Programmatic Environmental Assessment

Marine Turtle Research Program (MTRP)

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Pacific Islands Fisheries Science Center

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Summary

This Programmatic Environmental Assessment (PEA) was prepared in accordance with National Environmental Policy Act of 1969 (42 U.S.C. §4321, *et seq*.), as implemented by the Council of Environmental Quality regulations (40 C.F.R. §1500-1508); and NOAA Administrative Order Series (NAO) 216-6, *Environmental Review Procedures for Implementing the National Environmental Policy Act*, of May 20, 1999.

The green, hawksbill, loggerhead, leatherback, and olive ridley sea turtles are all listed under section 4(c) of the Endangered Species Act of 1972 (16 U.S.C. §1531, *et seq*.). Under the Proposed Action, the Marine Turtle Research Program (MTRP) proposes to continue its long-standing research activities with the addition (i.e., expansion) of new studies on the site fidelity of marine turtles to foraging grounds. The research activities include collecting biological and ecological data on marine turtle stocks in the Hawaiian Archipelago, providing technical assistance to and collaborating with marine turtle researchers across the Pacific Islands Region, and contributing to the scientific literature through publications relevant to the recovery of these stocks. The MTRP also includes responding to and aiding stranded turtles. The potential impacts on the human environment of the Proposed Action, and a range of reasonable alternatives, are discussed and analyzed in this PEA.

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Acronym	Full description
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNMI	Commonwealth of the Northern Mariana Islands
DAR	State of Hawaii, Division of Aquatic Resources
DLNR	State of Hawaii, Department of Land and Natural Resources
DOI	Department of the Interior
DPS	Distinct Population Segment
EA	Environmental Assessment
EOD	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FBSAD	Fisheries Biology and Stock Assessment Division of PIFSC
FFS	French Frigate Shoals
FONSI	Finding of No Significant Impact
FP	Fibropapillomatosis disease
GPS	Global Positioning System
IACUC	Institutional Animal Care and Use Committee
IUCN	International Union for Conservation of Nature and Natural Resources
KRF	Kewalo Research Facility
MHI	Main Hawaiian Islands
MPA	Marine Protected Area
MTAP	Marine Turtle Assessment Program of PSD/PIFSC
MTRP	Marine Turtle Research Program of PSD/PIFSC
NEPA	National Environmental Policy Act of 1969
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOC	National Ocean Council
NPS	United States National Park Service
NRC	National Research Council
NWHI	Northwestern Hawaiian Islands
PEA	Programmatic Environmental Assessment
PIFSC	NMFS Pacific Islands Fisheries Science Center
PIR	Pacific Islands Region
PIRO	NMFS Pacific Islands Regional Office
PIT	Passive Integrated Transponder
PMNM	Papahānaumokuākea Marine National Monument
PSD	Protected Species Division of PIFSC
RIA	Radioimmunoassay
RPM	Responsible Program Manager
SPREP	South Pacific Regional Environmental Program
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1 Purpose of and Need for Action

1.1 Status of Sea Turtles in the Pacific

Green, hawksbill, loggerhead, leatherback, and olive ridley sea turtles are protected throughout United States waters under the Endangered Species Act of 1972 (ESA). In the central and western Pacific, this includes: Hawaii, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), American Samoa, Howland Island, Baker Island, Wake Island, Jarvis Island, Midway Atoll, Johnston Atoll, Palmyra Atoll, and Kingman Reef (NMFS and USFWS 1998a, 1998b, 1998c, 1998d, 1998e). Inclusion of these species into the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has made it illegal to trade any products made from these species among the U.S. and 169 other countries. Recovery plans for all U.S. Pacific populations of sea turtles were finalized in 1998 and serve as guidance in actions to recover these stocks.

The green turtle (*Chelonia mydas*) is listed as threatened under the ESA throughout its Pacific Range, except for the endangered population nesting on the Pacific coast of Mexico. The green turtle in Hawaii is a genetically distinct stock. Analysis of mitochondrial DNA demonstrates the genetic discontinuity of the Hawaii population from other green turtle populations in the Pacific (Bowen et al. 1992, Balazs and Chaloupka 2004b, Dutton et al. 2008). Furthermore, protection and management of the Hawaiian stock are not complicated by international migrations because this stock forages and nests within the United States. Foraging grounds are primarily located in the waters surrounding the Main Hawaiian Islands (MHI), whereas nesting primarily occurs on sandy beaches 500 miles to the northwest of Honolulu in the Northwestern Hawaiian Islands (NWHI), with 90% of all nesting occurring at French Frigate Shoals (FFS) (Figure 1) (Balazs 1976). The Hawaiian green turtle stock is demonstrating encouraging signs of population recovery after years of protective efforts as indicated by a steady long-term increase in the number of nesting females in the NWHI as well as increases in the number of immature green turtles residing in foraging pastures of the MHI (Balazs 1996, Balazs and Chaloupka 2004a, Balazs and Chaloupka 2006, Chaloupka and Balazs 2007, Chaloupka et al. 2008a). However, outside of Hawaii, green turtle populations have seriously declined throughout most of the Pacific. The harvest of green turtles by humans for meat and eggs is the most serious threat. Other threats include habitat loss, incidental capture in commercial and recreational fishing gear, boat collisions, shark attack, and the tumor disease fibropapillomatosis (FP) (NMFS and USFWS 1998a, Chaloupka et al. 2008b).

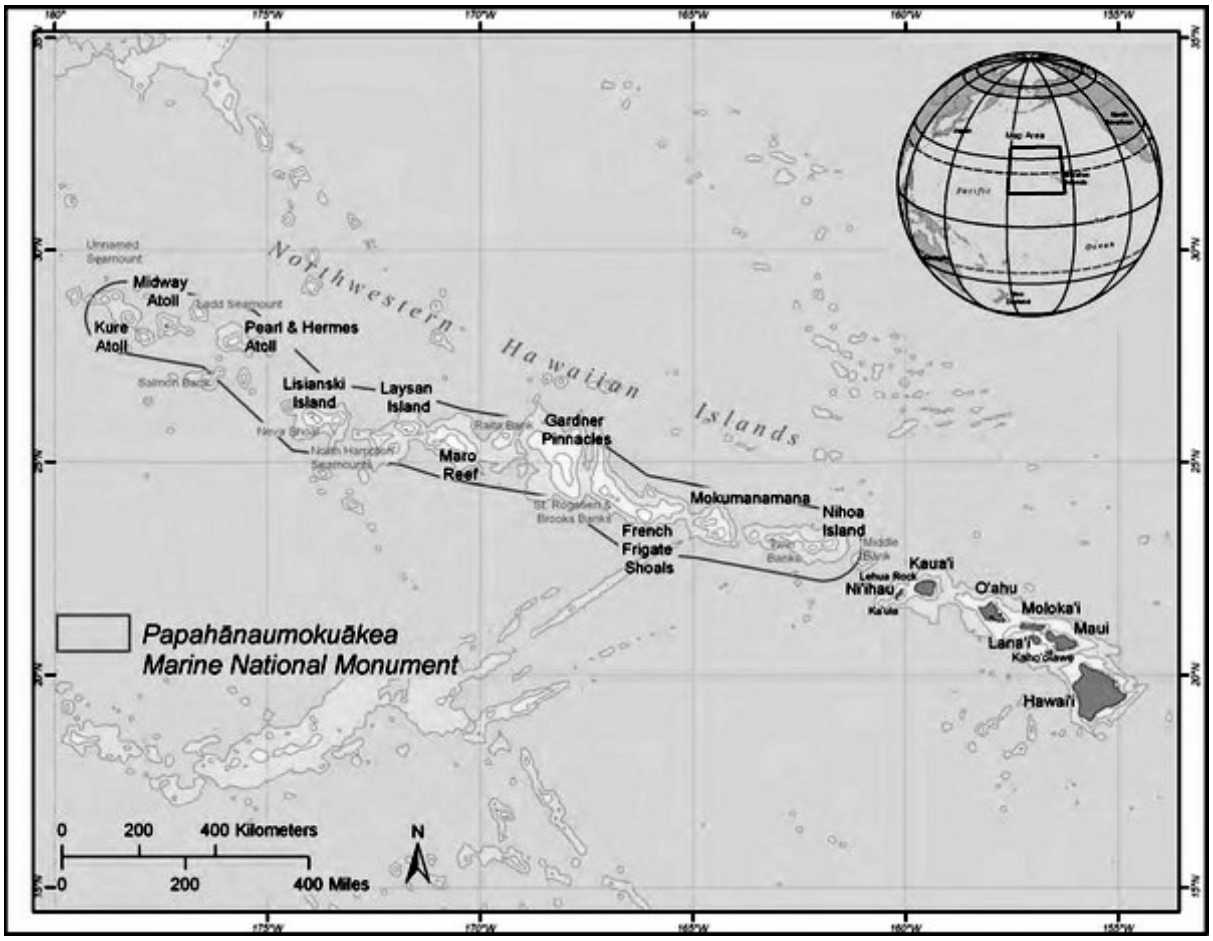

Figure 1. The Hawaiian Archipelago, showing the Northwestern Hawaiian Islands, Main Hawaiian Islands, and boundaries of the Papahanaumokuakea Marine National Monument (from noaa.gov).

The hawksbill turtle (*Eretmochelys imbricata)* is listed as endangered throughout its range. Hawksbill populations have declined dramatically in the Pacific, and the species is rapidly approaching extinction because of a number of factors. The intentional harvest of this species for meat, eggs, and tortoiseshell and the illegal international trade of items made from this species are the greatest threats to its survival. Other threats to the continued existence of this species include beach erosion, coastal construction, habitat loss, capture in fishing nets, and boat collisions (NMFS and USFWS 1998b). Hawksbill turtles nest in small numbers in the MHI (i.e., Hawaii, Maui, and Molokai) and migrate through, rest, and forage in the near-shore waters (Parker et al. 2009). Immature and mature hawksbills occasionally strand in the MHI and are documented through the MTRPs stranding research program. This population has not demonstrated signs of recovery despite years of protective efforts (G. Balazs, pers. comm. May 2006).

