMNM
Pacific Reef Assessment and Monitoring Program	NWHI (Monument) - shallow water	Permit Application		July-Aug 2011	High	8	PMNM
Permit to conduct level B harassment and biopsy sampling of cetaceans in Hawaiian waters	leeward coast of the island of Hawai`i	Ongoing		2007-2012	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
PR 1 Permit #1071-1770 Long-term population studies of cetacean species in the Eastern, Western and Central North Pacific Ocean	Main study area is Hawai`i; permit includes waters along the rim of the Pacific from CA northward to southeast AK, westward through the Gulf of AK, Aleutian Islands and regions of the upper Pacific.	Ongoing		2/9/2006 - 2/28/12; will be replaced by File No. 16053	High	4	NOAA
PR 1 Permit #731-1774 Baird - cetacean scientific research	Pacific Ocean (Hawai`i, California, Oregon, Washington, Alaska, other U.S. territories and international waters of the Pacific Ocean)	Ongoing		Expires 8/31/2011 (will be replaced by File No. 15330)	High	4	NOAA
PR 1 Permit #932-1905 research/enhancement	Beaches, coastal waters of the US, waters within the US EEZ, and international waters; world-wide import/export; U.S. rehabilitation and captive	Ongoing		6/30/2009 - 6/30/2014	High	1	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	facilities						
PR 1 Permit #978-1791 Auditory research on stranded and rehabilitating cetaceans	U.S. waters and rehabilitation facilities; primary location is Hawai`i	Ongoing		2/9/2006 - 2/28/12; will be replaced by File No. 16053	High	4	NOAA
PR1 Permit #587-1767 scientific research (To continue studies of long-term social affiliations among humpback whales)	Alaska/ Hawai`i	Ongoing		2005-2011	High	4	NOAA
PR1 Permit #978-1857 scientific research: examination of basic hearing and echolocation processes in odontocete cetaceans	Hawai`i; floating pens on the leeward side of Coconut Island in Kaneohe Bay at the Hawai`i Institute of Marine Biology, O`ahu Hawaii	Ongoing		2007 - 2012	High	4	NOAA
Quantify movement & ecology of top predators (sharks & large fishes)	NWHI (Monument)	Ongoing		May - Oct 2011	High	5, 6	PMNM
Relative Role of Terrestrial Sources of Nutrients for Algae and Bivalve Product.	NWHI (Monument)	Permit application		Permit applied for (2010); still under review by	High		PMNM

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
				co trustees			
Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas	Kure, Lisianski, FFs, Nihoa	Ongoing		NA	High	1, 3, 4, 5	PMNM
Tuna Tagging	Primarily around NOAA Weather monitoring buoys in MHI	Ongoing		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 "Decreasing or Eliminating Predation of Pre-weaned Hawaiian Monk Seal Pups by Galapagos Sharks in the NWHI" (NMFS Permit PMNM-2010-014). 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 1.6).

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 Permit File No. 10137 - Effects to USFWS Species). 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 G) 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 (MLCDs). 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 Research Monument Permit (PMNM 2011-001 see Appendix G). 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 ELEMENTS COMMON TO ALL ALTERNATIVES

This section presents requirements of Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) permits that are common to all alternatives and includes information on the duration of permits, reporting requirements, mitigation and permit conditions, and monitoring.

4.7.1 Duration of Permits

Scientific research and enhancement permits may be issued for a maximum of five years from the date of issuance (50 CFR 216.35[b]). The five-year period may be extended by a minor amendment up to 12 months beyond that established in the original permit, but such extension by a minor amendment may not authorize an increase in the number of animals taken, or changes to the geographic locations or species (50 CFR 216.39).

4.7.2 Reporting Requirements

Permit Holders must submit annual, final, and special reports in accordance with requirements established in the permit and any reporting format established by the Director, NMFS Office of Protected Resources (50 CFR 216.38).

Annual reports must be submitted to the Chief, Permits, Conservation and Education 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 information:

- A table reporting the actual number of animals taken for research and enhancement purposes, by activity and location;
- The number and type of non-permitted species caught, harassed, or otherwise taken, and the observed effects of such taking;
- Any problems or unforeseen effects encountered during the permitted activities and steps taken or proposed to resolve such problems;
- Measures taken to minimize effects of permitted activities 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 of if not in the way described in the permit;
- The physical condition of animals taken and used in the permitted activities;

- The effects permitted activities had on animals, including any unforeseen responses or effects;
- Steps taken to coordinate the permitted activities with other permit holders;
- Preliminary findings and an indication as to whether the goals of the permitted activities were accomplished;
- Titles of reports, publications, etc. resulting from the reporting period with copies of all final documents and publications submitted as available.
- Any incidental (non-research related) use of photographs, film, or other images (*e.g.*, on websites, in commercial publications or documentaries).

Special or "incident" reports are required for events such as serious injury, mortality, and exceeding authorized take. Incident reports must be submitted to the Chief, Permits Division within two weeks of the incident. Such reports must include a description of the events and identification of steps that will be taken to reduce the potential for additional research-related mortality or exceeding authorized take.

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

- Findings relative to the hypothesis, questions, or objectives in the permit application; this includes 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 with the authorized methodologies or gear; 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 as a result of researcher's actions, and whether the permitted activities had any effects on habitat;
- Whether the mitigation measures employed during permitted activities 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 during the course of the permit 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 any permit conditions that were difficult to comply with or were unclear; and whether the take numbers requested in the permit application were accurate and realistic.

4.7.3 Mitigation and Conditions of Permits and Authorizations

Scientific research and enhancement permits issued under the MMPA and ESA require researchers to abide by certain 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 each permit application, and as limited by the terms and conditions specified in a permit. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

All 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; 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 Section 2.6 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.

4.7.3.1 *Duration of Permit*

Permits expire on the date specified in the permit (not more than five years after issuance) and are non-renewable. As described in Section 4.7.1, the Director, NMFS Office of Protected Resources, may extend the permit by one year via a minor amendment.

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; in any case, an incident report must be submitted to the Permits Division. Authorization to resume activities is based on review of the report and in consideration of the terms and conditions of the permit.

4.7.3.2 *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 to document the permitted activities, provided it does not result in takes of protected species. Photos and other media may be used in printed materials (including commercial or scientific publications) and presentations; a statement citing the permit number under which the media was collected must accompany the images.

The Chief, Permits Division may authorize photography, filming, or audio recording activities not essential to achieving the objectives of the permitted activities (*e.g.*, a documentary film crew may accompany researchers to film seals). These activities must not influence the research or enhancement or result in takes of protected species. 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 (10137) and would apply to future permits:

- Carry out permitted activities efficiently and use biologists experienced in capture and sampling techniques to minimize handling time and disturbance.

- Whenever feasible, only take target animals when no other seals are in the immediate vicinity, particularly mother/pup pairs; move carcasses to a secure area during necropsies to avoid disturbance to seals; and not retrieve carcasses or samples (*e.g.*, scat, spew, molt) when other seals are in the immediate vicinity.

- Immediately cease activities if there is any evidence that the actions may be life threatening to a seal, including but not limited to, a seal showing signs of acute stress or protracted alarm reaction that may lead to serious injury, capture myopathy, other disease conditions, or death. In the event a seal has an adverse reaction, researchers must monitor and/or treat the animal as determined appropriate by the attending veterinarian, principal investigator (PI) or a co-investigator (CI).

- Researchers must minimize disturbance when approaching seals, particularly mother/pup pairs, and an approach or other activity must be stopped if there is evidence that the activity may be interfering with the mother/pup behavior, nursing, or other 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). Any rehabilitation of pups must be done in consultation with the Marine Mammal Health and Stranding Response Program (MMHSRP) and under the authority of the MMHSRP permit. Pups that are euthanized count against the total number of animals authorized for accidental mortality in the permit.

- Only experienced, well-trained personnel may perform intrusive procedures. For activities involving the use of sedatives, an experienced marine mammal veterinarian must be present.

- Researchers must use sterile disposable needles, biopsy punches, and other sampling tools to the maximum extent practicable and clean and disinfect all non-disposable equipment.

- Researchers must monitor seals that have been captured, treated, or are recovering from immobilizing drugs to ensure they resume normal behavior and have an opportunity to recover without risk of drowning or injury from other animals.

- Without causing further disturbance of seals and whenever possible, researchers must monitor seals following any disturbance.

- In the event any seal is seriously injured, dies or is euthanized, an incident report must be submitted to the Chief, Permits Division.

The following conditions pertain to conducting de-worming treatments:

- The Permit Holder must provide information to the Permits Division on how the treatments proceeded; any logistical problems encountered; observed short-term effects of the drugs and any follow-up observations; and any observed impacts to non-target species.

- If there is any indication that handling, treatments, or any other artifact of the de-worming study has compromised the health and welfare of seals, researchers must halt treatments, contact the Chief, Permits Division, and submit an incident report. Authorization to resume treatments is based on review of the incident report and in consideration of the terms and conditions of the permit.

- Prior to initiating full-scale de-worming treatments of up to 200 animals annually, the Permit Holder must provide evidence that treatments administered during the experimental phase are beneficial and have no significant adverse effects to seals and non-target species.

The following conditions pertain to conducting permitted euthanasia of moribund seals or aggressive adult male seals:

- Over the five-year period, up to 10 moribund seals may be humanely euthanized if an experienced on-site veterinarian determines that there is a high probability of the death of the animal due its condition.

- As a last resort to remove adult males known to seriously injure or kill other seals, up to 10 adult male seals may be humanely euthanized over the five-year period of the permit.

- In all cases, an experienced veterinarian must conduct the euthanasia and after necropsy, all parts not retained must be collected for environmentally safe disposal.

The following conditions pertain to translocations of Hawaiian monk seals within the Northwestern Hawaiian Islands:

- The Permit Holder must submit a written incident report in the event a seal dies, is seriously injured, or experiences health problems during the translocation process.

- The Permit Holder must submit information with the annual report regarding the number of seals translocated, their health and disease status, and a summary of post-release survival and behavior.

All disentanglements and necropsies, and any relocations of seals within the Main Hawaiian Islands, must be conducted in coordination with the NMFS Pacific Islands Regional Office Stranding Coordinator.

For health assessment sampling and instrumentation captures, annually up to 10 animals may be captured, released/not fully processed, and recaptured for full processing (to account for failed capture/processing attempts).

Up to 500 spinner dolphins may be taken annually by Level B harassment incidental to research and enhancement activities in the Northwestern Hawaiian Islands.

The following are U. S. Fish and Wildlife Service (USFWS) conditions for researchers working in the NWHI:

- Walking is prohibited on all beaches, from dusk to dawn, where adult sea turtles rest.
- All field camps must use maximum light control (shading, minimum wattage, etc.).
- All field camps must avoid disorienting hatchling turtles.

Researchers must comply with the following conditions related to methods of captive care and transportation of seals, as applicable:

- Hawaiian monk seals must be maintained in captivity 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.

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

4.7.3.3 *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 authority of a permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

- 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 (RAs) are individuals who 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 aboard 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.

4.7.3.4 *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 duplicate copy of the permit must be attached to any container, package, enclosure, or other means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

4.7.3.5 *Reports*

As described in Section 4.7.2 above, Permit Holders must submit annual, final, and incident reports, and papers or publications resulting from the activities authorized by a permit. Incident reports are due within two 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 4.7.2 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.

4.7.3.6 *Notification and Coordination*

Permit Holders must provide written notification of planned fieldwork to the Pacific Islands Assistant Regional Administrator for Protected Resources at least two 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 permitted activities with activities of 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.

4.7.3.7 *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.

4.7.3.8 *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.

4.7.3.9 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.

4.7.3.10 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.

4.7.4 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 captured or sampled animals for signs of acute stress or injury, monitor the effects of administering drugs, and to monitor haulouts following any disturbance. The results of such observations are to be included in reports submitted to the Permits Division. Monitoring protocols designed for the proposed research and enhancement activities are presented in Chapter 5 and Appendix E.

4.8 BIOLOGICAL ENVIRONMENT

4.8.1 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 F/PR1.

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.

4.8.1.1 *Assessment of Direct and Indirect Mortality 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 effect 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.

4.8.1.2 *Mechanisms of Injury 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 (GCs), 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.* in review, 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 mostly 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 were 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.* 2006; 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.* Goyman *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).

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).

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, the 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 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.

4.8.1.3 *Mechanisms of Injury 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 and myopathy from increased muscle activity;

- Increased energy expenditure with the potential for hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) 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.

4.8.1.4 *Mechanisms of Injury from Sedation or Anesthesia*

Diazepam (valium) is the drug used for field sedation of Hawaiian monk seals. Midazolam may also be used for sedation in some cases. 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 not covered 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 2005).

4.8.1.5 Mechanisms of Injury from Biomedical Sampling, Marking, Attachment of Telemetry Instruments, De-worming, 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 medications can occur by various routes, each with some potential risk. Injections (intra-muscular or subcutaneous) can cause pain, stress, swelling, and the risk of infection at the injection site. Oral intubation 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 de-worming medication has a potential to disturb or stress seals if they awaken during the application;

- 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.

4.8.1.6 Mechanisms For Injury 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 E (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.

- Translocated seals themselves may pose a risk to other seals if they carry communicable disease.

4.8.1.7 Mechanisms of Injury 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.

4.8.1.8 *Mechanisms of Injury 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 (Brunson *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).

4.8.1.9 *Number of Animals Affected by Research and Enhancement under Each Alternative*

Sections 1.8 and 2.6 describe in detail 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.

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 I (Take Tables) 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 10137 expires in 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) 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 seals from the NWHI to the MHI.

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.

4.8.1.10 Assessment of Mortality 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 I (Take Tables). These include:

- Adult male removals. These involve 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;

- Accidental mortality (research). This includes any unintentional deaths of seals that may occur as a result of research; and

- Accidental 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.* in review). 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 accidental or intentional (in the case of 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.

4.8.1.11 Research and Enhancement Activities That Involve Take

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.* in review). 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 which 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*). Future studies will consider other routes of drug administration or other drugs. 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.

Translocation – Baker *et al.* (in review) 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 J (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.* (in review) 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. Nearly 300 Hawaiian monk seals have been observed entangled in marine debris and over 60 have been observed with embedded hooks (Carretta *et al.* draft 2011 SAR). Many of these animals have

Nearly 300 Hawaiian monk seals have been observed entangled in marine debris and over 60 have been observed with embedded hooks (Carretta et al. draft 2011 SAR).

been captured and disentangled or dehooked and none have subsequently died from causes attributable to this enhancement activity.

Behavioral modification – As described above, behavioral modification research will involve a variety of techniques that entail some risk of 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 (Baker et al in press). 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. As with other behavior modification research, study subjects in the future would be closely monitored so that any resulting 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 (Appendix D, vaccination review and plan from TMMC). 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 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, harbor seals, and one 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 first on surrogate species, then 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) has been thought to have 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.

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*).

4.8.1.12 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). 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.

4.8.1.13 Quantitative Approach to Analyze the Effects of the Lethal Take

The monk seal simulation model (Appendix J) 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 J 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 most recent estimates for the vital rates (survival and reproduction) at each subpopulation. To better represent the way in which the population behaves in the real world, the vital rates varied year-to-year with the amount of annual variation conforming to that which has been historically observed. 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 accidental 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 I). For example, to simulate the four accidental 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).

4.8.1.14 Assessment of Reproductive Effects Due to Research and Enhancement

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.* in prep.), 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.

4.8.1.15 Assessment of Beneficial Contributions toward Conservation Objectives

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 Draft 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.

4.8.1.16 Methodology Used to Evaluate Two-Stage Translocation Effects

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 E (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 J) 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 E 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 NWHI to MHI translocations are allowed for 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 E).

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 year's 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 E, 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 E.

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 3); and
- Intrinsic growth rate (λ_{trans})[1] for the lifetable representing the translocated seals.

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.

4.8.1.17 *Direct and Indirect Effects of Alternative 1 – Status Quo*

<u>Direct and Indirect Mortality Due to Research and Enhancement</u>

Alternative 1 allows for the following lethal takes for both research and enhancement combined (see Table 4.8-3 and Appendix I 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.

[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 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 E, 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.

- Accidental 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 4.8-3) 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 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 (accidental mortality and male removals) were incorporated into the simulations.

Conclusions for Mortality Effects

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 accidental 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

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 4.8.1 (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

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

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.

4.8.1.18 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

Direct and Indirect Mortality Due to Research and Enhancement

Under Alternative 2, existing levels of research and enhancement could continue until the current permit expires in 2014. As of Spring 2011, there have been no accidental research or enhancement mortalities and no adult males have been brought into captivity or 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 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

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

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 1.6) 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

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.

4.8.1.19 Direct and Indirect Effects of Alternative 3 – Limited Translocation

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 I, Alternative 3 Take Table provides the numbers of animals proposed to be taken under this alternative (see also Table 4.8-3).

Increased Takes 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 accidental 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 for New Activities Under Alternative 3

New research and enhancement activities in Alternative 3 include:

- Two-stage translocation (described in detail in Appendix E). This does not include any translocation of seals from 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 (*i.e.*, GnHR agonist) behavioral modification of aggressive males as an alternative to translocation, permanent captivity or euthanasia.
- Vaccination research and implementation to mitigate infectious disease.
- Accidental 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 Under Alternative 3

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**: 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. **Accidental mortality due to research**: 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 accidental 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 accidental 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 accidental research mortality.

3. **Accidental mortality during enhancement activities**: This lethal take is further subdivided into three groups:

    a. Weaned pup (either sex): 4 pups over 5 years, with no more than 2 in one year

    b. Juveniles (either sex): 8 seals over 5 years, with no more than 4 in one year

    c. Adult Males: 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.* in review), 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 accidental 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 accidental 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 accidental mortality), and 16 additional accidental mortalities of either sex (including 4 weaned pups, 8 juveniles, and 4 seals of any age/sex).

The simulated loss due to accidental 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 4.8-3). 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

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

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

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. 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 (λ_{trans}) from 0.916 to 0.952.

Table 4.8-1 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 λ_{trans} = intrinsic growth rate of modified life table applicable only to the translocated seals.

Table 4.8-1 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

Alternative 3 would, to at least some degree, address all of the objectives of the Recovery Plan. However, maximum benefits would not be realized through the two-stage translocation proposed under Alternative 3 because seals could not be moved from areas of current low survival in the NWHI to higher survival in the MHI. Seals 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. Further, the inflexibility to adapt to unpredictable future conditions that might make translocations from the NWHI to MHI even more beneficial, would constrain the suite of options available to NMFS and reduce potential conservation benefits further.

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.

4.8.1.20 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Direct and Indirect Mortality Due to Research and Enhancement

Alternatives 3 and 4 are quite similar except for the approach to two-stage translocation. Under Alternative 4, NMFS would be permitted to move seals from the NWHI to the MHI. Since the level of 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

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

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 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 4.8-2. 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 4.8-2).

Table 4.8-2 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.

<u>Conclusions for Conservation Objectives</u>

Alternative 4 would, to the highest degree considered feasible, 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 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*. The effects of implementing Alternative 4 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 4 towards conservation objectives.

Table 4.8-3 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 4.8-3 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 (accidental mortality only)	889 (766,1019)	0.984 (0.970, 0.998)
3	Alt. 1 Status Quo (accidental mortality and male removals)	887 (770,1014)	0.983 (0.970, 0.997)
4	Alt. 3-4 (accidental mortality only)	874 (757,996)	0.982 (0.969, 0.996)
5	Alt. 3-4 (accidental mortality and male removals)	864 (749,985)	0.981 (0.968, 0.994)

4.8.1.21 *Cumulative Effects on Hawaiian Monk Seals*

Summary of Direct and Indirect Effects

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 4.8.1.15 through 4.8.1.18 and Appendix I, Take Tables). For Alternatives 1 (Status Quo), 3 (Limited Translocation), and 4 (Enhanced Implementation), the estimated mortality would result in minor to moderate adverse effects given the low number of mortalities expected from research and enhancement activities also supported by the fact that levels of take that are permitted are often higher than actual takes (or in this case mortalities) documented in the field. Direct and indirect effects on mortality under Alternative 2 (No Action) would likely be negligible given that no research or enhancement activities on wild Hawaiian monk seals would occur in the long term (after expiration of the current permit on 2014).