The loggerhead turtle (*Caretta caretta*) is listed as a threatened species throughout its range. In 2010, NMFS and USFWS proposed to reclassify loggerheads in the North Pacific as a distinct population segment (DPS) with an endangered status (75 FR 12598). Loggerheads in the North Pacific are derived

primarily from nesting beaches in Japan (Bowen et al. 1995, Kamezaki et al. 2003); whereas, loggerheads in the South Pacific are derived primarily from nesting beaches in eastern Australia and New Caledonia (Limpus and Limpus 2003, Boyle et al. 2009). These stocks are threatened primarily by incidental capture in commercial fishing gear (i.e., longline gear and nets) and loss or degradation of nesting habitat (NMFS and USFWS 1998d, Polovina et al. 2000, 2003, 2004, 2006, Peckham et al. 2007, Howell et al. 2008, Howell et al. 2010, Kobayashi et al. 2008, Chaloupka et al. 2008c).

The leatherback turtle (*Dermochelys coriacea*) is listed as endangered throughout its range. Leatherback populations in the Pacific are in severe decline and, in some cases, on the verge of extinction. The decline is primarily attributed to incidental take in coastal and high seas fisheries, the killing of nesting females by humans for meat, and the collecting of eggs at nesting beaches. Leatherbacks encountered in Hawaii represent individuals in transit between nesting beaches and foraging grounds. Some of the largest nesting populations of leatherback turtles in the world border the Pacific Ocean, but no nesting occurs on beaches under U.S. jurisdiction (NMFS and USFWS 1998c).

The olive ridley turtle (*Lepidochelys olivacea*) is listed as threatened in the Pacific, except for the Mexican nesting population, which is classified as endangered. The olive ridley is widely regarded as the most abundant sea turtle in the world; however, it is rare in the central Pacific because there are no nesting beaches in the Pacific Islands. Occasionally, a wayward female is found nesting in the Hawaiian Islands, most recently in 2009 on the Island of Oahu. Individuals also occasionally strand in the MHI and are incidentally captured in the Hawaii-based deep-set longline fishery more frequently than the other species. The primary threats to this species throughout the Pacific are incidental take in fisheries and harvest of eggs and adults on Mexican and Central American nesting beaches (NMFS and USFWS 1998e).

1.2 Background of the Marine Turtle Research Program (MTRP)

The MTRP began at the University of Hawaii, Hawaii Institute of Marine Biology in 1972. In 1981, NMFS took over management of the program and expanded the research on the Hawaiian population of green sea turtles through creation of the MTRP at its Honolulu Laboratory (now the Pacific Islands Fisheries Science Center, PIFSC). Since then, the MTRP has further expanded its research to include hawksbill sea turtles which nest and forage in the MHI, as well as olive ridley, loggerhead, and leatherback sea turtles which are incidentally captured in commercial fisheries but are rarely seen in the MHI. The MTRP also collaborates with the Marine Turtle Assessment Program (MTAP), which is also located at PIFSC. The MTAP uses data collected by the MTRP to develop sea turtle population assessments.

While the MTRP serves as the primary data collection and analysis entity of sea turtles in the region at NMFS, the management duties (e.g., writing Biological Opinions) are the responsibility of the NMFS, Regulatory Program, Pacific Islands Regional Office (PIRO). PIRO and the U.S. Fish and Wildlife Service (USFWS) share responsibility for the conservation and recovery of sea turtles pursuant to ESA mandates in the Pacific Islands Region. The Pacific Islands Region includes the Hawaiian Archipelago and the U.S. Insular Areas of the Pacific Ocean (Figure 2). NMFS has the lead responsibility for the conservation and recovery of sea turtles in the marine environment and USFWS has the lead for the conservation and recovery of sea turtles on nesting beaches.

The field research activities of the MTRP are focused on: (1) nesting surveys; (2) foraging and resting habitat surveys; and (3) stranding response and research. These research activities occur in both the NWHI and MHI. Additionally, the MTRP collaborates with researchers worldwide, focusing efforts on the nations in and around the Pacific Islands Region and serves as a model for other sea turtle research programs. With nearly 40 years of continuous data collection, the MTRP provides technical insight, logistical advice, and shares its experiences with other U.S. and international sea turtle research programs.

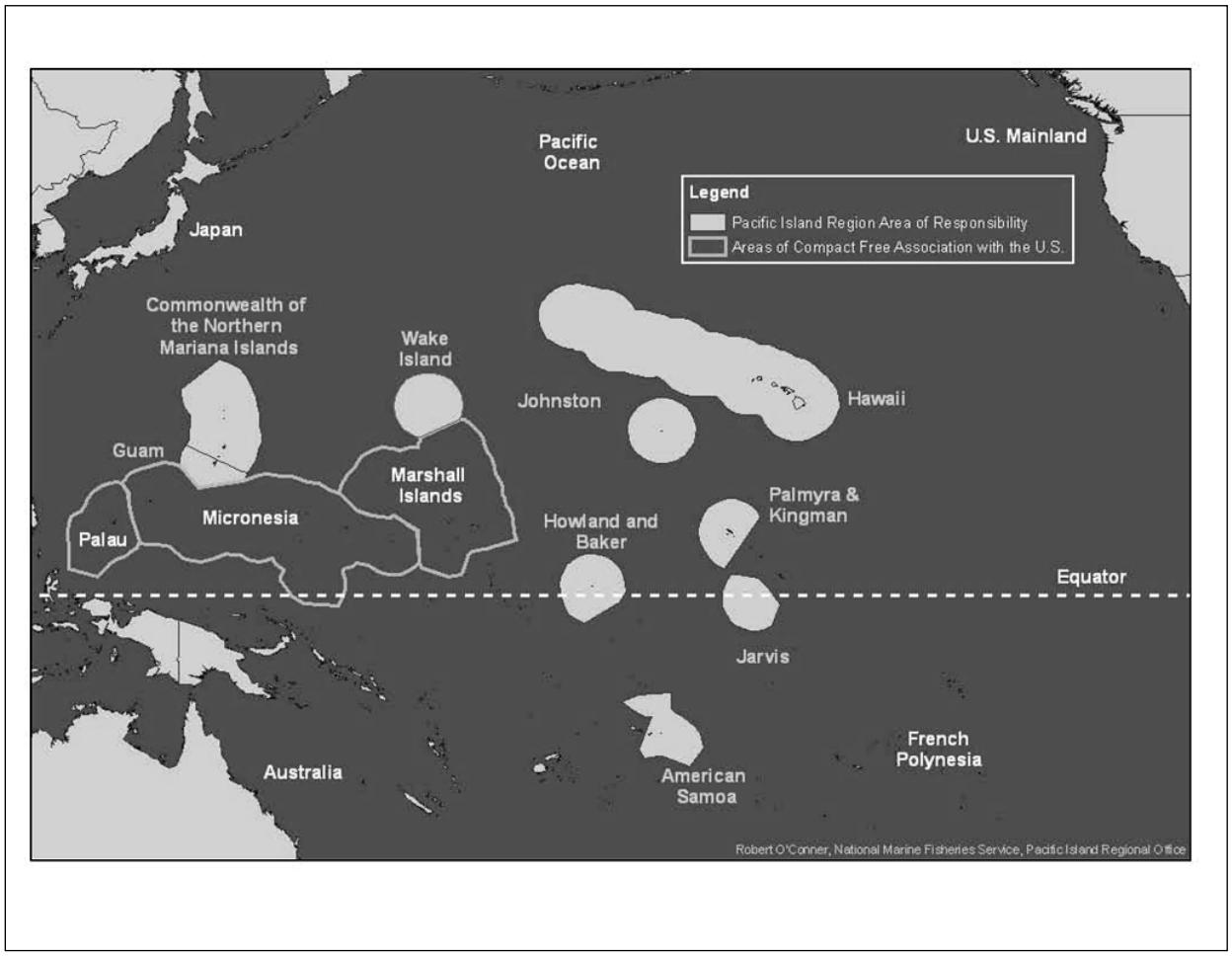

Figure 2. The Pacific Islands Region, showing the Hawaiian Archipelago and U.S. Insular Areas (with the Exclusive Economic Zone shaded around each) (from noaa.gov).

1.2.1 Nesting Surveys to Assess Abundance, Trends, Survival, and Threats

Nesting surveys are the most common method used to monitor marine turtle populations. Appropriately designed nesting beach surveys can provide information on the size of the adult female population, hatchling production, and inter-annual variability in production (Schroeder and Murphy 1999). Threats to these life-stages (i.e., nesting females and hatchlings) can be quantified such as: (1)

nest destruction from predation, inundation, and other females attempting to nest; (2) habitat loss from beach erosion and sea level rise; and (3) hatchling predation on land and in the water.

Nesting surveys have been conducted on East Island at FFS (Figure 3) for 38 consecutive years and provide an index of abundance for the Hawaiian green turtle stock. Trained biological technicians conduct annual nesting surveys at East Island. New turtles are tagged, measured, and sampled (i.e., tissue for genetic analysis and health, including FP tumors), and tags of previously tagged turtles are recorded. Satellite tags, or time-depth recorders, or both are deployed on nesting green turtles to determine habitat use, migration routes between breeding and foraging grounds (Balazs and Ellis 2000), daily and seasonal use of foraging and resting habitat, and localized movements of breeding males and gravid females between nesting and breeding sites and associated basking sites. Temperature data loggers are deployed in the substrate of East Island to provide data relevant to temperature-dependent sex determination and sex ratios of green turtle hatchlings.

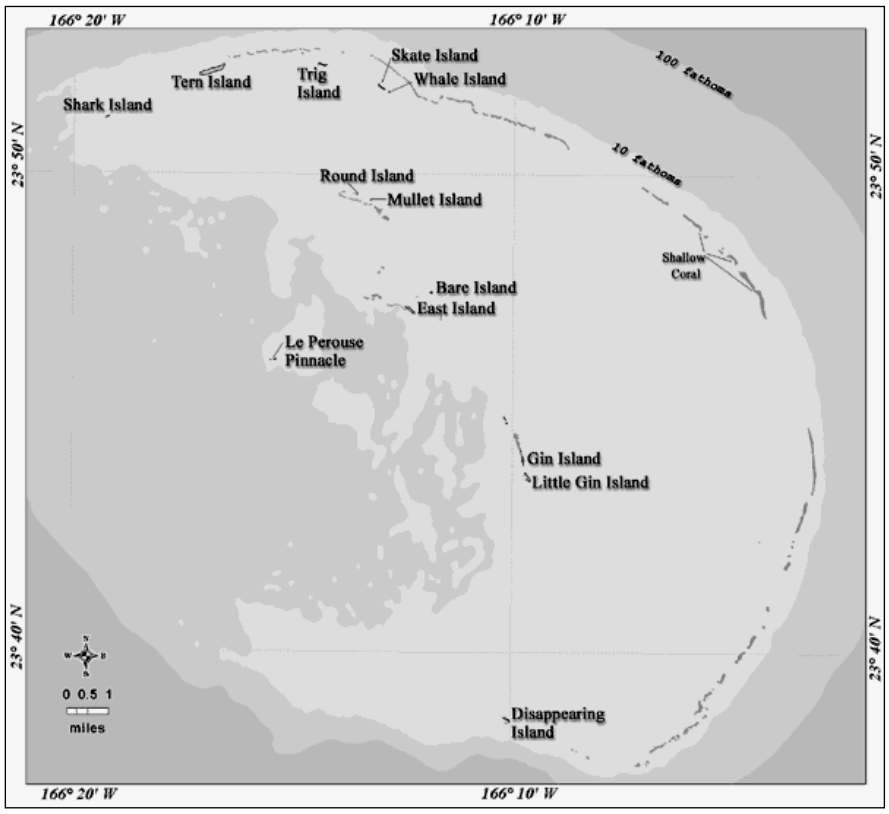

Figure 3. Map of French Frigate Shoals (from noaa.gov).

1.2.2 Foraging and Resting Surveys to Assess Abundance, Trends, Survival, and Growth

Although studying sea turtles in the water is difficult, research directed towards sea turtles on foraging and aquatic resting grounds can provide a wealth of information on the abundance, trends, survival, and growth rates of juvenile and adult turtles. Well-designed monitoring studies include capture and tagging work to provide information on individuals, habitat use, growth, diet, health and disease, survival, and

residency. A primary goal of foraging ground research is to integrate data from genetic analysis, flipper tagging, and satellite telemetry to identify nesting beach origins of turtles occurring in the Hawaiian Archipelago and contribute to the overall understanding of sea turtle stock structure in the Pacific Ocean.

Turtles are captured in shallow coastal and reef waters for these studies using various methods, including: hand net, scoop net, hand capture while snorkeling, hand capture while diving from a slowly moving boat, entanglement net capture, and bullpen net capture (Balazs et al. 1987, Balazs et al. 1998). All of these methods have been successfully and safely employed to study and tag green turtles in coastal waters of the Hawaiian Islands. Turtles are released at or very close to the capture site shortly after they have been processed.

1.2.3 Stranding Response and Research

The stranding response and research program of the MTRP has responded to sick, injured, or dead marine turtles in the Hawaiian Archipelago since 1982. Necropsies of stranded turtles provide information on species distribution, stock structure, sex ratio, health and disease, diet, age and growth, and cause of mortality and have been the source of data for numerous scientific publications (Work and Balazs 2002, Work et al. 2004, Work et al. 2005, Zug et al. 2002, Chaloupka et al. 2008b, Van Houtan et al. 2010).

1.3 Purpose of the Proposed Action

The purpose of the MTRP is to collect biological and ecological data on marine turtle stocks in the Hawaiian Archipelago, facilitate the collection of biological data on marine turtles in the Pacific Islands Region, and contribute scientific input relevant to the recovery of these stocks. The objectives of the program are:

1. Continue to conduct original research, in cooperation and coordination with peers in the United States and countries in and around the Pacific Islands Region, of the biology, life history, and ecology of sea turtles in their benthic habitats and on nesting beaches.

2. Continue to monitor population trends at nesting beaches and in foraging areas and identify new areas to monitor as appropriate, while continuing to explore the use of remote viewing digital imaging cameras and other experimental equipment for research and monitoring.

3. Continue to conduct a sea turtle stranding and salvage network for research, rescue, rehabilitation, and return to the wild, involving the collection of long-term data sets.

4. Continue to conduct health assessments, with focus on FP disease complex, to determine causes, evaluate impacts to individuals and populations, and develop and implement containment measures.

5. Continue to conduct education and outreach by training of NMFS and international observer personnel in research protocols on sea turtles captured incidental to Pacific Ocean fisheries as

part of their duties aboard commercial longline fishing vessels as well as continuing to train research personnel from within and around the Pacific Islands Region in sea turtle research techniques, and continue to share data, analyses, experience, and information to increase international research capacity.

6. Continue to conduct fishery bycatch reduction and mitigation research through international collaboration, leading to increased knowledge of the pelagic ecology and movements of sea turtles in the Pacific Ocean.

7. Continue long term monitoring and modeling by the process of data storage, management, and retrieval of long-term datasets collected from stranded individuals and during research conducted on nesting beaches and nearshore sea turtle benthic habitats. Continue the development and application of simulation modeling of sea turtle population dynamics using MTRP long-term datasets for the assessment of the status of the various stocks of sea turtles with emphasis on the green turtle in Hawaii.

11. Continue public outreach and scientific publishing by conducting educational outreach to the public, focused on sea turtle research projects and results, and using captive sea turtles when appropriate, to build public support for sea turtle research, and continue to publish research findings in a timely manner in peer-reviewed journals to increase the knowledge base of sea turtle biology and population dynamics worldwide.

1.4 Need for the Proposed Action

Research suggests that marine turtle populations today are less than ten percent of their historical numbers (Lotze et al. 2006). The systematic human exploitation of sea turtles for eggs, meat, and shells is considered a major factor in their decline (McClenachan et al 2006). These threats continue today, with the added impacts from incidental commercial fisheries capture, beach development, and climate change. The effect of changes in climatic variables (e.g., sea surface temperature, nest temperature, ocean productivity) on sea turtle abundance and distribution is the least understood yet may be the dominant long-term threat worldwide (Van Houtan 2010). More detailed research on all of these population influences is therefore essential to ensure the continued existence of marine turtles in the world's oceans.

1.4.1 Natural Impediments to Recovery

Habitat Loss

The principal nesting beaches for this stock are low-lying, small, sand islets located several hundred miles from the developed Hawaiian Islands. Most of the land at the primary nesting grounds of FFS is less than 2 m above sea level. Substantial loss of habitat has already occurred at FFS from 1963 – 2004 (Antonelis et al. 2006) and projected loss of habitat due to sea level rise for East Island is between 3% and 33% for a rise in sea level of +9 to +88 cm, whereas land loss at some of the other islets at FFS (Trig, Gin, and Little Gin) may be as great as 99%. East Island is the primary nesting site for Hawaiian green turtles and has the potential to host a substantially larger nesting population (Tiwari et al. 2010).

However, habitat loss of entire islands due to sea level rise may impose the greatest risk to the continued existence of this population. Laysan and Lisianski Islands may provide refuge for nesting turtles because their elevation is higher (Baker et al. 2006) provided other environmental variables (i.e., sand temperature and ocean currents) are conducive to the survival of hatchlings.

Reproduction

Changes in climate affect animals, such as sea turtles, whose reproductive success is determined by environmental factors. The sex of hatchling sea turtles is determined by nest temperatures. Increasing beach temperatures may lead to skewed sex ratios and ultimately a female biased population. Additionally, if beach sand temperatures increase considerably, the overall success of each nest may decrease due to embryonic mortality at high temperatures. Changes in sea surface temperatures may also change the timing of breeding and nesting (Van Houtan 2010).

Food availability

Competition for herbivorous food resources among green turtles may lead to reduced growth rates and increased time to maturity. This population exhibits slow and declining rates of growth at several sites in the MHI (Balazs and Chaloupka 2004b). As this population continues to recover, competition for resources will increase, not only between turtles but also between herbivorous fishes, and other reef creatures (Wabnitz et al. 2010). Green turtles are extremely resilient in harsh conditions (as are many reptilian species), so the overall impact of reduced food resources may not ultimately lead to death, however it may lead to even slower growth rates and greater age to maturity which could impact the recovery rate of the population.

Predation

Green turtles are preyed upon by sharks, finfish, and presumably sea birds in the marine environment. It is anticipated that the protected status of the NWHI and the resulting elimination of fishing pressures will provide all species and stocks the time and space to recover to higher population levels. This in turn may lead to higher predation rates of hatchlings by finfishes off the nesting beaches and higher rates of interactions between sharks and adult turtles in the inter-nesting habitat resulting in injury and potentially death.

Disease

The tumor disease, FP, which is caused by a herpes virus, is an ongoing threat to green turtles in the Hawaiian Archipelago. It has been estimated that FP causes approximately 28 percent of the injuries and mortalities to green turtles in Hawaii (Chaloupka et al. 2009). While some individuals may contract the disease and eventually overcome it, many others are plagued with large tumors that interfere with their ability to see and forage, and eventually lead to death. At some sites in the MHI, the disease has declined in both severity and prevalence (Chaloupka et al. 2009). At other sites, such as around the island of Maui, the disease still affects a large proportion of the population, but the overall trend is decreasing (Van Houtan et al. 2010).

1.4.2 Anthropogenic Impediments to Recovery

Commercial harvest

The Hawaiian green sea turtle population was listed in 1978 as a threatened species under the ESA. This listing was primarily because the stock had been over-harvested from the early nineteenth century up until 1978. Green sea turtles were killed by the thousands for their meat, skins, calipee (i.e., cartilage), eggs, and shells. Currently, the commercial harvest of all sea turtles in the United States is illegal. Even though the Hawaiian green sea turtle population is increasing, it has been demonstrated that they are vulnerable to exploitation because the population is relatively small and individuals are particularly slow growing, taking 35 years or more to reach maturity.