The effects of the alternatives on reproduction would be negligible for all alternatives. Alternatives 3 and 4 would seek to enhance monk seal survival by bolstering the translocation program and beginning deworming and vaccinations (if found effective) which would be expected to result in more female seals reaching the age of reproduction. Alternative 1 would, on a small scale, address some conservation objectives described in the 2007 Recovery Plan. Alternative 2 would address almost zero conservation objectives and would therefore result in a major adverse effect for the contribution to conservation. Alternative 3 would address most conservation objectives but not to their fullest extent while Alternative 4 would address most conservation objectives and several to their fullest extent.

Summary of Past Actions and Events

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 (2009) best estimate of total abundance is 1,125 seals (Carretta *et al.* 2011 SAR draft), and the number is declining at approximately 4.5% per year.

The species was driven to near extinction due to hunting in the 19th Century (Ragen 1999) but by 1958 had at least partially recovered. In that year, beach counts (an indicator of abundance) of non-pups at the six main NWHI subpopulations was over 900 (total population would have been considerably larger). Currently, food limitation, entanglement in marine debris, predation by sharks, male seal aggression, and other stressors are contributing to a continued decline. The causes of the decline as listed in detail in Section 3.3.1.7 include several key stressors from the past, many of which continue to be threats today. Table 4.4-9 provides a list of past actions and events considered in the cumulative effects assessment in this PEIS.

Prey Limitation

Juvenile monk seals struggle to find sufficient prey in the NWHI likely due to climate variability and competition. 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). In addition, large sharks and jacks (*Caranx sp*.) are extremely abundant in the NWHI compared to the MHI (Friedlander and DeMartini 2002) and may be competing with seals. Direct competition of seals and these fishes has been documented on video (Parrish *et al.* 2008).

Entanglement and Hooking

For many years, derelict fishing gear and marine debris collected and documented in the NWHI has been transported by ocean currents from fishing or other maritime industries, and this debris has been responsible for monk seal mortalities and injury for decades. During 1982-2009, there were 298 cases of entangled seals, 8 of which were confirmed to have died as a direct result. A total of 64 seals have been observed with embedded hooks in the MHI during 1989-2009 (including 12 in 2009, 4 of which resulted in serious injuries).

Shark Predation

Tiger shark predation on monk seals of all ages has long been documented but in recent years, Galapagos shark predation has become a significant problem at

French Frigate Shoals. From 6 to 11 pups (15–28% of those born at French Frigate Shoals) has been lost each year to shark predation since 2000.

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). Even though internal parasites are not identified as a cause of death, they have been shown to be significant stressors in many other species. Reif *et al.* (2006) reported that young Hawaiian monk seal seals infected with tape worms tended to be in poorer body condition than those uninfected.

Contaminants

Hawaiian monk seals, like other mammals, accumulate persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in their tissues through nursing when young and through their diet later in life. 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.* 2005a; and DeLong *et al.* 1973).

Climate change

Global sea-level rise threatens critical monk seal habitat at low-lying NWHI (Baker *et al.* 2006). As noted above, monk seal prey limitation appears to be partially mediated by climate ocean variability (Baker *et al.* 2007). Due to the unpredictable dynamics of future climate changes and their potential for significant effects on monk seal prey and/or habitat, the potential impact of ocean climate change is of concern.

Male Aggression

During the 1980s and early 1990s, injuries and deaths of female monk seals caused by multiple male aggression attacks inhibited population recovery at Laysan Island. This threat was greatly reduced through targeted translocations of adult males (Johanos *et al.* 2011), but this threat remains and is not unique to Laysan Island. Likewise, single male aggression directed toward pups remains a concern.

Critical Habitat Designation

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 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). 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). (See also *Critical Habitat Revision* under RFFAs below.)

Hawaiian Monk Seal Rehabilitation, Research and Enhancement

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. 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.* 2011 draft SAR.).

Human-Caused Mortality and Serious Injury

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). In recent years, Three seals (including a pregnant female) were shot and killed in the MHI in 2009 (Baker *et al.* 2011). There are also other reported cases of people intentionally harming seals. Fines and penalties have been lenient until only recently when 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 (Hawai`i Senate Bill 2441, sponsored by Kauaʽi Senator Gary Hooser).

Stranding Response and Disentanglement/De-Hooking

The MMHSRP (Stranding Program) has been authorized (Permit 932-1905) to take an unlimited number of wild monk seals via response, rescue, and rehabilitation (this includes disentanglement/de-hooking). This program is responsible for response, rescue, rehabilitation, and release of stranded seals; health-related research on captive and rehabilitating seals (excluding vaccination research); hazing or relocating seals away from imminently harmful situations; and translocation of MHI seals for their protection.

Military Activities

Incidental harassment permits are issued by NMFS F/PR1 for activities where Hawaiian monk seals may be unintentionally disturbed. The Navy has been authorized to incidentally harass up to 120 monk seals.

Coastal Infrastructure and Development

Development projects ranging from private homes to resorts to bridges, roads and other infrastructure along the coast likely have resulted in changes to the quality and quantity of monk seal critical habitat and may have resulted in disturbance of seals though the effects of this disturbance are difficult to measure.

Reasonably Foreseeable Future Actions

In addition to all of the past actions described above, the following information provides an overview of RFFAs (see Table 4.4-10) that would likely affect Hawaiian monk seals when considered cumulatively.

Infectious Diseases

Infectious diseases do not appear to be currently limiting recovery of the monk seal. The emergent threat of WNV and morbilliviruses is a serious concern. Although these diseases as well as others have yet to be detected in Hawaiian monk seals in Hawai`i, the threat they pose has high potential for causing devastating adverse effects should a disease outbreak occur.

Critical Habitat Revision

In 2008, NMFS received a petition to revise Hawaiian monk seal critical habitat designation under the ESA. The critical habitat review is considering adding the following areas 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 offshore. On June 12, 2009, in a 12-month finding, NMFS announced that a revision to critical habitat is warranted on account of new information available regarding habitat use by the Hawaiian monk seal and also announced the Agency's intention to proceed towards a proposed rule (74 FR 27988; June 12, 2009). The proposed rule is likely to be published in 2011 and is expected to benefit the species through protection of habitat.

Commercial Shipping

The potential disturbance impacts of commercial and recreational vessel traffic vary depending on the location, speed and size of the vessels, and physiological stage of the animal. Commercial shipping also contributes to the potential for oil spills. Overall, due to the protection offered by the NWHI Monument, the potential impacts from commercial shipping are likely to be low.

Spinner Dolphin EIS and Rulemaking

NMFS is currently in the process of developing a proposed rule and associated EIS to consider instituting partial (time-area based) closures for certain specified spinner dolphin resting habitat (or a subset thereof) in the main Hawaiian

Islands. Under the proposed action, NMFS would identify the primary areas utilized by spinner dolphins for resting habitat on each of the main Hawaiian Islands, and would institute closures of these areas during certain time periods. These time-area closures would likely result in negligible effects for monk seals due to the small areas that could potentially be affected.

Hawaiian Monk Seal Rehabilitation Facility at Natural Energy Laboratory of Hawaiʽi Authority (NELHA)

The Marine Mammal Center (Sausilito, CA) plans to construct a monk seal rehabilitation facility on a 2.6-acre property at Keahole Point on the Island of Hawaiʽi through an arrangement with NELHA, an agency of the State of Hawaiʻi. The facility will consist of a holding facility with two in-ground, custom-built fiberglass pools and two smaller in-ground pools designed specifically for monk seals. The proposed facility would provide moderate to major beneficial effects for monk seals needing rehabilitation, thereby further supporting the species' recovery.

Cumulative Effects

Mortality

The primary contributors to adverse cumulative effects on Hawaiian monk seal mortality include starvation (food limitation), entanglement, predation, with male aggression, infectious diseases, habitat loss, fishery interactions, and other human interactions also contributing to mortality on some level.

In the long term, once the current permit expires in 2014, Alternative 2 would contribute no mortalities and would therefore have negligible cumulative effect on mortality.

Alternative 1, 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 shootings 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 benefits to survival through enhancement activities intended to promote survival. Alternatives 3 and 4, 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 as just described. To the contrary, other actions proposed under Alternatives 3 and 4 would contribute to recovery and promote better survival of the species as described below.

Reproductive Effects

Disturbance from research and enhancement activities, 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 4.8.1. 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. The alternatives vary in the amount of research- and enhancement-related activities that may cause disturbance or other stress on the seals although none of the proposed alternatives are expected to contribute anything but negligible effects on reproduction.

Contribution to Conservation Objectives

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 4.8.1.15 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 NEHLA rehabilitation facility at Keahole Point on Hawai`i 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.

4.8.2 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 rated good with 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 antibiotics 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.

4.8.2.1 Direct and Indirect Effects of Alternatives

Status Quo (Alternative 1) activities would have zeor 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 G). 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 (BMPs) that are designed to avoid, minimize or mitigate potential impacts to water quality (see Appendix G). 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. 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.

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.

Alternative 3, which adds new activities with expanded scope and methods, has a slightly greater potential to impact water quality 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 water quality would be negligible to minor. 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 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 water quality would likely be negligible to minor due to the controls and mitigation measures already in place.

4.8.3 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

- 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 G) 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 2008).

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 included 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.

4.8.3.1 *Breeding and nesting success*

Green sea turtles which 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. 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 (NMFS 1998). Thus, by minimizing the presence of humans in specific areas such as French Frigate Shoals during green turtle nesting season, potential effects could be avoided.

4.8.3.2 *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. While the consequences of vessel collisions is high (*i.e.,* resulting in serious injury or mortality), the likelihood of this occurring is low. 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.

4.8.3.3 *Direct and Indirect Effects 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 G. Mortality effects on turtles are considered negligible under Alternative 1.

4.8.3.4 *Direct and Indirect Effects 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 activities or mortality of 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 or mortality.

4.8.3.5 *Direct and Indirect Effects of Alternative 3 (Limited Translocation) and Alternative 4 (Enhanced Implementation; Preferred Alternative)*

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 to moderate 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 G, PMNM 2011-001).

Minor short-term decreases in sea turtle survival and/or productivity could hypothetically 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.

4.8.3.6 Cumulative Effects

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).

Reasonably foreseeable future actions including removal of marine debris, vessel collisions during recreational, fishing or shipping activities, tuna aquaculture programs, and the joint high speed vessel programs may all contribute to potential adverse effects on sea turtles when considered cumulatively. 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 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.

4.8.4 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 and spinner dolphins 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 humpback whales and spinner dolphins.

In general, there are two potential types of mechanisms for effects that could result from the alternatives:

- Disturbance due to vessel, airplane 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 humpback whales 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 may alter their behavior and approach 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. Similar disturbance effects on humpback whales may occur, however, these effects are not likely to result in notable adverse effects on reproduction.

As summarized in the 2010 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). Most aerial surveys would occur during summer months when these whales are not present, but vessel and aerial surveys and transporting seals by air and boat could occur year-round.

The potential effects of sonic tags are summarized in the 2010 EA for NMFS Permit 10137 for Hawaiian monk seal research and enhancement (NMFS 2010) 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 spinner 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 G. While the risk of collisions does exist, to date, there have been no documented incidents of collision with monk seal research and enhancement vessels.

4.8.4.1 *Direct and Indirect Effects 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 2010). 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 would be extremely rare. 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 2010); 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 2010).

4.8.4.2 *Direct and Indirect Effects 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 still be expected to occur 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.

4.8.4.3 *Direct and Indirect Effects of Alternative 3 Limited Translocation and Alternative 4 Enhanced Implementation (Preferred Alternative)*

While Alternatives 3 and 4 could result in disturbance of individual spinner dolphins or humpack whales, these incidents are expected to be short-term and not result in long-term or population level effects on reproduction. Given the stringent BMPs and other permit conditions implemented by NMFS (see Appendix G), 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 2010).

The same procedures and mitigation would be followed in the Preferred Alternative as that described under Alternative 1. 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.

4.8.4.4 Cumulative Effects

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, or a depleted stock under the MMPA. Recent Stock Assessment Reports (SARs) 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.

Reasonably foreseeable future actions could have effects on humpback whales and spinner dolphins including other types of research, tuna aquaculture programs, shipping, recreation such as whale- or dolphin-watching tours, and the joint high speed vessel programs.

There are few other 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. There are no other permits authorizing harassment of spinner dolphins in the NWHI. 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.

Overall, Hawaiian monk seal research 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 effects on cetaceans.

4.8.5 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.

4.8.5.1 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 2010) 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.

4.8.5.2 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

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. 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. 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.

4.8.5.3 *Cumulative Effects*

Fish populations have been affected by commercial fishing, ocean pollution, climate change, and habitat degradation. Reasonably foreseeable future actions could have effects on fish populations including but not limited to commercial, (Table 4.5-2) recreational and subsistence fishing, climate change, ocean acidification, aquaculture programs, pollution and storm water runoff from population areas, construction projects, and tsunamis. The contribution of the proposed monk seal research and enhancement activities to cumulative effects on fish are expected to be negligible given there would be no dramatic changes in the levels of fish consumed by seals throughout the Hawaiian Islands. Given the small population of monk seals now, the continued decline under the best case scenario of Alternative 4, and the wide variety of prey species distributed across the Hawaiian Archipelago, the potential contribution to cumulative effects from the proposed alternatives for research and enhancement would be negligible.

4.8.6 Birds

4.8.6.1 Direct and Indirect Effects 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 2010a).

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 not exceed two weeks for holding seals (USFWS 2010a).

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 (PMNM 2008). 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 D, 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).

All species except Laysan finch occur outside of the Project Area and would rarely, if ever, come into contact with monk seal research personnel (see Section 3.3.6.1, Seabirds). USFWS previously found NMFS monk seal activities were not likely to affect the Nihoa millerbird, Nihoa finch and Laysan duck because they primarily occur in the vegetated or interior areas of the NWHI (USFWS 2010a). Nihoa millerbird and Nihoa finch only occur at Nihoa Island which is infrequently visited by researchers and no regular field camps occur here.

Laysan ducks may fly or run into holding pens when foraging, but requirements of the USFWS for holding pens would be in place to ensure the overall effects of air strikes on Laysan ducks are minimal (Appendix D, PMNM 2011-001). Short-tailed albatross typically nest higher in elevation than where NMFS monk seal activities will occur (USFWS, pers. Comm.). 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 short-tailed albatross are minimal (Appendix G, PMNM 2011-001).

Alternative 1 may moderately affect Laysan Finch (USFWS 2010a). Both NMFS and USFWS maintain field camps at Laysan Island, and NMFS maintains field camps at Pearl and Hermes Reef (see Section 3.3). Laysan finches are tame to human presence, thereby entering these field camps in search of food and water. Unintentional mortality or serious injury of two Laysan finches is possible. Under Permit 10137, NMFS is currently authorized to harass up to 200 Laysan finches. Despite efforts to prevent mortality, finches have previously drowned in camp containers which filled with rainwater during cloudbursts when biologists were away from camp, or have become trapped in camp gear. To mitigate effects to Laysan finch, monk seal research personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species (USFWS 2009). Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds (USFWS 2009).

Conclusions For Direct and Indirect Effects of Alternative 1

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 moderate adverse affects on Laysan Finch. Although not likely, monk seal research and enhancement activities may cause reduced productivity in nesting seabird colonies, collisions of birds with aircraft or holding pens, introduction of exotic species, and incidental take of Laysan finch.

BMPs and protocols of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds (PMNM 2008). 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.

4.8.6.2 Direct and Indirect Effects 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 and/or productivity in seabirds and/or short or long-term localized effects on seabird habitats.

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, but may cause minor 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 and/or short or long-term localized effects on habitat. 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 have 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

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 and/or short or long-term localized effects on bird habitats. Alternative 2 may also have moderate adverse affects on Laysan Finch. 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.

4.8.6.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

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, Atlernative 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 Hawaiian monk seal surveys and beach activities (*i.e.,* remote camera installations, increased capturing and translocation of Hawaiian monk seals, increased use of shore pens) 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 MMPA, ESA and NMFS 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 Hawaiian monk seal surveys and beach activities (*i.e.,* 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 MMPA, ESA and NMFS 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 MMPA, ESA and NMFS 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 have moderate adverse effects to Laysan Finch. 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.

Conclusions for Direct and Indirect Effects of Alternative 3

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 moderate adverse affects on Laysan Finch. 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 (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.

4.8.6.4 Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)

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 (Preferred Alternative), 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 G, 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 have moderate adverse effects on the Laysan Finch. 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.

<u>Conclusions for Direct and Indirect Effects of Alternative 4</u>

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 and/or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 4 may also have moderate adverse affects on Laysan finch. However, requirements of the Monument 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.

4.8.6.5 Cumulative Effects of the Proposed Alternative on Birds

<u>Summary of Direct and Indirect Effects</u>

Monk seal research and enhancement ground and aircraft surveys, holding pens, and the possible introduction of exotic species by research personnel or equipment under Alternative 1 may adversely affect bird survival, reproduction and habitat. However, protocols and BMPs in place by the Monument and briefing by USFWS regarding nesting seabirds would minimize the disturbance to birds. Thus, Alternative 1 would have minor or negligible adverse affects on birds. Alternative 2 would result in identical effects on birds, but for a shorter duration. Thus, the overall effect on seabird survival would be minor until the permit expires and thereafter would be considered negligible. Alternatives 3 and 4 would result in increased ground, boat, and aerial surveys, as well as increased research and enhancement activities on the beach. However, protocols and BMPs in place by the Monument would continue to be strictly followed, and new activities would have restrictions and mitigation measures required by the MMPA, ESA, and NMFS. Thus, Alternatives 3 and 4 would have minor adverse effects on bird survival, productivity, and habitat.

Summary of Lingering Past Effects

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.).

- 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).

Analysis of Reasonably Foreseeable Future Actions

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 (Baker *et al.* 2006;Keller at al. 2010). Models predict that sea level will continue to rise (Keller *et al.* 2010). 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 (Keller *et al.* 2010). 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

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.,* construction) is expected. Thus, the contribution of any alternatives to cumulative effects on birds in the MHI are considered negligible.

Because BMPS 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 very little to the overall cumulative effects on bird species. Alternative 2 would involve even less disturbance to birds from research and enhancement activities, and the direct and indirect effects associated with Alternative 2 would contribute even less to the overall cumulative effects on birds. Alternatives 3 and 4 would involve additional human disturbance associated with increased research and enhancement ground activities and/or aerial surveys than Alternative 1. However, the magnitude/intensity and duration of these effects are still considered minor. Overall, the contribution to an overall adverse cumulative effect from any of the alternatives is considered minor.

4.8.7 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) (NOAA 2008b).

4.8.7.1 *Direct and Indirect Effects of Alternatives*

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 current Monument permit (PMNM-2011-001 presented in Appendix D) 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 G).

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. 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, 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 to minor.

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 to minor due to the controls and mitigation measures already in place.

4.8.8 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.

4.8.8.1 Direct and Indirect Effects of Alternatives

Research and enhancement on Hawaiian monk seals would likely result in minor or negligible effects 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 G 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 Decisionmaking 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 minor adverse effects as the introduction of invasive species.

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 minor.

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.

4.8.8.2 *Cumulative Effects of the Alternatives*

Alternative 1

While the USFWS also maintains field research camps in the NWHI during periods throughout the year, mitigation measures and appropriate BMPs are in place as described above, to minimize the potential spread of invasive species. 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 NWHI prevent the spread of invasive species.

Alternative 2

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.

Alternative 3 and 4

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 but mitigated through strict protocols. While the USFWS also maintains field research camps in the NWHI during periods throughout the year, mitigation measures and appropriate BMPs are in place as described above, to minimize the potential spread of invasive species. 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.