Fishing Interactions

The incidental capture of green turtles in commercial and recreational fishing gear is a continuing concern. The interaction between green turtles and recreational fishing gear is the second most common cause of strandings in the MHI (7%). Discarded monofilament fishing line, fishing hooks, and gillnets pose serious threats to green turtles including injury, flipper amputation, and death. The cause of approximately half of all strandings is undetermined. Because drowning is difficult to determine (Work and Balazs 2010), it is possible that fishing gear interactions are responsible for a greater percentage of sea turtle fatalities than we currently believe (Chaloupka et al. 2009). The current regulations restricting gillnet fishing in the MHI should reduce the number of turtles incidentally caught and killed in gillnets.

Marine Debris

The entanglement in and ingestion of marine debris is a potential threat to this population. Such debris includes discarded or abandoned fishing gear such as nets and lines as well as plastics such as bags, 6-pack rings, tar balls, Styrofoam, and other refuse that might ensnare or be consumed by a green turtle. Entanglement in discarded nets and lines, as well as ingestion of plastics and other discarded debris may lead to injury or death.

Habitat Degradation

Green turtles depend upon algae, sea grass, and coral reef habitats for food and refuge. The degradation of these habitats poses a serious threat to the recovery of sea turtle stocks. Degradation of these habitats occurs through pollution, over-fishing, disease, anchoring, climate change, and other anthropogenic factors (Jackson et al. 2001, Rogers and Garrison 2001, Orth et al. 2006).

1.4.3 National Research Council Assessment

In 2010, the National Research Council (NRC), Committee on the Review of Sea Turtle Population Assessment Methods, published a report entitled *Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance*. The report addressed programs from across the nation and found that current monitoring generally does not provide enough information on sea turtle populations to evaluate the effectiveness of protective measures and additional data are needed for stock

assessments. A thorough population assessment needs to include a description and evaluation of change over time and space in the following areas:

- population structure (e.g., species, subspecies, distinct population segments)
- population lifecycle and demography (e.g., life stages, rates of survival, reproduction)
- population abundance and trends (e.g., evaluation and extrapolation of population indices)
- population ecology and behavior (e.g., habitat, distribution and movements, predators and prey, disease, parasites, contaminants)
- population size (e.g., numbers of individuals, age structure, sex ratio)
- current and projected threats (e.g., human-caused injury or mortality, habitat destruction, climate change)
- sources of variability (e.g., genetic, demographic, environmental, catastrophic).

To be useful in decision making, an assessment requires more than simple description of trends; the large and diffuse nature of sea turtle populations make extrapolation of trends over time, space, and generations difficult at best and potentially misleading. Observed and potential changes in sea turtle populations through time need to be assessed with age-structured models to determine population-wide status accurately and to diagnose causes of population change. As described in the Proposed Action, the MTRP has been collecting these types of data for the last 38 years and proposes to continue collecting these types of data in addition to additional population ecology and behavior data in order to contribute to a thorough population assessment of sea turtles in the Pacific Islands Region (National Research Council, 2010).

1.5 Geographic Scope of Analysis

The geographical scope of MTRP activities includes field research in the Hawaiian Archipelago, and cooperative research, technical assistance, and capacity building in the rest of the Pacific Islands Region. The islands, reefs, and atolls that are located within in the Pacific Islands Region, but outside of the Hawaiian Archipelago, are also referred to as the U.S. Insular Areas of the Pacific Ocean (U.S. GAO 1997). Of these Insular Areas, the United States has sovereignty over Guam (an organized unincorporated territory), American Samoa (an unorganized unincorporated territory), and the Commonwealth of the Northern Mariana Islands (CNMI) (a commonwealth in political union with the United States). Meanwhile, Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Atoll, and Wake Island are unincorporated and unorganized territories of the United States. Palmyra Atoll is an unorganized incorporated territory of the United States, meaning that it is subject to all provisions of the U.S. Constitution (U.S. GAO 1997).

This large geographical area roughly encompasses the range of the five sea turtle species being studied. The MTRP focuses on green turtle stocks because over 97% of the sea turtles encountered within the Hawaiian Archipelago are of that species. However, hawksbill sea turtles are also included, as this species is present within Hawaiian Archipelago and may be caught incidental to coastal fishing activities.

Loggerhead, leatherback, and olive ridley sea turtles are found rarely in the Hawaiian Archipelago because this area is generally outside their natural range. However, data have been and will continue to be collected from any individuals of these species encountered in the Hawaiian Archipelago during all activities of the MTRP.

The MTRP includes coordination and collaboration with and assistance to other sea turtle researchers in and around the Pacific Islands Region. Coordination, collaboration, or assistance may take the form of data collection (including technical instruction of research techniques), financial support, or both. These coordinated research efforts would be conducted in a manner consistent with the Proposed Action. If future research projects are not consistent with the type or scope of activities analyzed in this document, then they will need to conduct an additional separate NEPA analysis. A listing of the persons and agencies who have been involved with the MTRP is included in Section 6. Future coordination and collaboration may include other individuals from these agencies, institutions, and non-governmental organizations, or different but related organizations.

1.5.1 Relevant Resource Issues within the Geographic Scope of Analysis

The Hawaiian Archipelago provides habitat for the five federally threatened and endangered sea turtle species discussed in Section 1.1. It also provides habitat for the federally endangered Hawaiian monk seal (HMS). The HMS uses the same islands and atolls in Northwestern Hawaiian Islands as green sea turtles. The Northwestern Hawaiian Islands have been designated as critical habitat for HMS. Because the green sea turtle nesting season overlaps with the HMS weaning season, the potential interactions of the proposed action and HMS will be included in the environmental impacts section. Unlike the green sea turtle, the HMS monk seal forages primarily around the Northwestern Hawaiian Islands and few HMS (by recent estimates less than ten percent of the entire population) are found on the Main Hawaiian Islands. Therefore the potential for adverse impacts to HMS from the resting and foraging research, and stranding response and research program in the MHI has been considered, found to be negligible, and will not be considered in detail.

Along with HMS, the Hawaiian Archipelago is habitat for a large and diverse community of 22 seabird species. Each year millions of seabirds breed, nest, and forage in the NWHI. The proposed action will include data collection, field camping, and stranding response near these seabird colonies. Therefore, these impacts will be discussed in detail.

Within the geographic scope of analysis are several federally designated marine national monuments. The NWHI were designated as the Papahanaumokuakea Marine National Monument (PMNM) on June 15, 2006 by President George W. Bush in Presidential Proclamation 8031. Given the field work and data collection activities in the PMNM, specifically at FFS, the potential impacts of the proposed action on the marine resources of PMNM will be discussed in detail. Since creation of the PMNM the MTRP has conducted its research in accordance with the PMNM Management Plan and received permits for the Co-Trustees to conduct its research in the PMNM. The proposed research will continue to provide the data necessary for managers to further the restoration and remediation of the resources within the PMNM.

On January 6, 2009, the President Proclaimed three additional Maine National Monument in the Pacific Islands Region. Given that no field work is proposed in the Pacific Remote Islands Marine National Monument, the Marianas Trench Marine National Monument, or the Rose Atoll Marine National Monument potential impacts to these protected areas has been considered, was found to be negligible, and will not be discussed in detail.

Green sea turtles also have an important cultural relationship with Pacific Islanders. Known as honu in Hawaiian, green sea turtles are part of regional traditions, chanted in stories, and found in ancient petroglphys. Historically, green sea turtles also provided meat and eggs for food, and shell and bone for tools and weapons. Given the important role of sea turtles to the cultures and traditions of the Pacific Islands Region, the MTRP has worked with local communities to help in achieving the goal of recovery for all of the sea turtle species in the region. The proposed action includes a number of measures to avoid and minimize adverse affects to sea turtles and these are discussed in detail.

Given that the proposed action does not include constructing any permanent infrastructure, discharges of fill material, dredging, or using any hazardous materials that could be released into the environment, it has been determined that the potential impacts to water quality, noise, aesthetics, traffic, public access to the coastline, vegetation, air quality, are negligible. Therefore, impacts to these resources have been considered, but will not be discussed in detail.

On February 18, 2010, the Council on Environmental Quality released draft NEPA guidance on the consideration of the effects of climate change and greenhouse gas emissions. The direct and indirect impacts of a changing global climate (e.g., warmer nest temperatures and rising sea levels) on sea turtles have been discussed in section 1.4. The scientific research surveys and activities being proposed would not directly generate greenhouse gases, but the automobile and ship travel necessary to reach the research sites and implement the stranding response would consume a small amount of petroleum products annually and produce a negligible amount of greenhouse gases. These emissions would not be reasonably anticipated to even approach causing the direct emissions of 25,000 metric tons or more of carbon dioxide-equivalent greenhouse gas emissions on an annual basis, and therefore the impacts to global climate change will not be discussed in detail.

On July 19, 2010, concurrent with the release of the *Final Recommendations of the Interagency Ocean Policy Task Force* issued by the White House Council on Environmental Quality (CEQ), President Obama released an Executive Order (EO; rescinds EO 13366 of December 17, 2004) entitled *Stewardship of the Ocean, Our Coasts, and the Great Lakes*. This EO adopts the recommendations of the CEQ Task Force and directs executive agencies to implement the recommendations under the guidance of the National Ocean Council (NOC) created by the EO. The proposed action is consistent with these recommendations and will contribute to the scientific understanding of our ocean ecosystems.

Executive Order 12898 requires federal agencies to address actions affecting environmental justice in minority populations and low-income populations. The proposed research will take place primarily in unpopulated areas (e.g., a federal monument, public beaches on the MHI) involving principally short-term temporary data collection activities. Collaboration with other researchers, agencies, and NGOs will

be on a mutual basis. As such, the proposed research will have negligible environmental effects on minority and low-income communities, and therefore will not be discussed in detail.