A juvenile Hawaiian monk seal may weigh approximately 250 pounds and consume between 2,738 and 7,300 pounds of fish, cephalopod and crustacean biomass annually. Based on a total commercial catch of approximately 27 million pounds in 2009 (WPacFIN 2010) (see Table 3.4-5 Quantity, Value, and Price per Pound of Commercial Landings in Hawaiʽi, 1990- to 2009), this amounts to only about 0.01 to 0.03% of the catch per seal.

4.9 *SOCIAL AND ECONOMIC ENVIRONMENT*

4.9.1 *Commercial Fishing*

This section of the PEIS analyzes potential direct, indirect and cumulative effects of the Alternatives on commercial fishing. The area of analysis includes both the nearshore and offshore 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.

Effects on commercial fishing could be anticipated if an action results in a change in profits for the commercial fishermen and, therefore, not only affects their well-being and quality of life, but can 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. While there could potentially be some effects on costs associated with fishing due to the alternatives, there are no scientific data that can be used to examine whether any of the alternatives may result in increasing or decreasing such costs. Available historic data do not support a relationship between commercial catch and Hawaiian monk seal population in the MHI. Therefore, this analysis addresses any change 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*.

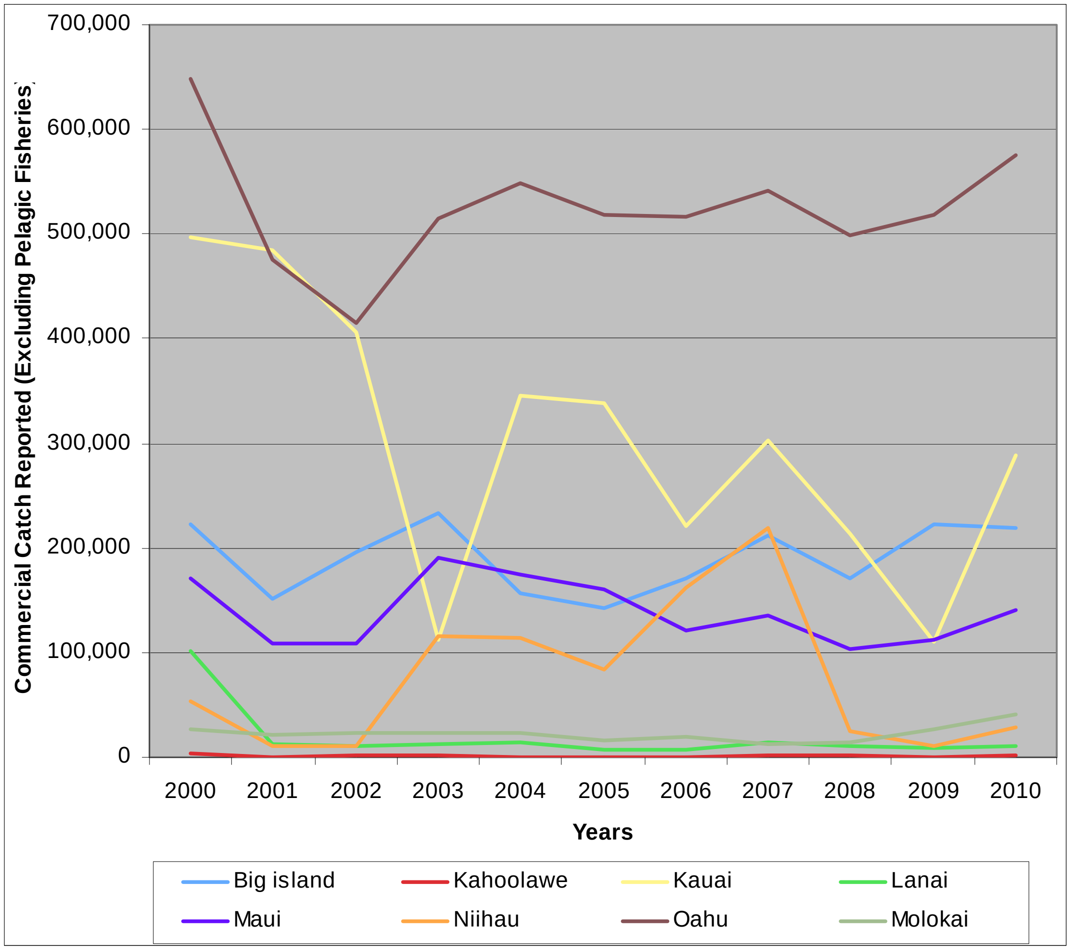
The alternatives are not anticipated to result in any direct effects on commercial fishing. However, indirect effects on commercial fishing may be possible if an Alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the commercial 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 of those species. This possible affect is examined in the paragraphs that follow.

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). According to the "Recovery Plan for the Hawaiian Monk Seal" (NMFS 2007), while seals and fisheries may exploit similar species in some cases, there is no evidence or study of ecological competition between fisheries and seals for a small seal population such as the Hawaiian monk seal. The Hawaiian monk seals are estimated to consume about three to eight percent of their body weight in biomass per day based on limited studies on monk seals and literature available on other marine carnivores (Littnan [NMFS] Personal Communication 2011). A juvenile Hawaiian monk seal may weigh approximately 250 pounds and consume between 2,738 and 7,300 pounds of fish, cephalopod (squid and octopus), and crustacean biomass annually (assuming 3 to 8% of body weight eaten per day). Total commercial catch in 2009 was approximately 27 million pounds (WPacFIN 2010) (see Table 3.4-5 *Quantity, Value, and Price per Pound of Commercial Landings in Hawai'i, 1990- to 2009*). This would amount to only about 0.01 to 0.03% of the catch per seal if seals exclusively ate individual marine organisms that would have otherwise been caught by commercial fishermen. This is not likely to be the case.

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, Hawaiian monk seals are known to prey on a wide variety of fishes, cephalopods, and crustaceans, some of which are not commercial fished. Further, it is likely that even commercially viable fish that a monk seal eats would not necessarily have otherwise been available to fishermen. For example, those fish may have been eaten by another predatory fish, seabird or marine mammal. Hawaiian monk seals are also known to forage over a wide range of areas, both in terms of depth and variety of habitats, many of which are not used by commercial fishermen. 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 calculation.

This is further supported by historic data on commercial catch and Hawaiian monk seal population in the MHI. Figure 4.9-1 presents the commercial catch reported (in pounds) for all zones in the MHI within 100 fathom bathyline between 2000 and 2010. These data are filtered by the zones where Hawaiian monk seals tend to haul out and forage. Also, these data do not include catch associated with pelagic fisheries given that most of those fish are not popular Hawaiian monk seal prey species. As stated above, the pelagic fisheries account for almost 96% of the commercial catch. It is evident from Figure 4.9-1 that while Hawaiian monk seal population in the MHI has been increasing since 2000 when the first formal surveys were conducted, commercial catch in the MHI has fluctuated. The increases and declines in commercial catch could be based on a variety of factors. However, there appears to be no relations hip between changes in commercial catch and Hawaiian monk seal population in the MHI.

Figure 4.9-1 Total Commercial Catch Reported (Excluding Pelagic Fisheries) in Pounds for All Zones within 100 Fathoms Bathyline 2000 to 2010



Source: Catch landings for fish (minus sharks and jacks) from the Hawai`i State Commercial C-3 coastal reporting zones (100-108, 300-314, 400-409, 500-506) for year 2000-2010.

4.9.1.1 *Direct and Indirect Effects 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) independent of actions take 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 and/or value of commercial catch.

Indirect effects of Alternative 1 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. As stated above, the Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 1 may enhance this growth. Given the marginal increase in Hawaiian monk seal population due to Alternative 1 activities, the potential effects on commercial fishing are anticipated to be negligible.

Conclusion for Direct and Indirect Effects

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 to none. A marginal increase in the already positive growth rate of the Hawaiian monk seal population within the MHI under Status Quo (Alternative 1) is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.9.1.2 Direct and Indirect Effects 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. As discussed above, effects on commercial fishing could stem from changes in the quantity or value of commercial catch.

Indirect effects of Alternative 2 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. However, given the marginal increase in the Hawaiian monk seal population that might be realized due to Alternative 2 actions, these effects are anticipated to be negligible.

Conclusion for Direct and Indirect Effects

Alternative 2 is not anticipated to directly affect commercial fishing in MHI. Because monk seal research and enhancement would cease after 2014 under Alternative 2, any indirect adverse effect on commercial fishing would be even smaller than under Alternative 1, and thereby likewise negligible.

4.9.1.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

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 a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually 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 may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually 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 population of commercially viable fish and, consequently, the quantity of commercial catch, due to an increased Hawaiian monk seal population. However, given the potential marginal increase in the rate of MHI Hawaiian monk seal population growth due to Alternative 3 activities, these effects are anticipated to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested commercially.

Conclusion for Direct and Indirect Effects

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 is not likely to result in an indirect adverse effect on subsistence fishing. Therefore, this effect would likely be negligible.

4.9.1.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

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 would exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The 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 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 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 population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. 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 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;

Assuming a worst case scenario in which all fish consumed by the translocated Hawaiian monk seals are commercially viable species and all prey eaten by these monk seals would have otherwise been available to fishers (i.e., not eaten by other predators or not taken in areas where fisheries do not operate), this constitutes only a 0.6% to 1.6% of annual commercial catch in the MHI.

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 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 on the above discussion on annual food consumption, 60 juvenile Hawaiian monk seals could potentially consume 164,250 to 438,000 lb. of fish. Assuming a worst case scenario in which all fish consumed by the translocated Hawaiian monk seals are commercially viable species and all prey eaten by these monk seals would have otherwise been available to fishers (*i.e.,* not eaten by other predators or not taken in areas where fisheries do not operate), this constitutes only a 0.6% to 1.6% of annual commercial catch in the MHI. Given the temporary increase in the Hawaiian monk seal population in the MHI, the effect on commercial catch is anticipated to be negligible. As previously stated, available historic data do not support that there is a relationship between commercial catch and the number of Hawaiian monk seals.

Conclusion for Direct and Indirect Effects

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 is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.9.1.5 Cumulative Effects

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

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 of those species. However, further analysis suggests that the indirect effects of the alternatives on commercial fishing are likely to be negligible at most.

Summary of Lingering Past Effects

Actions in the past that have affected commercial fishing in the MHI are fisheries management in Hawai'i, the national and local economic recession in recent years, and overfishing. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the Fisheries Ecosystem Plans (FEPs) for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. The local and global economic recession in recent years likely resulted in both a reduction in fish consumption, as well as fish exports, which may have led to reduced catch. However, as the economy is beginning to recover, commercial catch may be trending upwards (HIPA 2009).

Other possible effects from past actions are any short term limitations of access for commercial fishermen due to offshore military activities, especially if coincident with peak fishing locations. However, most of these events are of short duration and have a limited operational footprint.

Analysis of Reasonably Foreseeable Future Actions

Fisheries regulations, such as measures to prevent bottomfish overfishing in the Hawai`i Archipelago, could indirectly affect all commercial (and recreational) fisheries, as bottomfish fishermen will seek alternatives to supplement their incomes. 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.

Cumulative Effects

Commercial fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Other factors include offshore military activities that could have temporary effects on fishing through restricting access. Figure 4.9-1 presents the variation in commercial catch in select zones over the past ten years. It is evident that many factors affect this industry.

Because the direct and indirect effects associated with the alternatives are negligible, these would not contribute to the overall cumulative effects on commercial fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.2 Subsistence Fishing

This section addresses the potential direct, indirect and cumulative effects of the Alternatives on subsistence fishing. The area of analysis includes both the nearshore and offshore areas surrounding the MHI. As discussed in Section 3.4.4 *Subsistence Fishing*, there is no license required for subsistence fishing in Hawai`i. Therefore, it is difficult to assess the overall level of subsistence fishing activity due to a lack of detailed catch data. Absent formal data on subsistence fishing in Hawai`i, this analysis partly relies on data presented and analyzed in Section 4.9.1.

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 of those species. This possible effect is evaluated in Section 4.9.1 for commercial fisheries.

The analysis presented in Section 4.9.1 revealed that based on the fish biomass a juvenile Hawaiian monk seal can consume in a year as a percentage of total annual commercial catch, the potential decline in fish populations in the MHI due to any increase in Hawaiian monk seal populations under the Alternatives is negligible. Further, historic data on trends in commercial catch and Hawaiian monk seal population in the MHI does not reveal any relationship between the two variables. Given that it is widely believed that nearshore and offshore recreational and subsistence catch is likely equal to or greater than the nearshore and offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander *et al.* 2004), the results presented in Section 4.9.1 of the analysis of commercial fisheries in terms of negligible change in fish population are applicable to subsistence fishing.

4.9.2.1 Direct and Indirect Effects 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.

Alternative 1 is not anticipated to have any direct effects on subsistence fishing in the MHI. 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) independent of any 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 subsistence fishing could stem from changes in the quantity of fish caught for subsistence purposes, leading to modifications in the amount of fish consumed.

Indirect effects of Alternative 1 on subsistence fishing could be possible if there were marked changes in the populations of fish targeted by subsistence fishers and, consequently, the quantity of catch for subsistence purposes, due to increases in the Hawaiian monk seal population associated with the alternatives. However, given the marginal increase in the Hawaiian monk seal population growth rate expected under Alternative 1, these effects are likely to be negligible.

Conclusion for Direct and Indirect Effects

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 may have an indirect adverse effect on subsistence fishing due to possible decreases in fish caught for subsistence purposes. However, this adverse effect is likely to be negligible.

4.9.2.2 Direct and Indirect Effects 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, potential effects on subsistence fishing under Alternative 2 would not likely occur. As discussed above, 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. Alternative 2 is not anticipated to have any direct effects on subsistence fishing in the MHI.

Indirect effects of Alternative 2 on subsistence fishing could be possible if there were marked changes in the population of fish popular among subsistence fishers and, consequently, the quantity of catch for subsistence purposes, due to an increased Hawaiian monk seal population. However, given that after 2014, most research and enhancement activities on Hawaiian monk seals would cease, these effects are anticipated to be negligible. Further, as presented in Section 4.9.1, available historic data do not support the relationship between catch and Hawaiian monk seal population abundance in the MHI.

Conclusion for Direct and Indirect Effects

Alternative 2 is not anticipated to directly affect subsistence fishing in the MHI. Because monk seal research and enhancement would cease after 2014 under Alternative 2, any indirect adverse effect on subsistence fishing would be even less than under Alternative 1, and thereby likewise negligible.

4.9.2.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

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 Hawaiian monk seal population if seals with undesirable behaviors are able to remain in the wild as a result of behavioral modification. This would be expected to involve only a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce impacts on fishing.

As discussed previously, effects on subsistence fishing could stem from changes Alternative 3 is not anticipated to change the quantity of fish caught for subsistence purposes or the amount of fish consumed. Therefore, Alternative 3 would not have any direct effects on subsistence fishing in the MHI.

Given the small increase in Hawaiian monk seal population, indirect effects of Alternative 3 on subsistence fishing, such as changes in the population of fish popular among subsistence fishers or changes in the quantity of subsistence catch, are expected to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for subsistence.

Conclusion for Direct and Indirect Effects

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. Therefore, this effect would likely be negligible.

4.9.2.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

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 by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The 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 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 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 3 years of age.

In order to understand potential effects on subsistence fishers, the following worst-case scenario is evaluated. If all fish consumed by the translocated Hawaiian monk seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch for subsistence in the MHI. This extrapolation is based on the belief that nearshore and offshore recreational and subsistence catch [combined] is likely equal to or greater than the nearshore and offshore commercial fisheries catch (Friedlander, *et al.* 2004) and, therefore, annual subsistence catch quantity is assumed to be one half the quantity of annual commercial catch for which data are available).

Alternative 4 is not anticipated to have any direct effects on subsistence fishing in the MHI because there are not likely to be any changes in the quantity of fish caught for subsistence purposes or the amount of fish consumed. Given the temporary and increase in the MHI monk seal population under Alternative 4, the effects on subsistence catch are anticipated to be negligible.

Indirect effects of Alternative 4 on subsistence fishing are not likely because changes in the population of fish popular among subsistence fishers or the quantity of catch for subsistence purposes are not likely to occur. As per the analysis provided in Section 4.9.1.4, a maximum of 60 additional (translocated) monk seals could be in the MHI temporarily, and these seals may consume 164,250 to 438,000 lb of fish annually, much of which would likely be species or in areas not shared with subsistence fishers.

Conclusion for Direct and Indirect Effects

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.

4.9.2.5 *Cumulative Effects*

This section presents the cumulative effects on subsistence fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects

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 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.

Summary of Lingering Past Effects

Actions in the past that have affected subsistence fishing in the MHI are overfishing (NMFS and WPRFMC 2006) and any short term effects on access limitations for subsistence fishermen due to offshore military activities, especially if coincident with peak fishing locations. While overfishing has had longer-term effects on all fisheries, most of the military events are of short duration and have a limited operational footprint.

Other actions that have indirectly affected subsistence fishing are fisheries management in Hawai`i and the national and local economic recession in recent years. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. The local and global economic recession in recent years likely resulted in both a reduction in fish consumption, as well as fish exports, which may have led to reduced catch. However, as the economy is beginning to recover, commercial catch may be trending upwards (HIPA 2009). However, as the economy is beginning to recover, commercial catch is likely to trend upwards, possibly resulting in a decline in fish available for subsistence.

Analysis of Reasonably Foreseeable Future Actions

There is no license required for subsistence fishing in Hawai`i and, therefore, it is difficult to regulate these fisheries. Fisheries regulations, such as plans to end bottomfish overfishing in the Hawaiian Archipelago, could indirectly affect subsistence fishing, as commercial and recreational bottomfish fishermen will seek alternatives to supplement their incomes or derive recreational value, respectively. This could result in changes in the populations of other fish species, including those popular for consumption by the subsistence fishers. 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.

As stated above, most of these management actions do not apply to subsistence fishing, but can have indirect effects on fish available for subsistence purposes due to their effects on commercial and recreational fishing.

Cumulative Effects

Subsistence fishing in the MHI could be indirectly affected by fisheries management actions in Hawai`i, as well as the local and global economy. While both these factors do not affect subsistence fishing directly, these can have indirect effects on the fish available for subsistence purposes through their effects on commercial and recreational fishing. Other factors include overfishing and offshore military activities that could have temporary effects on fishing through restricting access.

Because the direct and indirect effects associated with the Alternatives are expected to be negligible, the proposed monk seal research and enhancement would not contribute to the overall cumulative effects on subsistence fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.3 Recreational Fishing

The potential direct, indirect and cumulative effects of the Alternatives on recreational fishing are analyzed in this section. The area of analysis includes both the nearshore and offshore areas surrounding the MHI. Based on Hawaii Marine Recreational Fishing Survey data (2006), it is estimated that 396,413 recreational fishers brought in 17.6 million pounds of fish (this amount does not include subsistence fishers). As discussed in Section 3.4.5 *Recreational Fishing*, there was no license required for non-commercial saltwater fishing in Hawai`i until recently. The new NMFS initiative, MRIP, is anticipated to collect better data and produce improved estimates of marine recreational catch and effort through the National Saltwater Angler Registry. At this point, however, similar to subsistence fishing, assessing the overall level of saltwater recreational fishing activity is a challenge due to a lack of detailed catch data. Occasional surveys, including those carried out as part of the national level Marine Recreational Fisheries Statistical Survey and the Hawai`i Marine Recreational Fishing Survey have been fielded over the years, but there has been no systematic collection of such data. In the absence of formal data on recreational fishing in Hawai`i, this analysis partly relies on data presented and analyzed in Section 4.9.1 for commercial fisheries.

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 affect 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 presented in Section 4.9.1 on commercial fishing, a potential decline in fish populations in the MHI due to an increase in Hawaiian monk seal populations under the alternatives would likely be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to recreational fishers. Given that it is widely believed that nearshore and offshore recreational and subsistence catch is likely equal to or greater than the nearshore and offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander, *et al.* 2004), the results of the analysis of commercial fisheries are applicable to recreational fishing. For these reasons, the potential of any alternative to affect recreational fishing would be negligible.