Executive Order 13089 requires federal agencies to identify actions that may affect coral reefs, protect and enhance the condition of coral reef ecosystems through existing programs, and ensure their actions do not degrade the conditions of coral reef ecosystems. The proposed sea turtle research activities will include work in the vicinity of coral reefs. The proposed action does not involve any direct impacts to coral reefs. The proposed action does aim to facilitate the recovery of sea turtles, which will have a small indirect beneficial effect on coral reefs by increasing the abundance of these native algae grazers to the ecosystem. The proposed action would have only short-term temporary effects on coral reefs during sea turtle captures and the algal studies, and impacts to coral reefs have been considered, but will not be discussed in detail.

Executive Order 13158 requires federal agencies to avoid harm of Marine Protected Areas. The nesting research will take place in a MPA (e.g., PMNM) and the stranding response may take place in other MPAs in the MHI (e.g., Pupukea Marine Life Conservation District, Hawaiian Islands Humpback Whale National Marine Sanctuary). The MTRP will avoid harm of MPAs to the maximum extent practicable while conducting the proposed action through implementation of the various avoidance and minimization measures described below.

The proposed MTRP activities will be undertaken in a manner consistent with the Hawaii Coastal Zone Management Program and will not affect any coastal use or resource. Therefore, impacts to these resources have been considered, but will not be discussed in detail.

Within the geographic scope of analysis occur a number of archeological and cultural resources. The NWHI are an important cultural resource in the Hawaiian traditions. Native Hawaiian seafarers travelled frequently between the MHI and NWHI. The NWHI are home two of the most important Hawaiian archeological sites, Nihoa Island and Mokumanamana (Necker Island). These islands are home to a number of sites listed on the National Register of Historic Places, including numerous heiau (i.e., places of worship). The proposed action does not include activities at either of these islands, or at any other location that is anticipated have resources listed on the National Register of Historic Places (e.g., East Island is a dynamic landform composed of coral rubble and sand). Therefore, impacts to these resources have been considered, but will not be discussed in detail.

2 Proposed Action and Alternatives

The MTRP proposes to continue the current research program that has been implemented over the last 38 years in Pacific Islands Region (Alternative A) with the addition of research on the Study of Site Fidelity to Foraging Grounds (Proposed Action: Alternative C). This document includes a range of reasonable alternatives (e.g., Alternative B) that address the purpose of the MTRP and need for sea turtle research and collaboration, while avoiding and minimizing adverse impacts to the environment.

2.1 Alternative A: Status Quo

The MTRP is one of the few long-term sea turtle research programs in the world, with more than 38 years of continuous, quality data.

2.1.1 Components of the Current MTRP

Using the techniques and methods described below, which have been implemented using the associated standard operating procedures (see 2.1.3), the MTRP currently undertakes a number of sea turtle research investigations that can be grouped into three broad categories: those associated with beach/nearshore habitat; those associated with pelagic habitat; and those associated with technical assistance, training, international collaboration, and analytic actions (Table 1). Table 1 identifies the specific techniques and methods described in Section 2.1.2 with its corresponding alphanumeric label and its associated research component identified in Sections 2.1.1.1, 2.1.1.2, and 2.1.1.3.

As noted above, most of the research is conducted on green turtle and hawksbill stocks endemic to the Hawaiian Islands Archipelago. Additionally, the MTRP studies loggerhead, olive ridley, and leatherback sea turtles incidentally caught in commercial fisheries on the high seas or by research programs in the Pacific Islands Region. These species are found infrequently within the MHI and are studied as part of the stranding program.

2.1.1.1 Research on Sea Turtle Stocks in the Hawaiian Islands on Beach/Shoreline Habitats

a. **Nest-Based Egg and Reproductive Success.** Evaluation of egg incubation, hatchling production, and examination of nest contents post-hatching, including evaluation of sex ratios based on temperatures measured in the nest and determining the sex of dead hatchlings salvaged, in the nest or on the beach.

b. **Nesting Beach Characteristics and Productivity. Collection of data from the nesting beach.** Assisting federal (USFWS and National Park Service, NPS) and state (Hawaii Department of Land and Natural Resources, DLNR, Division of Aquatic Resources, DAR) personnel with collection of data from green turtles and nests at FFS and the MHI, as well as from hawksbill turtles and nests at Volcano National Park on the Island of Hawaii and other locations in the MHI (i.e., Maui and Molokai). Data collected may include identification of the female, date of encounter or nest deposition, date of nest hatching, location of nest, nest density, degree of egg fertility, and hatchling production. This may involve affixing passive or active tags to nesting females.

c. **Stranding.** As part of a widespread stranding network, collection of data from live and dead stranded sea turtles, care and rehabilitation of live animals, and necropsy of dead animals.

d. **Post-Pelagic Juvenile and Adult Nearshore Foraging and Resting Habitat.** Identification of location, characteristics, and daily and seasonal use of foraging and resting habitat and local movements of post-pelagic juveniles and adults using marked animals with active transmitters.

e. **Breeding Males and Gravid Females Inter-nesting Habitat and Movements.** Identification of location, characteristics, and daily and seasonal use of foraging and resting habitat and localized movements of breeding males and gravid females between nesting at breeding sites and associated basking sites.

f. **Food Habits.** Collection of data from live and dead turtles and reef habitat, including evaluation of food found in the mouth, stomach, crop, gastrointestinal tract, or feces; and stable isotope studies using tissues.

g. **Basking Sea Turtles.** Collection of data from basking green turtles regarding, when appropriate, life stage, sex, health status, tags, and DNA.

h. **Fibropapillomatosis.** Collection of data related to the existence, causes, extent, and progression/regression of the FP disease complex.

i. **Localized Overcropping of Algal Forage by Increasing Numbers of Green Turtles.** Evaluation of potential for overcropping of algae by increasing numbers of sea turtles in the recovering Hawaiian population and other assessments of forage characteristics.

j. **Identification and Biology of Epibiota (animals and plants that live on the skin and shell of sea turtles).** Collection of barnacles, leeches, algae, and other flora and fauna attached to skin and shell for determining life cycle biology and taxonomy.

k. **DNA Analysis.** Collection of skin, blood, and/or tissue from live or dead turtles for stock identification.

l. **Internal Parasites.** Collection of blood from live turtles and tissues from dead turtles to analyze for presence of parasites and determine life cycle biology and taxonomy.

m. **Evaluation of Physical Condition.** Turtles are visually examined for emaciation status which ranges from a healthy, robust turtle to a weak and severely emaciated (i.e. neck/shoulders and/or plastron concave/sunken) turtle. Several measurements are taken to document body thickness, length, width, and weight. Samples may be taken for analysis of diet, stable isotopes, blood values, growth rates, disease, and external epibiota (an indication of reduced activity).

2.1.1.2 Research on Sea Turtle Stocks in the Hawaiian Islands in Pelagic Habitats

a. **Post-Hatchling Juvenile Pelagic Habitat Location and Use.** Tracking juvenile turtles marked with an active transmitter to determine use of ocean habitats over time, potentially including juveniles less than 25 cm in length as technology improves to create smaller telemetry equipment.

b. **Adult Migratory Movements.** Tracking adult sea turtles marked with an active transmitter to determine use of ocean habitats over time and migration between breeding and foraging grounds.

c. **Bycatch Data.** Management and evaluation of data collected from both live and dead sea turtles incidentally caught during coastal fishing or in commercial fisheries. Also may involve attaching telemetry equipment to the shell, when appropriate, to evaluate survival and movements.

d. **Release of Captive-Reared Turtles into the Environment.** Providing scientific advice and assistance regarding the release of captive-reared green turtles of the Hawaiian genetic stock into suitable habitat offshore of the Hawaiian Islands; as well as release of other species, such as captive-reared loggerhead turtles, into suitable habitat in cooperation with Pacific Islands and Pacific Rim nation research programs.

e. **Selected Projects for Cooperative Research on Captive-Bred/Captive-Reared Turtles at Authorized Facilities.** Any research conducted on turtles located at Sea Life Park Hawaii or other authorized facilities in which MTRP is a collaborator, including projects such as nest and hatchling research, training in research techniques, tissue and blood sampling, inspection and morphometrics, and educational outreach.

2.1.1.3 Research on Sea Turtle Stocks in the Pacific Islands Region through Technical Assistance, Training, Collaboration, and Analytic Actions

a. **International Collaboration.** Working collaboratively with sea turtle researchers from other Pacific Rim and Pacific Island nations and providing assistance to research programs to build research capacity, including training in research techniques, sharing information and data exchange, and providing scientific advice.

b. **Training Fishery Observers in Research Techniques.** Training fishery observers aboard commercial fishing vessels in collection of sea turtle data from sea turtles caught incidentally by commercial fishery.

c. **Education and Outreach.** Developing and distributing written educational materials, in conjunction with on-site field activities, making presentations at adult- and children-oriented venues, publishing in periodicals and peer-reviewed journals, and providing specimens to museums on-loan and other public and educational institutions.

d. **Modeling Population Dynamics.** Storing and manipulating data and using the data to develop models of sea turtle population dynamics and population recovery collaboratively with the Marine Turtle Assessment Program (MTAP) and other national and international programs and collaborators.

e. **Age and Growth Rates.** Analysis of data based on measurements collected from live and dead turtles and bone structure data collected from dead turtles to evaluate population age structure and individual growth rates.

2.1.2 Techniques and Methods Used by the MTRP for Sea Turtle Research Involving Varying Levels of Interaction with Dead and Living Sea Turtles

A. Encounter. This involves observing turtles from a distance.

1. Observe feeding and other behavior, either visually or with a camera.
2. Record presence, either visually or with a camera.
3. Count numbers, either visually or with a camera.