4.9.3.1 Direct and Indirect Effects 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.

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) independent of any 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. Changes in the quantity of fish caught for recreational purposes, leading to modifications in the number of recreational fishing trips are not anticipated under Alternative 1. Therefore, Alternative 1 is not anticipated to have any direct effects on recreational fishing in the MHI.

Indirect effects of Alternative 1, such as marked changes in the population of fish popular among recreational fishermen or the quantity of catch for recreational purposes, due to a marginal increase in the MHI monk seal population growth rate is not likely. Therefore, these effects would be negligible.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 1 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible. Continued marginal increases in the MHI monk seal population growth rate due to Alternative 1 actions would only result in an indirect adverse effect on recreational fishing if there were possible decreases in fish caught for recreational purposes and, consequently, decreases in the number of recreational fishing trips. However, this is not likely to occur therefore, this effect would be negligible.

4.9.3.2 *Direct and Indirect Effects 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 any actions taken by NMFS under the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on subsistence fishing under Alternative 2 would be negligible.

Indirect effects of Alternative 2 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen, are not expected to result given the temporary small increase in Hawaiian monk seal population attributable to Alternative 2 actions. Therefore, these effects would likely be negligible.

Conclusion for Direct and Indirect Effects

It is not anticipated that Alternative 2 would directly affect recreational fishing in the MHI. Increased MHI monk seal population growth rate attributable to Alternative 2 would not result in an indirect adverse effect on recreational fishing due to possible decreases in fish caught for recreational purposes or the number of recreational fishing trips. Therefore, this effect would likely be negligible.

4.9.3.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

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 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 Hawaiian monk seal population if seals with undesirable behaviors are able to remain in the wild as a result of behavioral modification. This would be expected to involve only a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce impacts on fishing.

Alternative 3 is not anticipated to have any direct effects on recreational fishing in the MHI because changes in the quantity of fish caught for recreational purposes or modifications in the number of recreational fishing trips are not likely. Indirect effects of Alternative 3 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen are not expected to result from the small increase in the MHI Hawaiian monk seal population that would attributable to Alternative 3 activities , these effects are anticipated to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for recreation.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 3 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible to none. A marginal increase in the MHI monk seal population growth rate due to Alternative 3 is not likely to result in an indirect adverse effect on recreational fishing and would be negligible.

4.9.3.4 Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, would be 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 would exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The 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 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 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 3 years of age.

As per the analysis provided in Section 4.9.1.4 for commercial fisheries, if all fish consumed by the translocated Hawaiian monk seals were species popular with recreational fishers and all these fish would have otherwise been available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch for recreation in the MHI. This extrapolation is based on the belief that nearshore and offshore recreational and subsistence catch [combined] is likely equal to or greater than the nearshore and offshore commercial fisheries catch (Friedlander, *et al.* 2004). Therefore, annual recreation catch quantity is assumed to be one half the quantity of annual commercial catch for which data are available). Given the temporary increase in the Hawaiian monk seal population due to Alternative 4 actions, the effect on recreational catch is anticipated to be negligible.

Alternative 4 is not anticipated to have any direct effects on recreational fishing in the MHI because no changes in the quantity of fish caught for recreational purposes or the number of recreational fishing trips would likely occur.

Indirect effects of Alternative 4 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen or the quantity of recreational catch, are not likely to result due to any increase in the Hawaiian monk seal population attributable to Alternative 4 actions.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 4 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible. Any short-term increase in the Hawaiian monk seal population within the MHI due to Alternative 4 actions would not likely adversely affect recreational fishing and would likely be negligible as a change number of seals is not anticipated to result in higher predation of fish available for recreational fishing.

4.9.3.5 Cumulative Effects

This section presents the cumulative effects on recreational fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects

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. The indirect effects of the Alternatives on recreational fishing are likely to be negligible at most.

Summary of Lingering Past Effects

Actions in the past that have affected recreational fishing in the MHI are overfishing (NMFS and WPRFMC 2006) and any short term effects on access limitations for recreational fishermen due to offshore military activities, especially if coincident with peak fishing locations. While overfishing has had longer-term effects on all fisheries, most of the military events are of short duration and have a limited operational footprint.

Other actions that have indirectly affected recreational fishing are fisheries management in Hawai`i and the national and local economic recession in recent years. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. 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.

Analysis of Reasonably Foreseeable Future Actions

Similar to subsistence fishing, 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.

As stated above, most of these management actions do not apply to saltwater recreational fishing, but can have indirect effects on fish available for recreational purposes due to their effects on commercial fishing.

Cumulative Effects

Recreational fishing in the MHI could be indirectly affected by fisheries management actions in Hawai`i, as well as the local and global economy. While both these factors do not affect recreational fishing directly, these can have indirect effects on the fish available for recreational purposes through their effects on commercial fishing and reduced tourism. Other factors include overfishing and offshore military activities that could have temporary effects on fishing through restricting access.

Because the direct and indirect effects associated with the alternatives are negligible, activities proposed would not contribute to the overall cumulative effects on recreational fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.4 Cultural Resources and Historic Properties

As described in more detail in Section 3.4.6, a variety of cultural resources are found in the MHI and NWHI, including fish ponds, heiau, prehistoric village sites, historic structures including residences, government buildings, churches, and schools, military facilities, and shipwrecks. The purpose of this section is to identify direct, indirect and cumulative effects to cultural resources that may occur within the area of potential effect. Figures 3.4-2 through 3.4-6 present NRHP sites located within the Area of Potential Effect (APE) while Figures 3.4-6 through 3.4-9 present known shipwrecks and navigational hazards located within the APE. Based on the analysis below, NMFS has determined that the proposed action is a type of activity that does not have the potential to cause effects on historic or cultural properties, assuming such properties are present. Therefore, no further obligations are required under NHPA section 106. A letter documenting this determination will be sent to the Hawai`i SHPD.

NMFS has been conducting research and enhancement activities on Hawaiian monk seals for decades and to date, no impacts to historic or cultural properties resulting from NMFS research or enhancement activities have been reported. Because the proposed undertaking will have no lasting visible manifestations, there is no potential for permanent indirect visual effects. Because the undertaking will not involve direct impacts on any structures or landforms, the potential for direct effects is minimal. Vehicles and activities associated with handling and transport of the Hawaiian monk seals could modify the land surface to a limited extent, but the modification would be no greater than that anticipated from normal use of the areas. Any land vehicles used for transport would be restricted to existing roads. As described in NAO 217-103 (Management of NOAA Small Boats), and BMPs 004 (Small Boat Operations Diving Activities in Water) and 013 (Small Boat Operations at Tern Island), NMFS follows strict policies for operation of small boats that would be used for monk seal research and enhancement.

The APE is limited to areas onshore (approximately 25 m inland from the shoreline) and offshore within 300 m of the shoreline, as well as camp sites further inland in NWHI, as described in Section 3.4.6. Historic structures adjacent to the shore do not have the potential to be affected by activities that may take place along the shoreline under any of the alternatives. The potential for researchers to encounter significant cultural or historic properties is expected to be extremely low. Evidence of past cultural activity found along the shoreline has survived regular tides, significant wind and waves from storms, and possibly boat or recreational traffic. Therefore, cultural resources along the shoreline are not expected to be subject to damage by any of the activities proposed under any of the alternatives.

NMFS recognizes there are numerous fishponds throughout the Hawaiian Islands and that these areas are considered sacred places to many Hawaiians. While no research and enhancement activities are planned near places where fishponds are located (see Figures 3.4-10 through 3.4-13, Fishponds), we acknowledge the potential, however rare, for Hawaiian monk seals to enter fishponds on their own. Should this occur in the future under any alternative, NMFS would work closely with the Hawai`i State Historic Preservation Office, landowner, local Native Hawaiian Organizations, and/or other appropriate entities to ensure that appropriate action be taken to minimize impacts on the fishpond and the monk seal.

The camp sites in the NWHI to be used by researchers have already been seasonally in use since the 1980's, with rigorous protocols in place to protect the natural and cultural resources surrounding the camps (see Appendix G, Monument Permit PMNM-2011-001). Therefore, use of the NWHI camps by researchers will not impact cultural resources.

Permits from the Monument are required to conduct Hawaiian monk seal research and enhancement activities in the NWHI and any associated activities must comply with general terms and conditions that satisfy Proclamation 8031 and Monument Regulations. Specifically, 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 (such as the NHPA) and state laws and regulations (NOAA 2008b).

In addition to the cultural briefing and protective measures described in the NAO 217-103 for operating small boats, the following precautions to avoid impacts to cultural resources and historic properties would also be undertaken for any of the proposed alternatives:

- Develop an unanticipated discovery plan for use by all field researchers, to include training for field personnel in recognition of cultural resources, guidance on cultural resources avoidance, and protocols for responding if any cultural resources are inadvertently encountered.
- Make boat crews aware of the locations of shipwrecks that could pose a hazard to navigation. These areas should be avoided, so as not to disturb any wrecks.
- Limit vehicle traffic to developed roads, to avoid impacting any areas previously undisturbed by vehicle traffic.
- Train all researchers camping in NWHI in cultural resource recognition and avoidance (as already required by NOAA).
- Require researchers landing on Nihoa and Necker (Mokumanana) Islands to limit activities to the extent possible, and avoid any potentially undisturbed areas, to protect the significant archaeological sites known on these islands.
- Launch and retrieve boats from developed locations, keeping out of previously undisturbed areas.
- Remove all markers put in place as soon as their temporary function has expired, such as those on beaches to guide people away from areas in use by Hawaiian monk seal.
- Remove all temporary pens as soon as their function if fulfilled, returning the location to its original state with minimal disturbance.

As described in Section 1.5.4, NMFS has prepared a Section 106 consultation document to satisfy such requirement under the NHPA. This document summarizes the analysis presented herein and is included as Appendix L, Draft Section 106 Analysis of the PEIS for the Hawaiian Monk Seal Recovery Program (April 2011).

4.9.4.1 Direct and Indirect Effects of Alternative 1 – Status Quo

As described in Section 2.6, Alternative 1, the Status Quo, involves aerial, vessel and land-based surveys, and some handling and transportation of Hawaiian monk seals. Boats would periodically come to shore. Hawaiian monk seals may be found in the shore zone (as described in Section 1.3), and land vehicles would transport researchers and possibly animals. These activities could occur in MHI, NWHI, and Johnston Atoll. In addition, researchers would seasonally (typically April or May through August) occupy existing camp sites in the NWHI (see Section 3.3.1.9).

Historic structures adjacent to the shore do not have the potential to be affected by proposed activities that may take place along the shoreline. Evidence of past cultural activity found within the APE has survived regular tides, significant wind and waves from storms, and possibly boat and recreational traffic. Therefore, cultural resources within the APE are not expected to be fragile. Based on the impact criteria presented in Table 4.4-7, if simple precautions are taken by researchers, Alternative 1 is expected to result in minor direct or indirect effects on cultural resources and historic properties given the likelihood of encountering such resources is expected to be rare. Even if such a sensitive area were encountered, activities in the area would be temporary and researchers would take all necessary precautions to avoid impacts to those sites.

Recommended precautions to avoid impacts to cultural resources as described above would be implemented under Alternative 1 thereby further reducing the potential for impacts. Because Alternative 1 will have no lasting physical manifestations, there is no potential for permanent indirect visual effects. Research and enhancement authorized under Alternative 1 would not result in direct impacts on any structures or landforms, therefore potential direct adverse effects on cultural and historic resources are considered minor. In the event that unforeseen impacts arise, the unanticipated discovery plan would protect historic and cultural resources to the extent possible.

4.9.4.2 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

Alternative 2 allows the currently permitted activities to continue through 2014, after which time no new permits would be issued. During the execution of the current permit through 2014, the potential impacts would be the same as for Alternative 1, and the same precautions would be recommended. After the current permit expires, activities would be limited to remote observation and some collection of samples from materials left by Hawaiian monk seals, but no Hawaiian monk seal translocation or handling would occur. Therefore, after 2014, Alternative 2 would involve less boat and land vehicle traffic, and less shoreline activity. While the unanticipated discovery plan is still recommended for Alternative 2 after 2014, the likelihood that historic and cultural resources would be encountered would be reduced, based on the reduced activity. Similar to Alternative 1, Alternative 2 has no potential for permanent indirect visual effects. Under Alternative 2, no direct impacts to any structures or landforms would occur, and any activities that could occur through 2014 are likely to be temporary thus potential direct effects are considered minor. In the event that unforeseen impacts arise, the unanticipated discovery plan would protect historic and cultural resources to the extent possible. Once the current research permit expires in 2014, potential impacts after that date are expected to be negligible given that no research on wild monk seals would occur.

4.9.4.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

Alternative 3 includes all of the proposed actions included in Alternative 1, plus additional actions including increased handling of Hawaiian monk seals for vaccination, more deworming, and translocation of Hawaiian monk seals within the MHI or within the NWHI, and from the MHI to the NWHI only (see Figure 2.9-1). Therefore, boat and land vehicle activity as well as shoreline activities would be greater under Alternative 3 than under Alternatives 1 or 2. For example, approximately 25 more weaned pups may be translocated under Alternative 3 annually than under Status Quo (Alternative 1). If the recommended precautions listed in the introduction of this section are followed for Alternative 3, including the unanticipated discovery plan, potential indirect visual effects under Alternative 3 would be minor as research and enhancement activities would likely be temporary and the likelihood of encountering a cultural or historic resource is low, or such properties could be avoided. Because Alternative 3 will not involve direct impacts on any structures or landforms, there is no potential for direct effects unless unforeseen impacts arise, in which case the unanticipated discovery plan will protect historic and cultural resources to the extent possible. Potential direct and indirect adverse effects on historic and cultural resources are considered minor under Alternative 3 due to the fact that, while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.

4.9.4.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 includes all of the actions included in Alternative 3, plus two-stage translocation of juvenile Hawaiian monk seal from NWHI to MHI, and then back to the NWHI when the Hawaiian monk seal reach the age of 3 years. While the number of seals potentially translocated does not increase in Alternative 4, increasing the transport of the seals may increase boat and land vehicle traffic. However, the recommended precautions described at the beginning of this section would be implemented for Alternative 4, including the unanticipated discovery plan. Alternative 4 therefore, is not expected to result in any permanent indirect visual effects. Under Alternative 4, research and enhancement on Hawaiian monk seals would not result in direct effects on any structures or landforms. Therefore, potential direct adverse effects are considered minor given the low likelihood of encountering a cultural or historic property, the temporary nature of research activities, and the fact that even if such an area were encountered, the unanticipated discovery plan would protect resources to the extent possible.

4.9.4.5 Cumulative Effects

The analysis of cumulative effects on cultural and historic resources considers the potential direct and indirect effects of proposed alternative on resources within the Project Area (or 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

The effects of research and enhancement activities proposed under Alternatives 1, 3, and 4 could result in 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 narrow area along the shoreline within the MHI and NWHI where few resources of this nature are likely to occur or could be avoided all together. While research and enhancement activities could occur under Alternative 2 through 2014, in the long term, no research on wild monk seals would occur, thus potential effects on cultural and historic resources would be negligible.

Summary of Past Actions and Reasonably Foreseeable Future Actions

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 associated Section 106, potential impacts to these resources could still occur as a result of the same activities and events listed as past actions.

Cumulative Effects

The design of each alternative includes best practices to avoid areas where cultural or historic resources may be located. The likelihood of researchers encountering cultural or historic properties is low given that activities would be limited to a relatively narrow shorezone and activities that could take place would be temporary in nature. Based on this information, the contribution of Alternatives 1, 3 and 4 to cumulative effects on cultural and historic resources is minor while Alternative 2 would result in negligible cumulative effects.

4.9.5 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 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.

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 three pathways.

4.9.5.1 Quality/Quantity of Recreation Resources

Wildlife-related recreation, including whale watching, is popular in Hawai'i. 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.

Increases in the monk seal population could affect the populations of fish species that are important for recreation, thereby affecting recreation and tourism. As discussed above in the biological resources sections, there is uncertainty surrounding the monk seal diet, but fish consumption by monk seal may decrease certain fish populations (and may increase other fish populations by consuming predators of those populations), but these effects are expected to be negligible under all Alternatives. It is possible that such changes in fish abundance may also affect other aquatic recreation activities, such as snorkeling. However, as noted in the recreational fishing section, effects to the abundance of fish species important for recreational fishing (and other recreation activities) 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.

4.9.5.2 *Access to Recreation / Tourism Resources*

> *At times, NMFS does establish 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.*

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 in any of the Alternatives. At times, NMFS does establish 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 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.

4.9.5.3 *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. Further, the few reported incidents involved disturbance of mother and pup. 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 that 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.

4.9.5.4 *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.

4.9.5.5 *Direct and Indirect Effects 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) 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 under 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

There are negligible direct effects of Alternative 1 anticipated for recreation and tourism activities in Hawai`i. Continued slight monk seal population increases within the MHI 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.

4.9.5.6 Direct and Indirect Effects 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 (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. Finally, changes in the monk seal population due to Alternative 2 would have negligible effects on public safety and cost of recreation experiences.

Conclusion for Direct and Indirect Effects

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 will 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.

4.9.5.7 Direct and Indirect Effects of Alternative 3 – Limited Translocation

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

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 will 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.

4.9.5.8 Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)

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. It is anticipated that Alternative 4 will exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2, or 3. The 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 increase in MHI population growth naturally occurring (*i.e.,* without NMFS intervention). Therefore, 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 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

Of all the alternatives, Alternative 4 would be the most effective at slowing the rate of population decline in the Hawaiian monk seal population. In addition, 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.

4.9.5.9 *Cumulative Effects*

This section discusses cumulative effects on recreation and tourism in the context of past and future foreseeable actions.

Summary of Direct and Indirect Effects

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.

Summary of Lingering Past Effects

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).

Analysis of Reasonably Foreseeable Future Actions

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

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.

4.9.6 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 3.4-11 Study Area Race and Ethnicity 2009, a high percentage of minority populations exist in the state of Hawai`i in all counties and islands, ranging from 60.9% on the island of Maui (Maui County) to 91.4% on Moloka`i (Maui County). Statewide, the average presence of minority populations is 69.8%. With the entire state of Hawai`i comprising the Project Area, all communities are assumed to be minority population communities.

Table 3.4-11 Study Area Income Below Poverty Level 2008, 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 9.3% of residents earning incomes below the poverty level. The counties and islands with greater percentages of residents living in poverty include Kaua`i County (9.9%), Moloka`i in Maui County (16.7%), and the Big Island (13.3%). The counties and islands with lesser percentages of residents living in poverty include the City and County of Honolulu (8.5%), Maui and Lāna`i in Maui County (7.9% and 8.3% respectively), and Kalawao County (0%).

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 4.9.3, 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.

4.9.6.1 *Direct and Indirect Effects 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 are expected to fishery resources or cultural resources and historic properties. 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.

4.9.6.2 *Direct and Indirect Effects 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, effects are unlikely to negligible to subsistence or commercial fishing. Cultural resources and historic properties effects would be expected to be negligible to 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.

4.9.6.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

Alternative 3 Limited Translocation encompasses all activities in Alternative 1 Status Quo; plus increased activities as detailed 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 congruent with those under Alternative 1 Status Quo. Consequently, disproportionately high and adverse effects to environmental justice communities would not be likely as negligible effects are expected to fishery resources or cultural resources and historic properties. 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.

4.9.6.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

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 3 years. Details of this alternative are included in Section 2.10 Alternative 4 Enhanced Implementation (Preferred Alternative).

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 are expected to fishery resources or cultural resources and historic properties. 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.

4.9.6.5 *Cumulative Effects*

<u>Summary of Direct and Indirect Effects</u>

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.

<u>Summary of Past Actions and Reasonably Foreseeable Future Actions</u>

Previous subsections of the larger socioeconomics section of this PEIS detail the past and reasonably foreseeable future actions that might have contributed to effects to commercial, recreation, and subsistence fisheries; economics; and cultural resources and historic properties. In summary, those actions include coastal human settlements or development, military operations or warfare, looting or other deleterious activities, significant natural occurrences such as storms such as typhoons and tsunamis, and past legislation and EOs such as NHPA, Hawai`i Acts 50 and 294, HEPA (HRS 343), and EO 12898.

<u>Cumulative Effects</u>

All alternatives would result in negligible effects to fisheries, economics, and cultural resources. Based on these resource analyses, the contribution of the alternatives would be expected to result in negligible cumulative effects. As a result, the alternatives are not likely to contribute cumulative effects that would raise environmental justice concerns.

4.9.7 *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.

4.9.7.1 *Direct and Indirect Effects 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 2.6 *Alternatives Carried Forward for Analysis*.

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) independent of actions take 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 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 their existing operations and does not require significant effort. Thus the majority of these 85 possible translocations would not involve *Coast Guard* assistance (NMFS pers. comm. 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

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.

4.9.7.2 Direct and Indirect Effects 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.

<u>Conclusion for Direct and Indirect Effects</u>

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 affected and therefore, potential effects would be considered negligible.

4.9.7.3 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Under Alternative 3, the research and enhancement activities currently permitted would be expanded (see section 2.6 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 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 F, 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__

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.

4.9.7.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Under Alternative 4, the research and enhancement activities would be the same as presented for Alternative 3 with the addition of a more robust translocation program to potentially include translocation of weaned seals from areas of low survival in the NWHI to areas of higher survival in the MHI for a temporary period until age 3 years at which point they may 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

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.

4.9.7.5 Cumulative Effects on Military Activities

Summary of Direct and Indirect Effects

Research and enhancement activities would likely result in negligible direct and indirect effects on military operations under all alternatives.

Summary of Lingering Past Effects

Lingering past effects on military operations in Hawai`i due to sensitive species interaction is largely related to the permitting process for various military activities and due to the implementation of Integrated Natural Resource Management Plans (INRMP). While the permitting process requires additional military labor and mitigation efforts these documents are not completely dedicated to monk seal management and mitigation. Examples of this would be the Navy Hawai`i Range Complex Final EIS as well as the other environmental compliance documents discussed in Section 3.4.12.3 *Coast Guard*.

As described in Section 3.4.11 *Sanctuaries, Monuments, and Refuges*, the USCG and NMFS have a standing MOA that allows for the USCG to assist NMFS in the translocation of Hawaiian monk seals. This MOA is authorized under NMFS permit 932-1905 and not under Permit 10137 (USCG and NOAA, 2010; see Section 3.4.12.3 *Coast Guard*). The protection of marine resources, such as the Hawaiian monk seal is but one of eleven USCG missions mandated by law.

Analysis of Reasonably Foreseeable Future Actions

RFFAs are described in Section 4.5.2. RFFAs that may potentially affect military activities and operations in the Hawaiian Islands would 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.

Under all alternatives, the Hawaiian monk seal population in the MHI is anticipated to increase naturally (*i.e.,* independent of NMFS action) due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011). This growth may be enhanced by alternative activities, such as de-hooking, disentanglement, and weaned pup translocation measures, with the exception of Alternative 2 as most research and enhancement would cease in 2014.

Military environmental planning would necessitate studying the potential implications of slight changes in the Hawaiian monk seal population on operations and management. However, it is likely that the existing mitigation efforts outlined for Navy operations within the Hawai`i Range Complex in Section 3.4.12.3 would apply and that minimal changes to operations or management of military activities would be needed. Current Navy mitigation efforts include a lookout and the decreasing of active sonar levels during training exercises when marine mammals are in close proximity. The contribution of any alternatives to cumulative effects on military activities due to minor changes in the monk seal population would likely be negligible.

4.10 SUMMARY OF EFFECTS

The following tables (Tables 4.10-1 through 4.10-12) 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 4.8 through 4.10.

This page intentionally left blank.

Table 4.10-1 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 (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
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	**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 (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
	Alternative would be negligible.			
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.
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** - promotes better survival through limited translocation, disentanglement, possible deworming, vaccination, and other measures.	**Major beneficial contribution** – enhanced translocation promotes best chance of survival combined with disentanglement, possible deworming, vaccination, and other measures.

Table 4.10-2 Summary of Direct/Indirect and Cumulative Effects – Sea Turtles

	Alternative 1: Status Quo	**Alternative 2: No Action**	**Alternative 3: Limited Translocation (only MHI to NWHI or within each region)**	**Alternative 4: Enhanced Implementation (Preferred Alternative)**
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; 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 4.10-3 Summary of Direct/Indirect and Cumulative Effects – Cetaceans

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
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 4.10-4 Summary of Direct/Indirect and Cumulative Effects – Fish

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
		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 4.10-5 Summary of Direct/Indirect and Cumulative Effects – Birds

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
		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.	**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 seabirds and nesting seabirds on beaches would be avoided.			

Table 4.10-6 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 (only MHI to NWHI or within each region)**	**Alternative 4: Enhanced Implementation (Preferred Alternative)**
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	**Minor adverse** – increased translocation of seals from MHI to NWHI may increase spread of invasive species but would 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.	**Minor adverse** – same as Alternative 3.

Table 4.10-7 Summary of Direct/Indirect and Cumulative Effects – Commercial Fisheries

	Alternative 1: Status Quo	**Alternative 2: No Action**	**Alternative 3: Limited Translocation (only MHI to NWHI or within each region)**	**Alternative 4: Enhanced Implementation (Preferred Alternative)**
COMMERCIAL FISHERIES				
DIRECT / INDIRECT EFFECTS				
Commercial Landings	**Negligible** – no direct affect on commercial fishing. Marginal Hawaiian monk seal population increase within the MHI not likely to result in indirect effect on subsistence fishing.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** – no direct affect on commercial fishing in MHI. Assuming a worst case scenario, if translocated seals preyed on commercial species and all prey eaten by these seals would have otherwise been available to fishers, this constitutes only 0.6% to 1.6% of annual commercial catch. Behavioral modification may reduce seal interactions with fishing operations. Marginal, temporary monk seal population increase not likely to result in an indirect adverse effect on subsistence fishing.	**Negligible** – same as Alternative 3.
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. Direct and indirect effects associated with the alternatives are negligible and would not contribute to overall cumulative effects on commercial fishing.			

Table 4.10-8 Summary of Direct/Indirect and Cumulative Effects – Subsistence Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
SUBSISTENCE FISHERIES				
DIRECT / INDIRECT EFFECTS				
Subsistence Catch	**Negligible** - data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for subsistence. Given the marginal, temporary increase in seals in the MHI, these effects are likely to be negligible.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** – same as Alternative 1. If all fish consumed by the translocated seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch.	**Negligible** – same as Alternative 3.
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 and offshore military activities could have temporary effects on fishing through restricting access. 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 4.10-9 Summary of Direct/Indirect and Cumulative Effects – Recreational Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action No Permit after 2014; activities	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
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.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** – same as Alternative 1. If all fish consumed by the translocated seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch.	**Negligible** – same as Alternative 3.
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 and offshore military activities could have temporary effects on fishing through restricting access. Direct and indirect effects associated with the alternatives are negligible, thus would not contribute to the overall cumulative effects on recreational fishing.			

Table 4.10-10 Summary of Direct/Indirect and Cumulative Effects –Cultural and Historic Properties

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
CULTURAL AND HISTORIC PROPERTIES				
DIRECT / INDIRECT EFFECTS				
Archaeological Sites	**Minor adverse** - would not result in direct impacts on any structures or landforms, therefore potential direct effects on cultural and historic resources are considered minor.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Minor adverse** - while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.	**Minor adverse** - while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.
CUMULATIVE EFFECTS				
Archaeological Sites	**Negligible contribution** - low likelihood that researchers would encounter cultural or historic properties given that activities would be limited to a relatively narrow shorezone and would be temporary in nature. 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 4.10-11 Summary of Direct/Indirect and Cumulative Effects – Recreation and Tourism

	Alternative 1: Status Quo	**Alternative 2: No Action**	**Alternative 3: Limited Translocation (only MHI to NWHI or within each region)**	**Alternative 4: Enhanced Implementation (Preferred Alternative)**
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.	**Moderate beneficial** - potential for more wildlife viewing opportunities of monk seals. 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 4.10-12 Summary of Direct/Indirect and Cumulative Effects – Environmental Justice

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
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.	**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 4.10-13 Summary of Direct/Indirect and Cumulative Effects – Military Activities

Effect	Alternative 1: Baseline	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
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.			

5.0 NEPA COMPLIANCE, IMPLEMENTATION, AND ADAPTIVE MANAGEMENT OF THE PREFERRED ALTERNATIVE

5.1 IMPLEMENTATION OF THE HAWAIIAN MONK SEAL RECOVERY ACTIONS PEIS PREFERRED ALTERNATIVE 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 Hawaiian Monk Seal Recovery Actions Programmatic Environmental Impact Statement (PEIS);

2) Document actions underway to address concerns raised during preparation of this PEIS regarding translocation, vaccinations, behavioral modification, and stakeholder and community coordination; and

3) Make recommendations for adaptive management of further actions associated with Hawaiian monk seal research and enhancement activities that have been suggested during the course of the NEPA process.

A number of recommendations for further actions were made during the scoping period that fall within two general categories:

- Monitoring plans for the translocation and vaccination processes, and
- Additional outreach and coordination with fishermen, local communities and Native Hawaiian Organizations.

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 Hawaiian Monk Seal Recovery Actions PEIS covers proposed research and enhancement programs for monk seals over the next 10 years. 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) will tier from the background information and evaluation of impacts presented herein. Tiered NEPA documents will focus on issues "ripe for decision" (CEQ 1986). This process is described in more detail in Section 5.1.2.1 below.

NMFS anticipates future submission of permit applications and permit amendments. Research and enhancement activities permit applications can be submitted at any time throughout the year, with one year lead-time recommended. At the time of submission, the NMFS Office of Protected Resources, Permits, Conservation, and Education Division (F/PR1) 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 Office of Protected Resources website at http://www.nmfs.noaa.gov/pr/permits/.

The Record of Decision (ROD) for this PEIS (which will be published after the PEIS is made final) will identify any conditions of approval relevant to permit applications, and will provide a listing of research and enhancement permit activities addressed by the Preferred Alternative 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 the Preferred Alternative 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 the Preferred Alternative 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*

Applications for new permits and amendments or modifications to permits for research or enhancement activities on Hawaiian monk seals will be reviewed by NMFS F/PR1. New permit application and permit amendments are processed using the following procedures:

- NMFS review of the permit application and the Final Hawaiian Monk Seal Recovery Actions PEIS and ROD to determine if the proposed research and enhancement is within the scope of the Preferred Alternative. 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 Environmental Impact Statement (EIS), depending on the potential impacts of the activity. These tiered documents would be very focused, incorporating by reference much of the detailed background information and evaluation of impacts presented herein;

- 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 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 F/PR1 requires annual and final reports from permit holders. Special reports are also required for activities including, but not limited to live captures; lethal takes; initial importation of marine mammal parts; and transfer, export, or re-importation of marine mammal parts. 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 F/PR1 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 (http://www.pifsc.noaa.gov/psd/).

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 (OPR) 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 regarding the proposed translocation process. Specifically, some stakeholders wanted details about how researchers would choose release or recipient sites in the Main Hawaiian Islands (MHI) and how the process would be evaluated for effectiveness over time.

The proposed two-stage translocation strategy is an option included in Alternative 4 (Preferred Alternative) and detailed in Appendix E that is aimed at improving juvenile Hawaiian monk seal survival. The strategy involves temporarily moving weaned female pups from the Northwestern Hawaiian Island (NWHI) subpopulations where there is very low juvenile survival to alternate sites (in either the NWHI or the MHI) where juvenile survival is higher, and then returning them several years later. 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 E.

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 E 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 would be carefully chosen to achieve the greatest possible benefit (in terms of increasing juvenile survival and enhancing the population);

- Public input would also play a role in deciding the most appropriate release sites, especially in the MHI. Specific release sites would be chosen both to minimize potential conflict with beach and ocean users and maximize the chances that the translocated seals are successful. Seals will 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;

- 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 occuring. Initially seals would 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 F. 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 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 F. 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.

Morbillivirus' 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 D).

The proposed vaccination activities (detailed in Appendix D) 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 2.6, 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.

The behavior modification program would be a joint effort between NMFS and their partners, with the primary lead being the PIFSC initially (during development). 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 any hardship or inconvenience for the public.

5.5 UNANTICIPATED DISCOVERY OF HISTORIC OR CULTURAL PROPERTIES

An Unanticipated Discovery Plan (UDP) would be developed by NMFS for use during research and enhancement activities. In the event that historic or cultural resources are encountered in the course of executing research and enhancement activities, the UDP would provide guidance about how to minimize impacts. While no impacts to historic or cultural resources are anticipated, the precautionary measure of a UDP would be in place.

5.6 RECOMMENDATIONS FOR COORDINATION WITH STAKEHOLDERS AND COMMUNITIES

Close coordination between NMFS and key stakeholders and community members is recommended to facilitate implementation of activities proposed in the preferred alternative. Ocean-oriented stakeholders and community members, such as fishers, surfers, 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. This section summarizes community-based programs currently supported by NMFS and discusses how these or similar programs could facilitate implementation of the proposed activities, especially implementation of the proposed archipelagic-wide translocation and behavior modification activities.

5.6.1 Native Hawaiian and Community-Based Programs

NMFS initiated a suite of programs in late 2010 that are designed to improve local community support for, and participation in, Hawaiian monk seal recovery and response in the MHI. These programs include a Native Hawaiian liaison program, a cultural practitioner network program, and a community liaison program.

The objectives of the Native Hawaiian liaison and cultural practitioner network programs are:

- Increased levels of support among Native Hawaiians for Hawaiian monk seal recovery and inhabitation of the MHI;
- Increased levels of participation by Native Hawaiians in Hawaiian monk seal recovery and management activities;

- Enhanced collaboration on Hawaiian monk seal recovery efforts between NMFS staff and partners, and Native Hawaiian practitioners and community leaders; and

- Enhanced consideration of traditional Native Hawaiian conservation and management practices, and enhanced incorporation of Native Hawaiian cultural practices and protocols in the NMFS Hawaiian monk seal recovery program.

These programs include:

- Interactive meetings and information sharing sessions with Native Hawaiians, NMFS, partner agencies, Non-Governmental Organizations (NGO's), and response volunteers;

- Identifying and reporting on opportunities and constraints to achieving monk seal recovery in the MHI; and

- Developing and maintaining a network of Hawaiian cultural practitioners and kūpuna (elders) to advise NMFS and to conduct cultural protocols during Hawaiian monk seal response and other monk seal management and recovery-related activities.

The community liaison program is designed to work in concert with the Hawaiian liaison program. The target group for the community liaison program includes long-time island residents and kamaʻāina (people born in Hawai`i), including and in addition to Native Hawaiians, who have family ties, knowledge and experience in the MHI shoreline areas and coastal waters inhabited by Hawaiian monk seals. The community liaison program uses team members called "community liaisons," funded under contract or grant, working on the islands of Kaua`i, O`ahu, Maui, Moloka`i, and Hawai`i. These community liaisons work part-time under NMFS leadership and in close partnership with other NMFS programs and other government and non-governmental partners. Tasks conducted under this program include:

- Recruiting local community members, including kamaʻāina and long-time residents, to join the marine mammal response network (described in Section 5.4.2) and actively participating in Hawaiian monk seal response and recovery activities;

- Identifying causes and sources of concern or conflict within the local community regarding NMFS monk seal recovery policies and activities, and recommending to NMFS actions to address the concerns and resolve the conflicts;

- Planning and facilitating productive and constructive information-sharing and "talk story" meetings between NMFS personnel (including response staff and volunteers) and various community members and organizations;

- Serving as a liaison between NMFS and local coastal property owners and local coastal resource users to help ensure timely and adequate shoreline access by NMFS staff, volunteers, contractors, vehicles, and equipment to conduct marine mammal response and Hawaiian monk seal recovery activities;

- Observing and evaluating monk seal response and recovery activities, including volunteer monk seal incident responses in the field, and recommending changes and enhancements to improve local community support for and acceptance of these activities;

- Documenting and communicating to NMFS descriptions of community residents' knowledge, understanding, attitudes toward and assessments of NMFS monk seal response and recovery activities; and

- Conducting public outreach and education in the community and schools regarding monk seal conservation and natural history in close coordination with NMFS marine mammal response and monk seal recovery staff.

Although only recently initiated, the community-based programs outlined above appear to have engaged several Native Hawaiian community leaders and other local stakeholders to actively support and participate in monk seal response and recovery activities.

5.6.2 Marine Mammal Response Network

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 (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, cordon 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 every island in the MHI except Lāna`i and Ni`ihau. 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. While this system is distinct from that used to estimate abundance and demographic rates in the NWHI, it is well suited for seal research 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.

5.6.3 Outreach and Collaboration with Fishers

NMFS has a tradition of working with fishers in Hawai`i on a variety issues related to fisheries management and conservation, and has recently begun partnering with government agencies, non-government organizations, and individual fishers to develop collaborative efforts supporting monk seal recovery in the MHI. Through its Protected Species Cooperative Conservation program, NMFS has awarded a grant (under Section 6 of the Endangered Species Act) to the Hawai`i Department of Land and Natural Resources (DLNR) to support Hawaiian monk seal (and sea turtle) conservation activities, including outreach and response coordination activities with local fishers.

NMFS has also recently developed a set of guidelines and recommendations for fishers to help prevent and mitigate monk seal interactions with fisheries. As a result of recent meetings and correspondences with individual fishers based on Kāua'i, Moloka`i and Maui, NMFS has plans to enhance its collaboration with fishers to protect seals from hooking and entanglement as well as to reduce seal depredation and other adverse effects on fishing gear and catch. One initiative under consideration is a pilot program intended to partner with a small group of boat and shore-based fishers to document and mitigate fishery-seal interactions associated with the various types of fishing gear and methods used extensively in the MHI.

5.6.4 Outreach and Collaboration with Other Community Members

NMFS has also recently begun to collaborate on monk seal recovery initiatives with other community members who have a presence along the shorelines or in the coastal waters of the MHI. This includes:

- Partnering with several hotels and resorts to conduct training with their staff and outreach with their guests so that seals are able to haul out and rest undisturbed in front of hotel and resort properties. Guests are able to enjoy a unique wildlife viewing experience and still use a large portion of the shoreline for many other recreational activities.

- Partnering with non-governmental organizations, such as conservation-oriented non-profits, to conduct community outreach promoting responsible wildlife viewing and reporting of monk seal sightings, injuries, and human-seal interactions.

5.6.5 Incorporating Community Feedback into Research and Enhancement Activities

To support activities proposed in the preferred alternative, 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 meetings, outreach events, 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 the proposed translocation, 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 translocated seals. 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 seal behaviors, seal health and body condition, 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.

Other programs conducted by NMFS and partners, including education and outreach efforts that target the general public and other audiences, such as students and teachers, could also support implementation of the proposed activities to varying degrees. Descriptions of these efforts are provided on the NMFS PIRO PRD web site:
http://www.fpir.noaa.gov/PRD/prd_outreach_education1.html

This page intentionally left blank.