B. Capture. This involves the actual handling of individual turtles.

1. Capture using gear in the water, such as a scoop net, a tangle net, or trapping in a pen.
2. Capture by hand, either on land or in the nearshore waters.
3. Capture on beaches, with open "box pen."
4. Capture of hatchlings and collection of eggs, either in the nest or on the beach.
5. Capture of dead or live stranded individuals, involving primarily capture by hand at the stranding site.
6. Incidental bycatch in commercial fisheries in the Pacific Ocean.

C. Inspect. This involves handling and manipulating the individual turtle after capture.

1. Measure for size and growth rate.
2. Weigh.
3. Attempt to determine sex visually.
4. Conduct external and oral exam for health status.
5. Search for presence of biota on skin/carapace, such as barnacles or leeches.
6. Conduct exam for external injuries, such as evidence of attempted predation, fishing line entanglement, or boat strike.
7. Record existence of and information from tag(s).
8. Count and describe FP tumors.

D. Sample. This involves handling and taking physical samples from individual turtles, alive and dead, after capture.

1. If animal is alive, in addition to the external inspections above, the following may be collected:

   a. Blood samples for total protein, packed cell volume, serum chemistry, and/or parasites and other desired considerations.

   b. Samples of biota living on skin or carapace, such as barnacles, leeches, and algae.

   c. FP tumors (if recapture, measure for progression/regression of disease).

d. Skin or blood for DNA identification.

e. Food samples from crop and/or mouth, including esophageal lavage.

f. Feces.

g. Tissue for stable isotope study.

2. If the animal is dead, during external exam and/or necropsy, in addition to the above samples (other than blood), the following may be collected:

a. Humerus bones and other tissue samples.

b. Food from gastrointestinal tract.

c. Urine and/or feces.

d. Reproductive organs for sex identification and reproductive status and fertility.

e. Tumor samples (if a recapture, evaluate for progression/regression of disease).

f. Skeletal materials.

g. Skin or other tissue for DNA identification.

h. Tissue for stable isotope study.

i. Epibiota (i.e., plants and animals attached to the skin and shell of a turtle).

j. Tissues from nest remains.

E. Tag. This involves placing a physical tag either into tissue of the flipper, under the skin surface, or affixed to the shell of the individual turtle.

1. Passive tags:

- External flipper tag (metal or plastic);
- PIT tag injected under the skin that can then be electronically scanned;
- External shell mark (i.e., alphanumeric identification etched into shell and painted white)

2. Active Tags:

- Radio transmitter that either transmits globally using satellites or short-range using sonic and VHF frequencies attached to the shell;
- Archival tag (collects and stores temperature, depth, time, and location data).

F. Veterinarian Care. This involves the handling and manipulation of individual turtles by licensed veterinary professionals for the purposes of rehabilitation and captive care.

1. Rehabilitate sick or injured turtles for release into the wild, including transport, holding, handling, diagnosis, observation of behavior, treatment (such as dosing with medicine and

surgery performed by a licensed veterinarian), feeding and other necessary care. Veterinary procedures typically performed may include but are not limited to:

- radiographs
- surgical flipper amputation under gas anesthesia
- medications administered (e.g., antibiotics, fluids, mineral oil, GasX, etc.)
- force feeding
- fishing line extracted from mouth or cut short at mouth if unable to extract
- fish hook removed with or without minor surgery and local anesthetic
- shell repaired with fiberglass/resin/epoxy/stainless steel wire
- tumor surgically removed (cryosurgery or cutting) or treated with topical ointment (blood root) or injection (Dermex)
- Endoscopy

2. Conduct humane euthanasia of a sick or injured sea turtle if two or more veterinarians decide it has no chance to recover or survive in the natural environment. There are only two Institutional Animal Care and Use Committee (IACUC) approved methods of euthanasia for reptiles, barbiturate overdose and penetrating captive bolt, and the MTRP only uses barbiturate overdose.
3. Conduct a comprehensive necropsy of all euthanized turtles by a licensed veterinary pathologist.

G. Transport of Captured Turtles. This involves handling, stabilizing, and transporting living turtles.

1. Using a certified animal carrier, with the turtle covered with a wet pad for cooling on a plane, in the back of a vehicle, or on a boat if the individual is captured at sea.
2. Transport of salvaged and frozen dead turtles or turtle tissues, boxed and shipped by ground or air transport.

H. Release of Wild Turtles Back into the Natural Environment. This involves tagging, transporting to the appropriate release point, and release of individuals into suitable habitat, as defined by sea turtle experts.

I. Collection of Environmental Samples. This involves collection of information and physical samples from the environment in support of sea turtle research.

1. Collect invertebrates such as sponges, algae and sea grasses in known turtle foraging areas.
2. Collect reef fish observed to groom sea turtles, such as saddleback wrasse, surgeonfish, and tangs for presence of viruses and other pathogens.
3. Collect sediments for presence of viruses and other pathogens.
4. Record and archive seawater temperature data.

5. Record and archive sand temperature data.
6. Collect seawater for presence of viruses and other pathogens.
7. Record and archive weather data and associated oceanographic characteristics.
8. Collect beach sand for analysis of beach physiology (sand grain size, porosity, water content, etc.).
9. Collect invertebrates and non-cleaning fish from foraging habitats for presence of viruses and other pathogens.

J. Technical Assistance, Modeling, Data Analysis, Educational Outreach, and International Collaboration. This involves data storage and manipulation, developing and using population models, educational outreach, and collaborating with international sea turtle researchers from the Pacific Rim and Pacific Island nations to further research in support of the recovery of Pacific stocks of sea turtles. Technical assistance involves the transfer of specific scientific expertise to train professionals in other countries, assist in data analysis, provide supplies, and perform other noninvasive actions.

Table 1. Sea turtle research techniques and methods potentially associated with each research project in the MTRP. The numbers and letters in the cells represent the specific actions described in Section 2.1.2.

	A. Encounter	B. Capture	C. Inspect	D. Sample	E. Tag	F. Vet Care	G. Transport	H. Release	I. Environmental Sampling	J. Modeling / Collaboration
1. Research conducted on the beach or in the nearshore ocean										
a. Reproductive Success	1-3	2-5	1-3,6	1d 2a,d,f-h					4,5,7,8	
b. Nesting Beach Research	1-3	2,3,4	1-8	1a-d,g 2j	1-2		1	H	5,7,8	
c. Strandings	1-3	1-3,5,6	1-8	1a-g 2a-h	1-2	1-3	1-2	H		
d. Nearshore Foraging and Resting Habitat	1-3	1-3,5	1-8	1a-g	1-2	1-3	1	H	1,2,3,4,6,9	
e. Breeding Adult Inter-nesting Habitat	1-3	1-3,5[1]			1-2[1]				4-8	
f. Food Habits	1-3	1-3,5,6	1-8	1a,e-g 2b,c,h	1-2		1	H	1,9	
g. Basking	1-3	3	1-8	1a-e,g	1-2		1	H	4-7	
h. Fibropapillomatosis Disease Complex	1-3	1,2,3,5,6	1-8	1a-c 2e,i	1-2	1-3	1-2	H	1-4,6,9	
i. Overcropping	1-3	1-3,5	1-8	1e,g	1-2		1	H	1,9	

	A. Encounter	B. Capture	C. Inspect	D. Sample	E. Tag	F. Vet Care	G. Transport	H. Release	I. Environmental Sampling	J. Modeling / Collaboration
j. Epibiota	1-3	1-3,5,6	1-8	1b 2i		1,3	1-2	H		
k. DNA		1-6		1d 2g, j			1-2	H		
l. Internal Parasites		1-3,5		1a 2a		3	1-2	H	9	
m. Evaluation of Physical Condition	1-3	1-3,5,6	1-8	1a-g 2a-c,e,g-i	1-2	1-3	1-2	H	1	
2. Research conducted in the ocean										
a. Pelagic Juvenile Habitat	1-3	1-3,5,6	1-8	1a-g	1-2		1	H	4,7	
b. Adult Migration		1-3,5,6	1-8	1a-d,g	1-2		1	H	4,7	
c. Bycatch	1-3	1,5,6	1-8	1a-g, 2a-i	1-2	3	1-2	H	7	
d. Captive Release	1-3		1-8	1a-d,g	1-2		1	H		
e. Captive-Bred / Reared Research at Facility	1-3		1-8	1a,d,g	1	3	1	H	5,8	
3. Analytic, training, modeling, and educational outreach										
a. Collaboration			1-8	1a-g 2a-i	1-2		2			J
b. Education / Outreach	1-3			2f			1	H		J
c. Observer Training	1-3		1,6,7	2a,g	1-2					J
d. Modeling										J
e. Age / Growth Analysis										J

[1] at locations other than French Frigate Shoals

2.1.3 Standard Operating Procedures for Implementation of Methods and Techniques

2.1.3.1 Standard Operating Procedures Accepted Worldwide

The MTRP ensures the safety of research and technician personnel first and foremost in all Program activities, and conducts constant training of all personnel in the implementation of techniques and methods, both in the laboratory and in the field.

All research techniques and methods are conducted consistent with accepted standards within the sea turtle research community (Eckert et al. 1999) based on efficacy and the experience gained through 34 years of implementation.