6.0 LIST OF PREPARERS

6.1 NOAA NATIONAL MARINE FISHERIES SERVICE

PACIFIC ISLANDS REGIONAL OFFICE

Jeff Walters, PhD	Project Manager, Marine Mammal Branch Chief
Marilyn Luipold	Regional NEPA Coordinator
Rachel Sprague, PhD	Assistant Hawaiian Monk Seal Recovery Coordinator
David Schofield	Regional Marine Mammal Response Network Coordinator

PACIFIC ISLANDS FISHERIES SCIENCE CENTER

Jason Baker, PhD	Research Marine Biologist
Charles Littnan, PhD	Supervisory Research Ecologist
Matthew Vandersande, D.Env.	NEPA and Permits Coordinator, Director's Office

NMFS HEADQUARTERS

Amy Sloan	Fisheries Biologist, Permits, Conservation and Education Division, NMFS Office of Protected Resources, Silver Springs, MD
P. Michael Payne	Chief, Permits, Conservation and Education Division, NMFS Office of Protected Resources, NMFS, Silver Spring, MD
Christopher Holmes	Environmental Protection Specialist, NMFS Office of the Assistant Administrator, Silver Spring, MD

NATIONAL MARINE FISHERIES SERVICE CONTRACTORS

Albert Harting, PhD	Harting Biological Consulting

6.2 CONSULTANT TEAM LIST

Project Leader

Anne Southam	ERM – Project Manager, Consultant Team

Task Leaders

April Brehm	ERM – Public Involvement Lead
Sue Ban	Cardno ENTRIX – Marine Science Lead

Contributors

Rabia Ahmed	Cardno ENTRIX – Socioeconomics
Terry Antrobus	Cardno ENTRIX – Marine Science – Avian Ecologist
Krieg Brown	Cardno ENTRIX – Socioeconomics
Joe Casey	ERM – GIS
Jack Colonell. PE, PhD	ERM – Partner In Charge
Laura Desmond	ERM – Project Support
Lee Elder	Cardno ENTRIX – Socioeconomics
Benn Levine	ERM – Database Management
Amy Mai	Cardno ENTRIX – Marine Science
Terry O'Halloran	Change Strategies & Innovation Ocean Resource Management – Local Content
Jacquie Payette	ERM – Cultural and Historic Resources
Amanda Thronson	ERM – Marine Science
Barbara Wyse	Cardno ENTRIX - Socioeconomics

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

AGENCIES

Malia Chow
NOAA Office of National Marine Sanctuaries HIHWNMS
NOAA Office of National Marine Sanctuaries HIHWNMS

Aaron Hebshi
Navy Region HI

Darcy Hu
NPS

Earl Miyamoto
Division of Aquatic Resources

Eric Roberts
US Coast Guard

Paul Dalzell
Western Pacific Fishery Management Council

Paula Hartzell
FWS

Topher Holmes
NOAA-NMFS-OPR

Myron Honda
DOH-CWB

Hoku Johnson
NOAA Pupahanaumokuakea

Amy Klein
US Army Corps of Engineers

Lydia Munger-Little
NOAA PIRO

Watson Okubo
Department of Health

Amy Sloan
NOAA – NMFS – OPR

Matthew Vandersande
NOAA PIFSC

Lisa White
Division of Acquatic Resources

Paul Wong
NOAA HIHWNMS

ELECTED/APPOINTED OFFICIALS

Representative Tokioka

Bernard Carvalho, Jr.
County of Kaua'i Mayor

Alan Arakawa
County of Maui Mayor

William J. Aila, Jr.
Department of Land and Natural Resources

Gary Hooser
Office of Environmental Quality Control

NGO & ADVOCACY GROUPS

Keiko Bonk
Save Our Seal

Philip Fernandez

Cody Graham

Sean Harris
KAHEA

Marti Townsend
KAHEA

OPTHER POTENTIALLY INTERESTED PARTIES

Aaron Agena	Kelii Alapai	Bud Antonelis
Kieran Lei ali'i A'okoa Rosas	Karen Ashley	Adam Asquith
Makana Bacon	Michele Bane	Bill & Brenda Barnard
Larry Basch	Brenda Becker	Austin Bello
Carl Berg	Hannah Bernard	Barbara & Robert Billand
John & Gina Biondi	Irene Bowie	Megan Brooker
Donna Brown	Nancy & Randal Bruckner	Chris Brun
Adrian Bulsum	Ben Butler	Suzanne Carlon
Billy Chang	Bradley Chiba	Bryson Chieto Koa Sakai-Soto
Kara Chow	Mani Christopher	Shanna & Forrest Cloud
Stuart Coleman	Ellen Coulombe	Amy Cremer
Ka'imipono Crivello	Henry Curtis	Kawika Cutchur
Steve Downey	Heather Driscoll	Camilla Dulac
Rondee Eckberg	Kekai Edens	Judy Edwards
Kelly Jean Evans	Ruth Evans	John & Liz Field
Michael Flaherty	Crystal & Kip Fryinaga	Leilani Furugon
Diane Gabriel	Inga Gibson	James Gomes
Krista Graham	Sue Green	Sean Guerin
James Haae	Wesley Haragioai	Randall Haraguchi
Cory Harden	George Harker	Robert Harris
Annie Hashimoto	Jundale Hashindo	Luana Heff
John Henderson	Sharron Henry	Paul Heraguchi
Colleen Heyer	Abraham Hiddy	Rich Hildebrand
Greg Holzman	Kalei Lehua O Panaewa Kahele	Richard Hurumoto
Wanda Ibia	Eric Ichimasa	Asuka Ishizaki

Rodney Izuo
Bruce Javellana
Carl Jelling
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
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

8.0 REFERENCES

16 United States Code (U.S.C.) 6401 et seq; Dec 23, 2000. Coral reef conservation act of 2000. Washington, DC: U.S. Government Printing Office.

16 U.S.C 703–712; 40 Stat. 755 (as amended)

Abernathy, K., & Siniff, D.B. (1998). *Investigations of Hawaiian monk seal, Monachus schauinslandi*, pelagic habitat use: range and diving behavior. Saltonstall Kennedy Grant Rep. No. NA67FD0058, 30 p.

Aguirre, A. (2000). Health assessment and disease status studies of the Hawaiian monk seal (Monachus schauinslandi). U.S. Dep. Commer., NOAA, NMFS, Southwest Fish. Sci. Cent. Rep. H-00-01, 44p.

Aguirre, A.A., Reif, J.S. & Antonelis, G.A. (1999). Hawaiian monk seal epidemiology plan: Health assessment and disease status studies. U.S. Dep. Commer. NOAA Tech. Memo. NOAA-NMFS-SWFSC-280, 69p.

Alcorn, D.J., & Kam, A.K.H. (1986). Fatal shark attack on a Hawaiian monk seal *(Monachus schauinslandi). Marine Mammal Science* 2: 313-315

American Association for Laboratory Animal Science. (2011). http://www.hawaii.edu/ansc/IACUC/generalinformation.html. Accessed in February 2011

Antonelis, G, Baker, J, Johanos, T, Braun, C, & Harting, A. (2006). Hawaiian monk seal *(Monachus schauinslandi)*: status and conservation issues. Unpublished manuscript, Department of Botany, University of Hawaii, Honolulu, Hawaii. Retrieved from http://www.botany.hawaii.edu/faculty/duffy/ARB/543/06.pdf

Antonelis, G.A., Baker, J.D. & Polovina, J.J. (2003). Improved body condition of weaned Hawaiian monk seal pups associated with El Nino events: Potential benefits to an endangered species. *Marine Mammal Science* 19:590-598.

Antonelis, G.A., Baker, J.D. Johanos, T.C. Braun, R.C. & Harting, A.L. (2006). Hawaiian monk seal (*Monachus schauinslandi*): status and conservation issues. *Atoll Research Bulletin* 543:75-101.

Ashmole N.P. & Ashmole, M.J. (1967). Comparative feeding ecology of sea birds of a tropical oceanic island. *Bulletin of the Peabody Museum of Natural History. 24*: 1–131.

Atkinson, S., & Gilmartin, W.G. (1992). Seasonal testosterone pattern in Hawaiian monk seals (*Monachus schauinslandi*). *Journal of Reproduction and Fertility* 96:35-39.

Atkinson, S., Gilmartin, W.G. & Lasley, B.L. (1993). Testosterone response to a gonadotrophin-releasing hormone agonist in Hawaiian monk seals (*Monachus schauinslandi*). Journal of Reproduction and Fertility 97:35-38.

Atkinson, S., Ragen, T.J., Gilmartin, W.G., Becker, B.L., & Johanos, T.C. (1998). Use of a GnRH agonist to suppress testosterone in wild male Hawaiian monk seals (Monachus schauinslandi). *General and Comparative Endocrinology* 112:178- 182.

Bailey, A.M. (1952). The Hawaiian monk seal. Museum Pictorial, Denver Museum of Natural History 7:1-32.

Baker J.D., Harting, A.L., & Johanos, T.C. (2006a). Use of discovery curves to assess abundance of Hawaiian monk seals. *Marine Mammal Science* 22:847-861.

Baker J.D., Polovina J.J., & Howell E.A. (2007). Apparent link between survival of juvenile Hawaiian monk seals and ocean productivity. *Marine Ecology Progress Series* 346:277-283.

Baker, J.D. & Johanos, T.C. (2004). Abundance of the Hawaiian monk seal in the Main Hawaiian Islands. Biological Conservation. 116: 103-110.

Baker, J.D. & Johanos, T.J. (2002). Effects of Research Handling on the Endangered Hawaiian Monk Seal. *Marine Mammal Science* 18:500-512.

Baker, J.D. & Thompson, P.M. (2007). Temporal and spatial variation in age-specific survival rates of a long-lived mammal, the Hawaiian monk seal. *Proceedings of the Royal Society B* 274:407-415.

Baker, J.D. (2004). Evaluation of closed capture-recapture methods to estimate abundance of Hawaiian monk seals, *Monachus schauinslandi*. *Ecological Applications*: 14:987-998.

Baker, J.D. (2008). Variation in the relationship between offspring size and survival provides insight into causes of mortality in Hawaiian monk seals. *Endangered Species Research* 5:55-64.

Baker, J.D., Becker, B.L., Wurth, T.A., Johanos, T.C., Littnan, C.L., & Henderson , J.R. In review. Review of translocation as a tool for conservation of the Hawaiian monk seal.

Baker, J.D., Harting, A.L., Wurth, T.A., Johanos, T.C. In press. Dramatic shifts in Hawaiian monk seal distribution predicted from divergent regional trends. Marine Mammal Science Published Online: May 26 2010 2:27AM DOI: 10.1111/j.1748-7692.2010.00395.x.

Baker, J.D., Littnan, C.L. & Johnston, D.W. (2006b). Potential effects of sea-level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. *Endangered Species Research* 4:1-10.

Baker, M.R., Gobush, K.S. and Vynne, C.In review. Systematic review of factors influencing stress hormones in wildlife. *Conservation Biology*.

Balazs, G.H., & Whittow, G.C. (1979). First record of a tiger shark observed feeding on a Hawaiian monk seal. *Elepaio* 39: 107-109.

Banish, L.D. & Gilmartin, W.G. (1992). Pathological findings in Hawaiian monk seals. *J. Wildl. Dis*. 28: 428-434.

Bard, S.M. (1999). Global Transport of Anthropogenic Contaminants and the Consequences for the Arctic Marine Ecosystem. *Marine Pollution Bulletin* 38: 356-379.

Beckmen, K.B., Blake, J.E., Ylitalo, G.M., Stott, J.L., O'Hara, T.M. (2003). Organochlorine contaminant exposure and associations with hematological and humoral immune functional assays with dam age as a factor in free-ranging northern fur seal pups *(Callorhinus ursinus)*. *Marine Pollution Bulletin* 26: 594-606.

Bellwood, P. (1978). The Polynesians: Pre-history of an island people. Thames and Hudson, London.

Bertilsson-Friedman, P. (2006). Distribution and frequencies of shark-inflicted injuries to the endangered Hawaiian monk seal (*Monachus schauinslandi*). *Journal of Zoology* 268: 361–368.

Bertschinger H.J., Asa, C.S., Calle, P.P., Long, J.A., Bauman, K., DeMatteo, K., Jöchle. W,, Trigg, T,E. Human A. Control of reproduction and sex related behavior in exotic wild carnivores with the GnRH analogue deslorelin: preliminary observations. (2001) *J Reprod Fertil Suppl.* 57:275-83.

Boehlert, G.W. (1993). Fisheries and marine resources of Hawai`i and the U.S.-associated Pacific Islands: An introduction. *Marine Fisheries Review.* 55(2): 3-6.

Bonier, F., Martin P. R., Moore I. T., and Wingfield J. C.(2009). Do baseline glucocorticoids predict fitness? *Trends Ecol. Evol.* 24:634-642.

Braun, R. C. & Yochem, P.K. (2006) Final Report. Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals. Hubbs-SeaWorld Research Institute. San Diego California

Bromirski, P.D., Cayan D.R., & Flick, R.E. 2005. Wave spectral energy variability in the northeast Pacific. *J. Geophys. Res. 110*: C03005.

Bronson, E., S. Deem, C. Sanchez, C., and S. Murray. 2007. Serologic response to a canarypox-vectored canine distemper virus vaccine in the giant panda (*Ailuropoda melanoleuca*). *Journal of Zoo and Wildlife Medicine* 38: 363-366.

Busch, D. S., and Hayward L. S.(2009). Stress in a conservation context: A discussion of glucocorticoid actions and how levels change with conservation-relevant variables. Biological Conservation 142:2844-2853.

Cahoon, M. [MSc Thesis. Will be finished in next couple months]

Carretta et al. In prep. U.S. Pacific Marine Mammal Stock Assessments: 2011. NOAA-TM-NMFS-SWFSC-XXX.

Carretta, J.V., Forney, K.A., Muto, M.M., Barlow, J., Baker, J., Hanson, B., & Lowry, M. (2006). *US Pacific Marine Mammal Stock Assessments: 2005.* NOAA-TM-NMFS-SWFSC-388

Center for Biological Diversity, Kahea, & Ocean Conservancy (2008). Petition to Revise Critical Habitat for the Hawaiian Monk Seal (*Monachus schauinslandi*) under the Endangered Species Act.

Church, J.A., Gregory, J.M., Huybrechts, P., Kuhn, M., Lambeck, K., Nhuan, M.T., Qin, D., & Woodworth, P.L. (2001). *Chapter 11: Changes in sea level.* Climate change 2001: the scientific basis. In: Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P., Dai, X., Maskell, K. and Johnson, C.I. (editors): Contribution of working group I to the third assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge, p. 641-693.

Clapp, R.B., & Woodward, P.W. (1972). The natural history of Kure Atoll, Northwestern Hawaiian Islands, *Atoll Research Bulletin* 164:303-304.

Clean Water Board (2011) Hawai`i Department of Health, Clean Water Branch http://hawaii.gov/health/environmental/water/cleanwater/prc/about/aboutcwb.html

Clean Water Board (2010) Annual Report 2009 Polluted Runoff Control Program. Retrieved from http://hawaii.gov/health/environmental/water/cleanwater/prc/about/reports/cleanwater/prc/pdf/EndOfYearReport2010.pdf March 2011

Coastal Geology Group (2011) University of Hawai`i at Manoa, School of Ocean & Earth Science & Technology Retrieved from: http://www.soest.hawaii.edu/coasts/publications/hawaiiCoastline/hawaii.html; March 2011

Council on Environmental Quality (CEQ) (1981). *Forty Most Asked Questions Concerning CEQ's NEPA Regulations.* Council on Environmental Quality, Executive Office of the President, Washington, D.C.

CEQ (1983). *Guidance Regarding NEPA Regulations.* Council on Environmental Quality, Executive Office of the President, Washington, D.C.

CEQ (1981). *Memorandum for General Counsels, NEPA Liaisons and Participants in Scoping.* Council on Environmental Quality, Executive Office of the President, Washington, D.C.

CEQ (1997). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Council on Environmental Quality, Executive Office of the President, Washington, D.C.

CEQ (2010). http://ceq.hss.doe.gov/ceq_regulations/guidance.html.

CEQ 40 CFR Parts 1500 to 1508.

County of Hawai`i Department of Research and Development Databook (2010) Retrieved from http://www.co.hawaii.hi.us/databook_current/Table%205/5.5.pdf. March 2011

Craig, M.P. & Ragen, T.J. (1999). Body size, survival, and decline of juvenile Hawaiian monk seals, *Monachus schauinslandi*. *Marine Mammal Science* 15(3): 786-809.

Dailey, M. D., Santangelo, R. V. & Gilmartin. W.G. (1988). A coprological survey of helminth parasites of the Hawaiian monk seal from the Northwestern Hawaiian Islands. *Marinine Mammal Science*. 4:125-131.

Daily Bulletin, The (Honolulu). May 15, 1895. "Laysan Island Lighthouse."

Dameron, O.J., Parke, M,. Albins, M., & Brainard, R. (2007). Marine debris accumulation in the Northwestern Hawaiian Islands: An examination of rates and processes. *Marine Pollution Bulletin* 54(4): 423-433.

De Swart, R.L., Ross, P.S., Vedder, L.J., Timmerman, H.H,, Heisterkamp, S., van Loveren, H., Vos, J.G., Reijnders, P.J.H., & Osterhus, A.D.M.E. (1994). Impariment of immune function in harbor seals (*Phoca vitulina)* feeding on fish from polluted waters. *Ambio* 23, 155-159.

Deem, S. L., L. H. Spelman, R. A. Yates & R. J. Montali. (2000). Canine distemper in terrestrial carnivores: a review. *Journal of Zoo and Wild Animal Medicine* 31: 441-451.

Delong, R.L., Gilmartin, W.G., & Simpson, J.G., (1973.) Premature births in California sea lions: association with high organochlorine pollutant residue levels. *Science* 181, 1168–1170.

DeLong, R.L., Kooyman, G.L., Gilmartin, W.G. & Loughlin, T.R. (1984). Hawaiian monk seal diving behavior. *Acta Zoologica Fennica* 172:129-131.

DeMartini, E.E. & Friedlander, A.M. (2004). Spatial pattern of endemism in shallow water reef fish populations of theNorthwestern Hawaiian Island. *Mar. Ecol. Prog. Ser. 271*:281-296.

Department of Business Economic Development & Tourism (DBEDT) (2009a). *County Social, Business and Economic Trends in Hawaii: 1990 – 2008.*

DBEDT, Research & Economic Analysis Division (2010). *Hawaii's Population on April 1, 2010 from the 2010 Census*. December 21, 2010.

DBEDT (2009a). The State of Hawai`i Data Book 2009. Retrieved from http://hawaii.gov/dbedt/.

DBEDT (2009b). The State of Hawai`i Data Book 2009. Retrieved from http://hawaii.gov/dbedt/.

Department of Health, Clean Air Branch. (2007). Annual Summary of the 2007 Hawai`i Air Quality Data. Retrieved 1/14/2011 from http://hawaii.gov/health/environmental/air/cab/cabmaps/pdf/2007_aqbook.pdf

Department of Land and Natural Resources, Division of Aquatic Resources. (2011). Hawai`i Marine Life Conservation Districts. Retrieved from http://hawaii.gov/dlnr/dar/coral/mlcd.html.

Dill, H.R., & Alanson Bryan, W.M. (1912). Report of an expedition to Laysan Island in 1911, *Biol. Surv. Bull*. 42:1-30.

Dillingham Military Reservation/Dillingham Airfield, April 26, 2005, Website (http://www.globalsecurity.org/military/facility/dillingham.htm) accessed March 15, 2011.

Division of Aquatic Resources (DAR) & Western Pacific Fishery Information Network (WPacFIN). (2010). State of Hawai`i 2008 Fishery Statistics.

DAR (2002). The "Got Fish" Story. *Wave Report.* March 2002, #1.

DAR (2003). The "Got Fish" Story Continued.... *Wave Report.* February 2003, Issue #2.

DAR, Department of Land & Natural Resources (2004). Hawai`i Marine Recreational Fishing Survey. November 2004.

DAR, Department of Land & Natural Resources (2008). *Commercial Marine Landings Summary Trend Report.*

Donohue, M.J. & Foley, D.G. (2007). Remote Sensing Reveals Links Among the Endangered Hawaiian Monk Seal, Marine Desbris and el Nino. *Marine Mammal Science* 23:468-473.

Donohue, M.J., Boland, R.C., Sramek, C.M. & Antonelis, G.A. (2001). Derelict fishing gear in the Northwestern Hawaiian Islands: diving surveys and debris removal in 1999 confirm threat to coral reef ecosystems. *Marine Pollution Bulletin* 42(12):1301_1312.