Eckert et al. (1999) incorporates standards for:

- Capturing (L.M. Ehrhart and L.H. Ogren. *Studies in Foraging Habitats: Capturing and Handling Turtles*; see also: Balazs et al. 1987 and Balazs et al. 1998);
- Tagging (S.A. Eckert. *Data Acquisition Systems for Monitoring Sea Turtle Behavior and Physiology*; G.H. Balazs. *Factors to Consider in the Tagging of Sea Turtles*; see also: Balazs et al. 1996);
- Collecting physical measurements (A.B. Bolten. *Techniques for Measuring Sea Turtles*);
- Diet sampling and diet component analysis, including the use of esophageal lavage (G.A. Forbes. *Diet Sampling and Diet Component Analysis*, see also: G.H. Balazs 1992);
- Measuring growth and growth rates (R.P. Van Dam. *Measuring Sea Turtle Growth*);
- Genetic population sampling (N. FitzSimmons, C. Moritz, and B.W. Bowen. *Population Identification;* also see: Bowen et al. 1992);
- Determining clutch size and reproductive success (J.D. Miller. *Determining Clutch Size and Hatching Success*);
- Diagnosing sex of sea turtles in foraging habitats (T. Wibbels. *Diagnosing the Sex of Sea Turtles in Foraging Habitats*);
- Techniques for evaluating infectious diseases of sea turtles (L.H. Herbst. *Infectious Diseases of Sea Turtles*);
- Tissue sampling and biopsy techniques (E.R. Jacobsen. *Tissue Sampling and Necropsy Techniques;* see also Dutton and Balazs 1996);
- Techniques for sampling blood and conducting laparoscopy for determining reproductive cycles (D. Wm. Owens. *Reproductive Cycles and Endocrinology*);
- Conducting stranding and salvaging networks (D.J. Shaver and W.G. Teas. *Stranding and Salvage Networks*)

2.1.3.2 MTRP Standard Operating Procedures

These standard operating procedures are designed to minimize the impact of MTRP's techniques and methods on the environment, and turtles in particular.

- Skin sites for all activities that require puncturing the skin, such as tag application activities that require attachment to skin (physical tags or PIT tags), and collecting biopsies and blood samples, and use of tools for carapace marking and measuring, are cleaned with an antiseptic.
- Skin biopsies are taken from turtles incidentally caught in commercial fisheries, confiscated by law enforcement, captured during fieldwork, encountered on a nesting beach, and stranded turtles. The biopsy (a small plug of skin and tissue) is quickly taken from the edge of a hind flipper or from the soft skin near the hind flippers using a sharp pre-sterilized punch tool.

- When possible, satellite and VHF radio transmitters are attached, removed, and/or replaced on nesting females only when the turtle has finished nesting to avoid nest abandonment.
- All wild turtles are typically held for field research activities for periods of time varying from minutes to 1 to 2 hours, unless a satellite or radio transmitter is being attached, at which point holding could extend to 3 hours.
- All drugs, including topical medications, vitamins and dietary supplements, and antibiotics are administered to turtles only by trained staff under the supervision of licensed veterinarians using approved IACUC protocols.
- Release of wild turtles from anywhere in the Hawaiian Islands back into the natural environment either during research activities or after rehabilitation at the NMFS Kewalo Research Facility (KRF) in Honolulu, Hawaii includes:
    - Any potentially diseased individual (known to be or potentially exposed) will not be released into areas having no known evidence of disease. When necessary, the animal is placed in quarantine for an appropriate duration, and the animal is observed for abnormal physical, physiological, or behavioral conditions; blood samples are collected to ensure absence of or an acceptable level of medical problems, as determined by a veterinary pathologist, prior to release.
    - Turtles stranded in areas not known to have the FP disease (i.e., leeward coast of Hawaii) are never released back into the original stranding site because the seawater used at KRF is recycled from the Oahu coast and the turtles could have been infected during their rehabilitation. All such turtles are released at sites on Oahu.
    - Turtles with or without FP tumors stranded from waters known to have the disease are released into calm waters close to the capture site, or in Kaneohe or Kailua Bays. Kaneohe Bay has the highest prevalence of FP disease in Hawaii and has calm waters; therefore, it is an appropriate release site for animals that have previously been exposed to the disease.
    - Turtles with one or more flipper amputated in the wild or by surgery because of severe entanglement or physical damage are released into calm waters of Kailua Bay or Maunalua Bay on Oahu to facilitate swimming.
    - Turtles are transported by truck to the release site in an approved container, covered with a wet absorbent pad, and are carried by hand where they are released near the water's edge or gently from a boat.
    - After release, observers watch for the turtle to surface several times to breathe to ensure that the turtle is behaving normally and moving away from shore.

2.1.3.3 Standard Operating Procedures for Avoiding Disturbance to Other Species, Especially Monk Seals on Sea Turtle Nesting Beaches, Including at East Island, FFS

Prior to going into the field to conduct MTRP activities, all personnel undergo training, study the program's standard operating procedures manual, and are prepared to adhere to all requirements.

- On East Island, monk seals typically rest facing inland, therefore researchers always scan with the flashlight from the shoreline berm towards the center of the island to avoid shining the light in the eyes of monk seals.
- If a monk seal happens to be facing the researcher, the light is turned off and the researcher slowly moves away.
- Researchers encountering monk seals remain at an appropriate distance at all times.
- Nesting research surveys at East Island are conducted no more than once per hour to minimize disturbance to nesting turtles, seabirds, and monk seals unless a particular turtle needs to be identified or observed.
- Researchers maintain a low profile during daylight when encountering a monk seal, and whenever possible, pass it from downwind.
- Researchers attempt to keep noise or sudden sounds to a minimum.
- If a monk seal notices the researcher, the person crouches down and slowly moves away.

Although sea turtle nesting at FFS spans several months, sea turtle researchers are typically on East Island for up to 45 days at the height of the nesting season, June and July, which minimizes disturbance to monk seals and other sensitive wildlife.

2.2 Alternative B: Expansion of the Status Quo Program to Include the Study of Hatchling Predation at FFS

This alternative would include the current program as described in Alternative A plus include a study at FFS to determine the causes and levels of green turtle hatchling predation on land and in the nearshore environment. This alternative would include: (1) capturing wild live predatory birds (e.g., frigatebirds) and inducing them to regurgitate their crops; (2) evaluating population levels and food habits of large predatory fish such as jacks (the family Carangidae) and ghost crabs; (3) collecting tissue samples from predators and dead hatchlings for conducting a stable isotope food habit study; and (4) using on-land remote cameras and underwater videography.

This study would require capturing potential predators of hatchlings, including live birds, fish, and ghost crabs. Birds would be captured by hand or long handled fishing nets. Study would be conducted during the peak sea turtle hatching period in September, on East and Tern Islands. No more than 200 frigatebirds would be captured and studied. This would include lethal collection of fish and ghost crabs for stomach content and DNA analyses to determine if hatchlings have been consumed. Methods to identify the predation event would include tethering hatchlings to lines (Gyuris 1994) or by visual tracking (Stewart and Wyneken 2004). Up to 580 hatchlings per year would be used in this study for up

to three years. Hatchlings would be collected shortly after emergence from their nest and stored in a cool, shaded box. Hatchlings would be used within 12 hours of capture. Animals that did not regain their post-emergence vigor would not be used for the study, and would be released into the ocean. Hatchlings would be tethered to lines for approximately 10 minutes. If no predation event occurred the animal will be released and allowed to swim away. If predation event occurs, it is assumed that this represents a normal predation event that would have occurred. These animals are presumed dead at this point. Techniques and methods used will be consistent with those described (Tables 1 and 2).

Table 2. Sea turtle research techniques and methods potentially associated with the study of predation levels on hatchlings entering the sea.

	A. Encounter	B. Capture	C. Inspect	D. Sample	E. Tag	F. Vet Care	G. Transport	H. Release	I. Environmental Sampling	J. Modeling / Collaboration
Green Turtle Hatchling Predation	1-3	1,4 - hatchlings 1 predators	1-4,6 hatchlings 1-3,6 predators	1e, 2b,h predators			2		4,5,7	

2.3 Alternative C (Proposed Action): Expansion of the Status Quo Program to Include the Study of Site Fidelity to Foraging Grounds

This alternative would include the current program as described in Alternative A and also include: (1) capturing and relocating post-pelagic juvenile and subadult green turtles that exhibit slow growth rates in potentially over-cropped foraging areas and other suitable areas with more abundant forage, and; (2) tracking and monitoring their movements and subsequent rate of shell growth. This alternative would not include the activities discussed under Alternative B. This study would evaluate if slow turtle growth rates may be caused by decreased food in over-cropped foraging grounds from an increasing green turtle population in the area. Over-cropped areas would be determined by biomass estimates and consumption rates, estimates of available forage, and the amount of competition for available resources. All turtles selected for the study would be resident to the area and have at least 5 years of evidence of slow carapace growth as indicated from recapture data. A trial study with one turtle would be conducted to test the relocation technique and, if successful, the study would be expanded to include the minimum sufficient number of turtles for statistical analyses, approximately 40. All of the coastal areas of the MHI, except the leeward coast of Hawaii Island, are known to have some level of FP disease. To avoid spreading the disease, either studies would be conducted outside of the leeward coast of Hawaii Island, or turtles moved from sites along the leeward coast of Hawaii Island would only be relocated to other areas along this coast. Techniques and methods used will be consistent with those described earlier (Tables 1 and 3).

Table 3. Sea turtle research techniques and methods potentially associated with the study of site fidelity to foraging grounds.

	A. Encounter	B. Capture	C. Inspect	D. Sample	E. Tag	F. Vet Care	G. Transport	H. Release	I. Environmental Sampling	J. Modeling / Collaboration
Green Turtle Foraging Site Fidelity	1-3	1,2	1-8	1a-g	1-2	1	1	H	1,3,4,6,7,9	

2.4 Alternative Not Considered in Detail

2.4.1 No Federal Action

An alternative that stops the MTRP research activities is not being considered in detail because: (1) this program is consistent with the recovery plans of all five species of marine turtles (NMFS and USFWS 1998a, 1998b, 1998c, 1998d, 1998e); (2) sea turtle populations have not recovered per the recovery plans; and (3) the causes, spread, and impacts of FP disease are poorly understood and the disease remains a potential threat to sea turtle recovery.

If the MTRP ceased conducting research on sea turtles, then data would not be collected on sea turtle stocks or life history (i.e., nesting, foraging, movement, genetics). Furthermore, the program would not engage in international collaboration, training, technical assistance, education, outreach, population modeling, or data analysis. As agents and federal employees of the NMFS, MTRP staff would continue to aid stranded sea turtles in accordance with the programmatic permit described at 50 CFR § 222.310.