Eberhardt, L.L. (1977). Optimal policies for conservation of large mammals with special reference to marine ecosystems. *Environmental Conservation* 4(3): 205-212.

Engilis, Jr., A. & Naughton, M. (2004). U.S. Pacific Islands Regional Shorebird Conservation Plan. U.S. Shorebird Conservation Plan. U.S. Department of the Interior, Fish and Wildlife Service. Portland, Oregon.

Environmental Protection Agency (EPA) (2008). National Coastal Condition Report III. Chapter 8 Part B Alaska, Hawai`i and Island Territories. Retrieved March 2011 from http://water.epa.gov/type/oceb/assessmonitor/upload/2008_12_09_oceans_nccr3_chapter8_ak_hi_islands-b.pdf.

EPA (2011). Basic Information. Retrieved from http://www.epa.gov/environmentaljustice/basics/index.html

Final Rule for Reporting and Recordkeeping Requirements. (1996). 61 Fed. Reg. 21926, May 10, 1996

Firing, J. & Brainard, R.E. 2006. Ten years of shipboard ADCP measurements along the Northwestern Hawaiian Islands. *Atoll Research Bulletin* 543:347-364.

Fischer, J. (2011) Moku'aikaua Church, Kailua-Kona, Big Island - Historic Churches of Hawai`i, http://goHawai`i.about.com/od/bigislandsights/ss/mokuaikaua.htm, accessed 3/1/2011.

Flament, P., Kennan, S., Lumpkin, R., Sawyer, M., Stroup, E.D. (1998). Ocean Atlas of Hawai'i. Retrieved 1/14/2011 from http://www.soest.hawaii.edu/hioos/oceanatlas/authors.htm

Fowler, M.E. Editor in Chief. 1986. Zoo and Wild Animal Medicine. 2nd Edition. W.B. Saunders Company, Philadelphia.

Friedlander, A., Keller K., Wedding L., Clarke A., Monaco M. (eds.). (2009). *A Marine Biogeographic Assessment of the Northwestern Hawaiian Islands.* NOAA Technical Memorandum NOS NCCOS 84. Prepared by NCCOS's Biogeography Branch in cooperation with the Office of National Marine Sanctuaries Papahanaumokuakea Marine National Monument. Silver Spring, MD. 363 pp.

Friedlander, A.M., & DeMartini, E.E. (2002). Contrasts in density, size and biomass of reef fishes between the Northwestern and the main Hawaiian islands: the effects of fishing down apex predators. *Marine Ecology Progress Series* 230:253–264.

Gerrodette, T.M., & Gilmartin, W.G. (1990). Demographic consequences of changed pupping and hauling sites of the Hawaiian monk seal. *Conservation Biology* 4:423-430.

Giambelluca, T.W., & Schroeder, T.A. (1998). Climate. In: *Atlas of Hawaii*, J. Juvik and S. Juvik, (eds). University of Hawai'i Press. Honolulu.

Gilman, Eric (2004). References on seabird bycatch in lonline fisheries. Western Pacific Regional Fishery Management Council. Honolulu, HI.

Gilmartin, W.G. (1990). Hawaiian monk seal work plan, fiscal years 1991-1993. U.S. Department of Commerce, NOAA, NMFS, Southwest Fisheries Science Center. Report H-90-14, 43 p.

Gilmartin, W.G. (1993a). *Research and management plan for the Hawaiian monk seal at French Frigate Shoals, 1993-96.* Honolulu Lab., Southwest Fisheries Science Center, Natl. Marine Fisheries Service., Administrative Report H-93-08. 22 pp.

Gilmartin, W.G. (1993b). Hawaiian monk seal work plan, fiscal years 1994-1996. U.S. Department of Commerce, NOAA, NMFS, Southwest Fish. Sci. Cent. Rep. H-93-16, 83 p.

Gilmartin, W.G., & Alcorn, D.J. (1987). A plan to address the Hawaiian monk seal adult male "mobbing" problem. U.S. Dep. Commer., NOAA, NMFS, Southwest Fisheries Science Center. Report H-87-12, 24 p

Gilmartin, W.G., & Antonelis, G.A. (1998). Recommended recovery actions for the Hawaiian monk seal population at Midway Island. NOAA-TM-NMFS-SWFC-253.

Gilmartin. W.G. (1983). Recovery plan for the Hawaiian monk seal, Monachus schauinslandi. In cooperation with the Hawaiian Monk Seal Recovery

Team. U.S. Department of Commerce. NOAA, NMFS Tech. Rep., 29 p. + tables, appendix.

Global Security (2011a). Maui Space Surveillance Site. Retrieved from http://www.globalsecurity.org/space/systems/msss.htm. Date accessed: 01/2011

Global Security (2011b). Schofield Barracks. Retrieved from http://www.globalsecurity.org/military/facility/schofield-barracks.htm. Date accessed: 01/2011

Global Security (2011c). Bradshaw AAF. Retrieved from http://www.globalsecurity.org/military/facility/bradshaw.htm. Date accessed: 01/2011

Global Security (2011d). Coast Guard Air Station Barbers Point. Retrieved from http://www.globalsecurity.org/military/facility/barbers-point.htm. Date accessed: 01/2011

Global Security (2011e). Kaneohe Bay. Retrieved from http://www.globalsecurity.org/military/facility/kaneohe-bay.htm. Date accessed: 01/2011

Global Security (2011f). Pacific Missile Range Facility. Retrieved from http://www.globalsecurity.org/military/facility/schofield-barracks.htm. Date accessed: 01/2011

Global Security (2011g). U.S. Army Garrison, Hawaii. Retrieved from http://www.globalsecurity.org/military/agency/army/usaghi.htm. Dat e accessed: 01/2011

Global Security (2011h). Dillingham Military Reservation/Dillingham Airfield, April 26, 2005, Retreived from http://www.globalsecurity.org/military/facility/dillingham.htm. Date accessed 3/15/2011

Gobush, K. S. 2010. Shark predation on Hawaiian monk seals: Workshop II & post-workshop developments, November 5-6, 2008. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-21, 43 p. + Appendices.

Gobush, K. S., Mutayoba B., and Wasser S. K. (2008). Long-term impacts of poaching on relatedness, stress physiology and reproductive output of adult female African elephants. *Conservation Biology* 22:1590-1599.

Gobush, K.S., J.D. Baker and F.M.D. Gulland. (In preparation). The effectiveness of an anti-helmintic treatment, injectable Praziquantel, in improving the survival and condition of free-ranging juvenile Hawaiian monk seals.

Goodman-Lowe, G.D. (1998). Diet of the Hawaiian monk seal (*Monachus schauinslandi*) from the Northwestern Hawaiian Islands during 1991-1994. *Marine Biology* 132:535-546.

Government Printing Office, Federal Register. (2010). Notice of Intent: Preparation of the PEIS for Modernization of Training Infrastructure at Pohakuloa Training Area, HI. Washington DC: U.S. Government Printing Office.

Goymann, W., East M. L., Wachter B., Honer O. P., Mostl E., Van't Hof T. J., and Hofer H.(2001). Social, state-dependent and environmental modulation of faecal corticosteroid levels in free-ranging female spotted hyenas. Proceedings of the National Academy of Sciences (London B) 268:2453-2459.

Griffin D. E. and M. B. A. Oldstone (eds) 2009. Measles – Pathogenesis and Control. Springer-Verlag Berlin Heidelberg.

Grigg, R.W. (1983). Community structure, succession and development of coral reefs in Hawaii. *Mar Ecol Prog Ser 11*:1-14.

Grigg, R.W., Polovina J., Friedlander A., & Rohmann, S. (2008). Biology and paleoceanography of the coral reefs in the northwestern Hawaiian Islands. In: Coral reefs of the U.S. (B. Riegl and R. Dodge, eds.). Springer-Vergal Publishing.

Gulland, F. M. D., Haulena M., Lowenstine L. J., Munro C., Graham P. A., Bauman J., and Harvey J. (1999). Adrenal function in wild and rehabilitated Pacific harbor seals (Phoca vitulina richardii) and in seals with phocine herpesvirus-associated adrenal necrosis. Marine Mammal Science 15:810-827.

Harting, A.L. (2002). Stochastic simulation model for the Hawaiian monk seal. PhD thesis, Montana State University, Bozeman, MT

Harting, A.L., Baker, J.D., & Johanos, T.C.. (2007). Reproductive patterns of the Hawaiian monk seal. *Marine Mammal Science* 23:553-573.

Haulena, M. and R.B. Heath (2001). Marine mammal anesthesia. In: CRC Handbook of Marine Mammal Medicine, Second Edition, L.A. Dierauf and F.M.D. Gulland (eds.), CRC Press LLC, Boca Raton. Pp. 655-688.

Hawai`i Institute for Public Affairs. Hawaiian Fisheries Initiative. August 2009. *A Comprehensive Review of Hawai`i's Fisheries Industry*.

Hawai`i Invasive Species Council (HISC) (2008a). About the problem of invasive species. Retrieved from http://www.hawaiiinvasivespecies.org/ on 1/12/2011

HISC (2008b). Hawai`i invasive species council. Retrieved from http://www.hawaiiinvasivespecies.org/hisc/ on 1/12/2011

HISC (2008c). Hawaii's high-profile invasive species. Retrieved from http://www.hawaiiinvasivespecies.org/pests/ on 1/12/2011

HISC (2008d). Algae. Retrieved from http://www.hawaiiinvasivespecies.org/pests/algae.html on 1/12/2011

HISC (2008e). Hull fouling. Retrieved from http://www.hawaiiinvasivespecies.org/pests/hullfouling.html on 1/12/2011

Hawai`i Tourism of Authority (HTA). *Hawai'i Tourism Strategic Plan 2005 – 2015.*

HTA (2009). 2009 Annual Visitor Research Report.

HTA, Department of Business, Economic Development & Tourism-Research and Economic Analysis Division (2010). *November 2010 Visitor Spending Climbed 30.4 Percent.* December 28, 2010 (10-32).

Hawai`i Invasive Species Council (HISC). (2008f). Snowflake coral (carijoa riisei). Retrieved from http://www.hawaiiinvasivespecies.org/pests/snowflakecoral.html on 1/12/2011

Henderson, J.R., & Johanos, T.C. (1988). Effects of tagging on weaned Hawaiian monk seal pups. *Wildl Soc Bull*. 16:312–317.

Hiruki, L.M., & Ragen, T.J. (1992). A compilation of historical Hawaiian monk seal (Monachus schauinslandi) counts. U.S. Dept . Comm., NOAA Tech Memo. NOAA-TM-NMFSSWFSC-172, 183 p.

Hiruki, L.M., Gilmartin, W.G,. Becker, B.L., & Stirling, I. (1993a). Wounding in Hawaiian monk seals (*Monachus schauinslandi*). *Can J Zool* 71:458-468

Hiruki, L.M., Stirling, I., Gilmartin, W.G., Johanos, T.C., & Becker,B.L. (1993b) Significance of wounding to female reproductive success in Hawaiian monk seals (*Monachus schauinslandi*) at Laysan Island. *Can J Zool* 71:469-474

Hunt, K. E., W. T. A., and K. W. S. (2004). Validation of a fecal glucocorticoid assay for Steller sea lions (Eumetopias jubatus). Physiology & Behavior 80:595-601.

International Union for Conservation of Nature. Red List of Threatened Species. April 2010. Website (http://www.iucnredlist.org/apps/redlist/details/13654/0) accessed April 25, 2011.

Iverson, S., Piché J., & Blanchard, W. (2006). Hawaiian monk seals and their prey in the Northwestern Hawaiian Islands: assessing characteristics of prey species fatty acid signatures and consequences for estimating monk seal diets using quantitative fatty acid signature analysis (QFASA). Unpublished Contract Report.

Johanos et al. Quebec abstract. This is a conference abstract I'm having trouble finding. Will follow up on that.

Johanos, T.C., Becker, B.L., Baker, J.D., Ragen, T.J., Gilmartin, W.G., & Gerrodette, T. (2010). Impacts of sex ratio reduction on male aggression in the critically endangered Hawaiian monk seal *Monachus schauinslandi. Endangered Species Research* 11: 123–132.

Johanos, T.C., Becker, B.L., Ragen, T.J. (1994). Annual reproductive cycle of the female Hawaiian monk seal (*Monachus schauinslandi*). *Marine Mammal Science* 10:13-30

Johnson, Hoku. (2011). Policy Coordinator with Papahānaumokuākea Marine National Monument. Personal communication. January 18, 2011.

Johnson, P.A., & Johnson B.W. (1984). Hawaiian monk seal observations on French Frigate Shoals, 1980. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFC-50, 47 p.

Juvik, S.P., & Juvik, J.O. (1998). Atlas of Hawai`i: Third Edition. Hawai`i: University of Hawai`i Press.

Kahihikolo, L.R. (2008). Hawai`i Environmental Justice Initiative Report. Prepared for the State of Hawai`i Environmental Council.

Kazmin, A.S. & Rienecker, M.M. (1996). Variability and frontogenesis in the large-scale oceanic frontal zones. *J. Geophysical Research 101 (C1)*: 907-921.

Keay, J. M., Singh J., Gaunt M. C., and Kaur T. (2006). Fecal glucocorticoids and their metabolites as indicators of stress in various mammalian species: a literature review. Journal of Zoo and Wildlife Medicine 37:234-244. 4.8.1

Keller, K. E., Anders, A.D., Mooney, A., Kosaki, R., Chow, M. & Monaco,M. (2010). A marine biogeographic assessment of the Northwestern Hawaiian Islands to Support the Papahanaumokuakea Marine National Monument. NOAA's National Centers for Coastal Ocean Science, Center for Coastal Monitoring and Assessment.

Kenyon K.W. & Rice D.W. (1959). Life history of the Hawaiian monk seal. *Pac Sci* 13:215-252

Kenyon, K.W. (1972). Man versus the monk seal. *Journal of Mammology* 53:687-696.

Kobayashi, Ken (2010). Judge Rules Against Army. Retrieved from http://www.staradvertiser.com/news/20101028_Judge_rules_against_Army.html. Date accessed: Oct 2010

Leonard, C.L., Bidigare R.R., Seki M.P., & Polovina J.J. (2001). Interannual mesoscale physical and biological variability in the North Pacific Central Gyre. *Progress In Oceanography 49(1-4*): 227-244.

Littnan, C.L., Baker, J.D., Parrish, F.A. & Marshall, G. J. (2004). Evaluation of possible effects of video camera attachment on the foraging behavior of immature Hawaiian monk seals. *Marine Mammal Science* 20:345-352.

Littnan, C.L., Stewart, B.S., Yochem, P.K. & Braun, R. (2006). Survey for selected pathogens and evaluation of disease risk factors for endangered Hawaiian monk seals in the main Hawaiian Islands. *EcoHealth* 3:232-244.

Littnan, Charles, Lead Scientist, Hawaiian Monk Seal Research Program, NOAA Fisheries, Personal communication with Rabia Ahmed and Barbara Wyse on March 1, 2011

Longenecker K. (2010). Fishes in the Hawaiian monk seal diet, based on regurgitate samples collected in the Northwestern Hawaiian Islands. *Marine Mammal Science* 26:1748-7692.

Mantua, N.J., Hare S.R., Zhang Y., Wallace J.M., and Francis, R.C. (1997). A Pacific interdecadal climate oscillation with impacts on salmon production. *Bulletin of the American Meteorological Society* 78: 1069-1079.

Mashburn, K. L., and Atkinson S. (2007). Seasonal and predator influences on adrenal function in adult Steller sea lions: Gender matters. *General and Comparative Endocrinology* 150:246-252.

Meegan, J., W. Collard, G. S. Grover, N. Pussini, B. Van Bonn, F. Gulland. 2010. Ceftiofur pharmacokinetics. Abstract in the International Association for Aquatic Animal Medicine 2010 Proceedings.

Mellish, J., Hennen D., Thomton J., Petrauskas L., Atkinson S., and Calkins D. (2007). Permanent marking in an endangered species: physiological response to hot branding in Steller sea lions (Eumetopias jubatus). Wildlife Research 43, 34-37.

Mitchell, C., Ogura, C., Meadows, D.W., Kane, A., Strommer, L., Fretz, S., Leonard, D. & McClung (2005).A. Hawaii's Comprehensive Wildlife Conservation Strategy. Department of Land and Natural Resources. Honolulu, HI. 722 pp

Monument Management Board (2009). *Boat Operations Diving Activities In Water Work.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Human Hazards To Seabirds Briefing.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Laysan Finch Protocol.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Marine Wildlife Viewing Guidelines.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Precautions for Minimizing Human Impacts on Land Birds.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Reducing Light Impact Sea Turtles.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Monument Management Board (2009). *Small Boat Operations at Tern Island.* Papahānaumokuākea Marine National Monument, Honolulu, HI.

Nakamura, H. & Kazmin, A.S. (2003). Decadal changes in the North Pacific oceanic frontal zones as revealed in ship and satellite observations. *J. Geophysical Research 108 (C3),* 3078.

National Audubon Society (2008). Important Bird Areas in the U.S. Hawaii's Important Bird Areas Program. Retrieved from http://www.audubon.org/bird/iba. Accessed January 2011.

National Environmental Policy Act (NEPA) the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4321 et seq.)

National Marine Fisheries Service (NMFS) and Western Pacific Regional Fisheries Management Council (WPRFMC). (2006). 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.

NMFS (2001) MMPA Small Take Letter of Authorization: U.S. Navy Training in the Hawai`i Range Complex

NMFS (2002). Biological Opinion for the Management of the Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region According to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region.

NMFS (2003). Environmental Assessment on the Effects of NOAA Fisheries Permitted Scientific Research and Enhancement Activities on Endangered Hawaiian monk seals. National Marine Fisheries Service (NMFS), Office of Protected Resources, Silver Spring, MD. 78p.

NMFS (2005a). Biological Opinion on proposed Marine Mammal Permits which would authorize various research activities on Steller sea lions. NOAA Fisheries Office of Protected Resources, Laurie Allen Director.

NMFS (2005b). Pacific Islands Region. U.S. Department of Commerce, National Oceanic and Atmospheric Administration . Draft Programmatic Environmental Impact Statement: Towards an Ecosystem Approach for the Western Pacific Region: From Species-based Fishery Management Plans to Place-based Fishery Ecosystem Plans.

NMFS (2007). Recovery Plan for the Hawaiian Monk Seal (Monachus schauinslandi). Second Revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp.

NMFS (2010). Pacific Islands Fisheries Science Center. 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

NMFS Response Coordinator, Personal communication with Lee Elder on March 17, 2011

National Oceanic and Atmospheric Administration (NOAA), Marine Recreational Information Program. 2011. (http://www.countmyfish.noaa.gov/index.html) website accessed July 27, 2011.

NOAA (1999). NOAA Administrative Order (NAO) 216-6 Environmental Review Procedures for Implementing the National Environmental Policy Act.

NOAA (2002). National Ocean Service, National Marine Sanctuary Program. Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan.

NOAA (2005). Environmental Assessment National Oceanic and Atmospheric Administration's Pacific Islands Fisheries Science Center. Coral Reef Ecosystem Division 2005-2010 activities. (Federal Register Vol. 65, No. 105). Washington, DC: U.S. Government Printing Office

NOAA (2008a). Hawai`i range complex final EIS/OEIS.

NOAA (2008b). Papahanaumokuakea marine national monument management plan environmental assessment volume ii.

NOAA (2009a). Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program: Final Programmatic Environmental Impact Statement. National Oceanic and Atmospheric Administration (National Oceanic and Atmospheric Administration)

NOAA (2009b). Environmental Assessment on Issuance of a Permit for Field Research and Enhancement Activities on the Endangered monk seal. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.

NOAA (2009c). Effects to USFWS species. (NFMS Permit File No. 10137). Washington, DC: U.S. Government Printing Office

NOAA (2009d) Papahānaumokuākea Marine National Monument Permitted Activities Annual Report 2009. p 15-16.

NOAA (2010a). Pacific Islands Fisheries Science Center (Administrative Report H-10-03). Honolulu, Hawaii.

NOAA (2010b). Paphanaumokuakea Marine National Monument. Office of National Marine Sanctuaries. Honolulu, HI.

NOAA (2011). Fisheries Authorizations and Permits for Protected Species (APPS) Website : https://apps.nmfs.National Oceanic and Atmospheric Administration.gov. Date accessed: Jan 2011

National Park Service (NPS) (2010). Project to Repair the Kalaupapa Dock Structures Environmental Assessment. Retrieved from http://parkplanning.nps.gov/document.cfm?parkID=313&projectID=17209&documentID=36787.

NPS (2011). Kalaupapa National Historic Park: Management. Retrieved from http://www.nps.gov/kala/parkmgmt/index.htm.

National Register Bulletin. (1997). "How to Apply the National Register Criteria for Evaluation." Accessed at: www.cr.nps.gov/nr/publications/bulletins/nrb15/Index.htm

National Register of Historic Places (NRHP) (2011a) www.nationalregisterofhistoricplaces.com/hi/Hawai`i/districts.html

National Register of Historic Places (NRHP) (2011b) nomination form--http://pdfhost.focus.nps.gov/docs/NHLS/Text/87001302.pdf

Office of NEPA Policy and Compliance (2004). Recommendations for the preparation of environmental assessments and environmental impact statements. (Department of Energy publication, second edition). Washington, DC: Government Printing Office.

Oki, C., and Atkinson S. (2004). Diurnal patterns of cortisol and thyroid hormones in the Harbor seal (*Phoca vitulina*) during summer and winter seasons. *General and Comparative Endocrinology* 136:289-297.

Ortiz, R. M., and Worthy G. A. J. (2000). Effects of capture on adrenal steroid and vasopressin concentrations in free-ranging bottlenose dolphins (*Tursiops truncatus*). *Comparative Biochemistry and Physiology a-Molecular and Integrative Physiology* 125:317-324.

Papahānaumokuākea Marine National Monument. (2008a). Management Plan, Volume I.

Papahānaumokuākea Marine National Monument. (2008b). Papahanaumokuakea Marine National Monument Management Plan Final Environmental Assessment. National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and Hawai`i Department of Land and Natural Resources. Honolulu, HI.

Papahänaumokuäkea Marine National Monument. (2009). Permitted Activities 2009 Annual Report. p 15-16.

Parrish, F. A., Abernathy, K., Marshall, G. J., & Buhleier, B.M. (2002). Hawaiian monk seals (*Monachus schauinslandi*) foraging in deepwater coral beds. *Marine Mammal Science* 18:244-258.

Parrish, F.A., Craig, M.P., Ragen, T.J. Marshall, G.J., & Buhleier, B.M. (2000) Identifying diurnal foraging habitat of endangered Hawaiian monk seal using a seal-mounted video camera. *Marine Mammal Science 16*:392-412.

Parrish, F.A., Marshall, G.J., Buhleier, B,. Antonelis, GA. (2008). Foraging interaction between monk seals and large predatory fish in the Northwestern Hawaiian Islands *Endangered Species Researc*h 4:299-308.

Parrish, F.A., Marshall, G.J., Littnan, C.L., Heithaus, M., Canja, S., Becker, B., Braun, R., & Antonelis, G.A. (2005) Foraging of juvenile monk seals at French Frigate Shoals, Hawaii. *Mar Mamm Sci* 21: 93–107.

PIBHMC (2009). Pacific Islands Benthic Mapping Center. Retrieved 1/14/2011 from http://www.soest.hawaii.edu/pibhmc/pibhmc_mhi.htm. Date accessed: Jan 2011.

Plumb, D.C. 2008. Veterinary Drug Handbook, Sixth Edition. Blackwell Publishing, Minnesota. 1120p.

Polovina, J.J. & Haight. 1999. Climate variation, ecosystem dynamics, and fisheries management in the NWHI. *Ecosystem Approaches for Fisheries Management.* Alaska Sea Grant College Program AK-SG-99-01.

Polovina, J.J. (2005). Climate variation, regime shifts, and implications for sustainable fisheries. *Bull. Mar. Sci. 76*: 233-244.

Polovina, J.J., Chai, F., Howell, E.A., Kobayashi. D,R., Shi, L, & Chao, Y. (2008a). Ecosystem dynamics at a productivity gradient: A study of the lower trophic dynamics around the northern atolls in the Hawaiian Archipelago. *Progress in Oceanography* 77(2-3): 217-224.

Polovina, J.J., Howell, E., Kobayashi, D.R., & Seki, M.P. (2001). The transition zone chlorophyll front, a dynamic global feature defining migration and forage habitat for marine resources. *Progress in Oceanography 49(1-4):* 469-483.

Polovina, J.J., Howell, E.A., & Abecassis. M. **(2008b)**. Ocean's least productive waters are expanding. *Geophysical Research Letters* 35(3).

Polovina, J.J., Mitchum, G.T., Graham, N.E., Craig, M.P., DeMartini. E.E, & Flint, E.N. (1994) Physical and biological consequences of a climate event in the central North Pacific. *Fish Oceanogr* 3:15-21.

Ragen, T.J. (1999) Human activities affecting the population trends of the Hawaiian monk seal. In: Musick JA (ed) Life in the slow lane: ecology and conservation of long-lived marine animals. *Am Fish Soc Symp* 23:183-194.

Rausch, R. L. (1969). Diphyllobothriid cestodes from the Hawaiian monk seal, *Monachus schauinslandi* Matschie, from Midway Atoll. *J. Fish. Res. Board Can*. 26:947-956.

Reeder, D. M., & Kramer K. M. (2005). Stress in free-ranging mammals: Integrating physiology, ecology, and natural history. *Journal of Mammalogy* 86:225-235.

Regional Economic Information System, Bureau of Economic Analysis (BEA), US Department of Commerce. (April 2010). CA25N Footnotes. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N.

Reif, J.S., Bachand, A., Aguirre, A.A., Borjesson, D.L., Kashinsky, L., Braun, R. & Antonelis, G. (2004). Morphometry, hematology, and serum chemistry in the Hawaiian monk seal (*Monachus schauinslandi*). *Marinine Mammal Science*. 20 (4): 851–860.

Rice, D. W. 1960. Population dynamics of the Hawaiian monk seal. *Journal of Mammology* 41:376-385.

Rignot, E., & Kanagaratnam, P. (2006) Changes in the velocity structure of the Greenland Ice Sheet. *Science* 311:986–990

Rosendahl, P.H. (1994). Aboriginal Hawaiian structural remains and settlement patterns in the upland archeological zone at Lapakahi, Island of Hawaii. *Journal of Hawaiian Archeology* (3): 14 - 70.

Rubin, K. (2009). Air Quality in Hawaii. Retrieved from http://www.soest.hawaii.edu/GG/ASK/hawaii-air.html. Date Accessed Jan 2011

Schmitt, R.C. (1977). Historical Statistics of Hawaii. The University Press of Hawaii.

Schofield, David. Marine Mammal Response Network Coordinator, NOAA Fisheries, Protected Resource Division, Personal communication with Cardno ENTRIX, March 17, 2011.

Schultz J.S., Baker J.D., Toonen R.J., Harting A.L., & Bowen B.W. In press. Range-wide genetic connectivity of the Hawaiian monk seal and implications for translocation. *Conservation Biology*.

Schultz, J.K., Baker, J.D., Toonen, R.J., Bowen, B.W. (2008). Extremely low genetic diversity in the endangered Hawaiian monk seal (*Monachus schauinslandi*). *Journal of Heredity 100:25–33*.

Schultz, J.K., Becker. B.L , Johanos T.C., Lopez J.U., & Kashinsky L. In review. Dizygotic twinning in the Hawaiian monk seal.

Science Daily (2011) *Lost Whaling Shipwreck With Link to Melville's Moby-Dick Discovered in the Northwestern Hawai'ian Islands,* February 14, 2011, www.sciencedaily.com/releases/2011/02/110213212230.htm, accessed 3/1/2011.

Selkoe, K.A., Halpern, B.J., & Toonen, R.J. (2008). Evaluating anthropogenic threats to the Northwestern Hawaiian Islands. *Aquat Conserv 18*:1149–1165

Selkoe, K.A., Halpern, B.S., Ebert, C.M., Franklin, E.C., Selig, E.R., Casey, K.S., Bruno, J., & Toonen, R.J. (2009). A map of human impacts to a ''pristine'' coral reef ecosystem, the Papahānaumokuākea Marine National Monument. *Coral Reefs 28:*635-650.

State Historic Preservation Division (2001) Statewide Historic Preservation Plan for the State of Hawai`i. http://Hawai`i.gov/dlnr/hpd/presplan.htm, accessed 2/17/11.

Stewart B.A., Antonelis, G.A., Baker, J.D., & Yochem, P.Y. (2006). Foraging biogeography of the Hawaiian monk seal in the Northwestern Hawaiian Islands. *Atoll Research Bulletin* 543:131-145.

Stewart, B.S., & Yochem, P.K. (2004a). *Dispersion and foraging of Hawaiian monk seals (*Monachus schauinslandi*) near Lisianski and Midway Islands: 2000-2001*. Pacific Islands Fisheries Science Center Admin. Rep. H-04-04C.

Stewart, B.S., & Yochem, P.K. (2004b). *Use of marine habitats by Hawaiian monk seals (*Monachus schauinslandi*) from Laysan Island: Satellite-linked monitoring in 2001-2002.* Pacific Islands Fisheries Science Center Admin. Rep. H-04-02C.

Stirling, I (1983) The evolution of mating systems in pinnipeds. In: Eisenberg JF, Kleiman DG (eds) *Advances in the study of mammalian behavior*, Spec Pub 7, Am Soc Mammalogists, p 489-527.

Tarlow, E. M., & Blumstein D. T. (2007). Evaluating methods to quantify anthropogenic stressors on wild animals. A*pplied Animal Behaviour Science* 102:429-451.

Trigg, T. E., Doyle A.G., Walsh, J.D., Swangchan-uthai, T. A review of advances in the use of the GnRH agonist deslorelin in control of reproduction. (2006) *Theriogenology;* 66(6), Pages 1507-1512, DOI: 10.1016/j.theriogenology.2006.02.037.

U.S. Air Force (2011). About MHPCC. Retrieved from http://www.mhpcc.hpc.mil/about/about.html. Date accessed: Jan 2011.

U.S. Air Force. About MHPCC, Retrieved from http://www.mhpcc.hpc.mil/about/about.html.

U.S. Army (2001). Integrated Natural Resource Management Plan Oahu Subinstallations 2002 – 2006.Prepared by 25th Infantry Division, U.S. Army Hawai'i, and Center for Environmental Management of Military Lands.

U.S. Army Environmental Command (2008). Supplemental Programmatic Environmental Impact Statement: Army Growth and Force Structure Realignment to Support Operations in the Pacific Theater. Retrieved from http://aec.army.mil/usaec/nepa/usarpacdspeis_july08.pdf.

U.S. Army Environmental Command (2009a) 25th Infantry Division and U.S Army Hawai'i. June 2009. Final Environmental Impact Statement Military Training Activities at Makua Military Reservation, Hawai'i. U.S Army Environmental Command and U.S. Army Corps of Engineers. Retreived from http://www.garrison.hawaii.army.mil/makuaeis/FinalDocs/Makua%20FEIS%20Volume%201%20-%20Cover.pdf

U.S. Army Environmental Command and U.S Army Corps of Engineers (2009b). Record of Decision: Military Training Activities at Makua Military Reservation. Retrieved from http://www.garrison.hawaii.army.mil/makuaeis/final.html. Date accessed: Jan 2011

U.S. Census Bureau (2008). Population Estimates Program

U.S. Census Bureau (2009). Population Estimates Program

U.S. Coast Guard (USCG) & NOAA(2010). Memorandum of Agreement between Fourteenth Coast Guard District and NOAA Fisheries, Pacific Islands Regional Office.

USCG (1997). Commandant Instruction M5090.3: Natural Resource Management, Washington DC.

U.S. Department of Commerce, NOAA (2006). Draft Supplemental Environmental Impact Statement: Bottomfish and Seamouth Groundfish Fisheries of the Western Pacific Region. National Oceanic and Atmospheric Administration National Marine Fisheries Service Pacific Islands Region.

U.S. Department of Defense (USDOD) (2008). Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Washington, DC: U.S. Government Printing Office.

U.S. Department of the Army (2010). Garrison Hawaii/Fact and Figures Retrieved from http://www.garrison.hawaii.army.mil/sites/about/facts.asp. Date accessed Jan 2011.

U.S. Department of the Navy (2000). Rim of the Pacific (RIMPAC) Environmental Assessment, Commander THIRD FLEET, Hawaii, May.

U.S. Department of the Navy (2007). Hawai`i Range Complex: Final Request for Letter of Authorization for the Incidental harassment of Marine Mammals Resulting from Navy Training Operations Conducted with the Hawai`i Range Complex.

U.S. Department of the Navy (2008a). Hawai`i Range Complex final Environmental Impact Statement/Overseas Environmental Impact Statement. Hawai`i Range Complex Pacific Missile Range Facility. Kekaha, Kauai, HI. Retrieved from http://www.govsupport.us/navynepahawaii/FEIS.aspx.

U.S. Department of the Navy (2008b). Record of Decision for Hawai`i Range Complex. Retrieved from http://www.govsupport.us/navynepahawaii/Docs/HRC%20ROD%20-%20final%20-%20signed.pdf.

U.S. Department of the Navy (2010). Joint Base Pearl Harbor-Hickman, Retrieved from http://www.cnic.navy.mil/navycni/groups/public/@hawaii/@phh/documents/document/cnicd_a072164.pdf.

U.S. Department of the Navy (2011). Commander Navy Region Hawaii/About Us, Retrieved from http://www.cnic.navy.mil/HAWAII/AboutUs/index.htm. Date accessed: Jan 2011.

U.S. Department of the Navy (2011a). Duty in this Region. Retrieved from http://www.cnic.navy.mil/HAWAII/AboutUs/DutyinthisRegion/index.htm. Date accessed Jan 2011.

U.S. Department of the Navy (2011b). Welcome to the Pacific Missile Range Facility. Retrieved from http://www.cnic.navy.mil/PMRF/. Date accessed Jan 2011.

U.S. Fish and Wildlife Service (USFWS) (2005). Regional Seabird Conservation Plan, Pacific Region. U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, Pacific Region, Portland, Oregon.

USFWS (2008a). Papahānaumokuākea Marine National Monument Management Plan: Vol. 1. Washington, DC: U.S. Government Printing Office.

USFWS (2008b). Birds of Conservation Concern 2008. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pp.

USFWS (2008c). Short-tailed Albatross Recovery Plan. Anchorage, AK, 105 pp.

USFWS (2008d). Laysan finch (honeycreeper) (Telespiza cantans): 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office. Honolulu, HI.

USFWS (2009a). Invasive species endangered species program. Retrieved from http://www.fws.gov/invasives/endangered-species.html Date accessed: Jan 2011

USFWS (2009b). What are invasive species? Retrieved from http://www.fws.gov/invasives/index.html Date accessed: Jan 2011

USFWS (2009c). Biological Opinion for the Issuance of a Permit to Conduct Field Research on the Hawaiian Monk Seal, Hawai`i and Johnston Atoll. Pacific Islands Fish and Wildlife Office, Honolulu, HI.

USFWS (2010a). Endangered Species Program. Species Reports. Listings and occurrences for Hawaii. Retrieved from http://ecos.fws.gov. Date accessed: Jan 2011.

USFWS (2010b). Short-tailed Albatross Nesting at Midway Atoll National Wildlife Refuge. News Release. December 09, 2010.

USFWS (2010c). Endangered Species. Retrieved from http://www.fws.gov/pacificislands/species.html. Date accessed: Jan 2011

USFWS (2011). Welcome to Hawaiian Islands National Wildlife Refuge. Retrieved from http://www.fws.gov/hawaiianislands/.

U.S. Marine Corps (2006) Marine Corps Base Hawai'i, November 2006, Final Marine Corps Base Hawai`i Integrated Natural Resources Management Plan Update (2007-2011). Prepared by Environmental Compliance & Protection Department and Sustainable Resources Group International. Kaneohe Bay, HI. Retreived from http://www.iiirm.org/hawaiian_consultation/workshop%20materials/inrmp_icrmp/inrmp.htm march 2011

United Nations Educational, Scientifc and Cultural Organization (UNESCO) (2011). World Heritage Committee inscribes new sites on World Heritage List. Retrieved from http://whc.unesco.org/en/news/640.

University of Hawai`i Institutional Animal Care & Use Committee (UH IACUC). (2002). http://www.hawaii.edu/ansc/IACUC/generalinformation.html. Accessed in February 2011

USGS. (1999). The long trail of the hawaiian hotspot. Retrieved from http://pubs.usgs.gov/gip/dynamic/Hawaiian.html. Date accessed: March 2011

Western Pacific Fishery Information Network (WPacFIN). (2010). 1982-2009 Commercial Landings (various data tables and charts). Retrieved from http://www.pifsc.noaa.gov/wpacfin/central/Pages/central_data.php

Western Pacific Regional Fishery Management Council (WPRFMC). (2005). *Fishery ecosystem plan for pacific pelagic fisheries of the western pacific region*.

WPRFMC. (2011). Hawai`i precious corals management unit species. Retrieved from http://wpcouncil.org/hawaii-regulations.html. Date accessed: Jan 2011.

Westlake R.L. & Gilmartin W.G. (1990). Hawaiian monk seal pupping location in the Northwestern Hawaiian Islands. *Pac Sci* 44:366-384.

Wetmore, A. (1925). Bird life among lava rock and coral sand. *The National Geographic Magazine*. 48:77-108.

Whittow, G. C., Balazs, G. H. & Schmidt, G. D.. (1980). Parasitic ulceration of the stomach in a Hawaiian monk seal (*Monachus schauinslandi*). 'Elepaio 39:83-84.

Wilcox, M,K,, Woodward, L,A,, Ylitalo, G,M,, Buzitis, J,, Atkinson S, & Li, Q.X. (2004). Organochlorines in the free-ranging Hawaiian monk seal from French Frigate Shoals, North Pacific Ocean. *Science of the Total Environment* 322: 81-93.

Wingfield, J. C., K. Hunt, C. Brueuner, K. Dunlap, G. S. Fowler, L. Freed, & J. Lepson. (1997). *Environmental stress, field endocrinology, and conservation biology*. Pages 95-131 in J. R. Clemmons, and R. Buchholz, editors. Behavioral Approaches to Conservation in the Wild. Cambridge University Press, Cambridge.

Wirtz, W.O. (1968). Reproduction, growth and development, and juvenile mortality in the Hawaiian Monk Seal. Journal of Mammology. 49:229-238.

Ylitalo, G,M,, Myers, M., Stewart, B.S., Yochem, P.K., Braun, R., Kashinsky, L., Boyd, D., Antonelis, G,A., Atkinson, S., Aguirre, A.A., & Krahn, M.M. (2008). Organochlorine contaminants in endangered Hawaiian monk seals from four subpopulations in the Northwestern Hawaiian Islands. *Marine Pollution Bulletin* 56: 231-244.

Ylitalo, G.M., Stein, J.E., Hom, T.E., Johnson, L.J., Tilbury, K,L,, Hall ,A.J., Rowles, T., Greig, D., Lowenstine, L.J., Gulland, F., (2005). The role of organochlorines in cancer-associated mortality in California sea lions (*Zalophus californianus*). *Marine Pollution Bulletin* 50, 30–39.

Yochem, P.K., Braun, R.C., Ryon, B., Baker, J.D. & Antonelis, G.A. (2004). Contingency plan for Hawaiian monk seal. Unusual mortality events. NOAA-TM-NMFS-PIFSC-2, 27. pp.

9.0 INDEX

A

B

C

D

E

F

G

H

I

O

P

R

This page intentionally left blank.