This alternative would fail to meet the purpose of the MTRP at the PIFSC and would fail to fulfill the data needs of the federal government as the entity responsible for sea turtle recovery. Furthermore, data that otherwise would have been collected and analyzed by the MTRP would not be published in the peer-reviewed literature and other technical reports. Therefore, it would be difficult for the federal government and related management organizations to develop or implement management strategies for sea turtle species in the Pacific Ocean because they would not have the necessary biological and ecological information about the species.

This alternative would result in a short-term reduction in minor adverse impacts to the environment (i.e., turtles and similarly affected species) because researchers would not be actively working in the field handling turtles and collecting data. Handling turtles causes a small amount of non-lethal stress to the animal, but implementation of the standard operating procedures described in minimizes these temporary effects. The long-term impact of this alternative would be a lack of data necessary to analyze population trends and make management decision to recover these species (i.e., remove them from the list of threatened and endangered species). This would have moderate direct and indirect adverse ramifications on the cultural identity and practices of native peoples, tourism, the fishing industry, and ecological services (e.g., food-web maintenance) in the Pacific Islands Region.

The lack of research staff in the field would also likely reduce the overall response to stranded turtles because there would be fewer people in locations where turtles occur. It is anticipated that non-federal governmental agencies and non-governmental agencies (NGOs) would take over some of those data collection tasks, but the extent that these agencies would fill the role of the MTRP is difficult to predict. Given that the MTRP serves as the primary data collecting entity in the region, it is unlikely these agencies would have the same focused purpose or level funding, staff, or expertise to meet the data needs. Therefore, this no federal alternative fails to meet the purpose and need of the MTRP, and will not be considered further in this document.

3 Description of Affected Environment

The Pacific Islands Region covers approximately 1.5 million square nautical miles and coincides with the management area of the National Marine Fisheries Service, Pacific Islands Region (i.e., the U.S. Exclusive Economic Zone of the central and western Pacific). The focus of the MTRP data collection and stranding response and research activities is in the Hawaiian Archipelago. Nesting surveys will be conducted primarily on East Island at FFS in the NWHI. Resting and forging research will be conducted primarily in the MHI. Activities located in the U.S. Insular Areas of the Pacific Islands Region would be limited to episodic collaboration with other researchers (mostly as technical assistance), and stranding response and research. The baseline environmental conditions within this vast geographic scope of analysis range from degraded (e.g., the highly urbanized Waikiki Beach on the island of Oahu), to a protected marine national monument (e.g., PMNM in the virtually uninhabited NWHI). A detailed description of the environmental conditions within the Pacific Islands Region is provided in the Final Programmatic Environmental Impact Statement (FPEIS) prepared by the Western Pacific Regional Fisheries Management Council in coordination with NMFS entitled *Toward an Ecosystem Approach for the Western Pacific Region: From Species-Based Fishery Management Plans to Place-Based Fishery Ecosystem Plans* (WPRFMC 2009). Given that the majority of the environmental impacts of the proposed action involve handling sea turtles on dynamic landforms (i.e., environments that are constantly changing, such as coral sand beaches), and do not involve permanent adverse impacts to the physical environment, this section will provide a general description of this large geographic area.

3.1 Hawaiian Archipelago

3.1.1 Northwestern Hawaiian Islands

The NWHI were are an assemblage of islands, atoll, reefs, banks, pinnacles, and seamounts that stretch approximately 1,200 miles northwest of the Island of Kauai. The NWHI are a sacred and spiritual place to the Kanaka Maoli (Native Hawaiians). The NWHIs are the oldest part of the Hawaiian archipelago and are also known as the Leeward Islands. There are ten main islands and atolls (from southeast to northwest): Nihoa Island, Mokumanama (Necker Island), French Frigate Shoals, Garnder Pinnacles, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll. The two southernmost islands, Nihoa and Mokumanamana, are basaltic islands with little beach areas. Four of the five middle landmasses are open atolls (French Frigate Shoals [FFS] and Maro Reef) and sandy islands (Laysan and Lisianski). La Perouse Pinnacle (at FFS) and Gardner Pinnacles are small basaltic outcrops, remnants of islands similar to Nihoa and Mokumanamana. The three northernmost landmasses, Pearl and Hermes, Midway, and Kure, are classical atolls. The beaches of the NWHI are highly dynamic given their low-lying topography and exposure to waves and currents from the northern and southern hemisphere. The texture of beaches ranges from fine sand to corral rubble. This emergent land is vital habitat to the 14 million resident and migratory seabirds, which rely on these islands for roosting and breeding habitat and on the surrounding waters for food and which are protected under the Migratory Bird Treaty Act (PMNM 2008). The NWHI are part of the State of Hawaii (except for Midway Atoll, which is under control by the Federal government).

The NWHI have had varying levels of legal protection since their discovery. In response to the slaughter of millions of seabirds by poachers, President Theodore Roosevelt created the Hawaiian Islands Bird

Reservation in 1909. In 1940, President Franklin Delano Roosevelt renamed it the Hawaiian Islands National Wildlife Refuge. Since 1940, most of the populations of plants and animals on the islands have rebounded to their pre-exploitation levels (Rauzon 2001). The entire chain is now part of the Papahanaumokuakea Marine National Monument. As a National Monument, access to the islands and atolls, and activities within 50 nautical miles of the shoreline are regulated through a permitting system co-administered by the NMFS, USFWS, and State of Hawaii.

French Frigate Shoals is the primary location of the green sea turtle nesting surveys. Occasionally, abundance surveys are also opportunistically completed on other islands as part of the PIFSC research program. FFS is the largest atoll in the chain, with approximately 9,300 hectares of coral reef habitat and only 27 hectares of emergent land. The islets within the atoll are highly dynamic systems made of coral sand and the total area of emergent land can fluctuate from year to year. The focus of the nesting surveys is East Island, a sparsely vegetated sand island. Tern Island has been modified from a naturally sand island to an airplane runway, with a number of associated permanent buildings. These buildings and associated infrastructure serve as the base for research at FFS. The modifications of Tern Island are a result of dredge and fill operations within the atoll. Aside from the temporary USFWS and NMFS staff that lives on Tern Island, FFS is not inhabited by humans.

3.1.2 Main Hawaiian Islands

The eight main islands make up only one quarter of the Hawaiian Archipelago's area, but are home to almost all 1.3 million people that live in the state. The eight high volcanic islands include (from southeast to northwest): Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau. The islands are located approximately 2,500 miles from North America and 3,000 miles from Asia. Despite these distances, tourism constitutes the largest part of the Hawaiian economy. Tourists are attracted to the tropical climate and diverse marine resources including coral reefs, sandy beaches, and surf breaks. The sandy beaches are generally protected by the fringing reefs but the sediment dynamics are vulnerable to disruption of near-shore currents. Agriculture and the military are the other main sources of state income. Consequently, the marine resources of the MHI experience pressures for overuse at tourist destinations and shipping traffic at the military bases and ports. Oahu is the most populous island and one of the most densely populated areas in the United States.

The MTRP is based at the Pacific Islands Fisheries Science Center in Honolulu, Hawaii. The rehabilitation facility of sea turtles is located at the Kewalo Research Facility also in the city of Honolulu. The facility is equipped with three tanks of various sizes allowing for the rehabilitation of turtles of all sizes and conditions. Tanks have active saltwater filtration and pump systems. All tanks and equipment are thoroughly cleaned to avoid disease transfer from individuals. Furthermore one tank is dedicated for turtles with FP.

3.1.3 Marine Resources around the Islands

The Hawaiian Archipelago falls within the Insular Pacific-Hawaiian Large Marine Ecosystem (LME) (Sherman 1991). The movement of water in the region is dominated by North Pacific Subtropical Gyre, which rotates clockwise, and is located between the North Equatorial Current and Subtropical High

(WPRFMC 2009). It is considered a low productivity ecosystem due to limited nutrient availability, but it has a high diversity of marine species (NMFS 1999). The most valuable fisheries in the MHI are tuna (bigeye, yellowfin, skipjack, and albacore). Other commercial fisheries within the LME include bottomfish, near-shore reef fish, and invertebrates (e.g., lobster, shrimp, squid, and octopus). Marlin, yellowfin tuna, and albacore are important recreational fisheries. Subsistence and recreational fishing pressure is high near-shore, and around the more densely populated islands. Subsistence and recreational fishing is primarily for near-shore reef fishes, tuna, and mahi mahi. The coral reefs that surround the islands provide not only habitat for fish and other marine life, but protect the coastline from powerful seasonal waves.

The marine resources of the NWHI are somewhat unique and range from shallow reef to deepwater banks. The shallow reefs are composed of reef-building corals (generally found in the less than 30 meters of water), unconsolidated sediments, hard bottom substrates, non-reef building corals, and algae. The NWHI are habitat for approximately 355 species of algae and 838 species of invertebrates (Friedlander et al. 2005). Deepwater habitats include banks, shoals, slopes, and seamounts. These deepwater habitats are home to a number of bottomfish, spiny and slipper lobsters, and precious gold, pink, and black corals. Overall, the marine resources of the NWHI are characterized by a diverse assemblage of reef fish, pelagic fish, cetacean, pinnipeds, algae, and invertebrates. Approximately 54 percent of the biomass in the NWHI is composed of apex predators, such as sharks and jacks (Friedlander and DeMartini 2002). The percentage of apex predators in the MHI is a fraction of that amount. Historically, the NWHI were extensively fished for bottomfish, sharks, tunas, and lobsters. Consequently, the abundance of these species is still below their pre-exploitation levels.

3.2 U.S. Insular Areas

As described in section 1.5, the U.S. Insular Areas are located within the Pacific Islands Region, but outside of the Hawaiian Archipelago. This includes Guam, American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Atoll, Wake Island, and Palmyra Atoll. The MTRP activities within the U.S. Insular Areas are generally limited to technical assistance to sea turtle researchers, educational outreach, and occasionally stranding response. Because the MTRP does not include any specific field research within the U.S. Insular Areas, a description of the environment is included by reference (WPRFMC 2009).

4 Environmental Impacts of the Proposed Action and Alternatives

The proposed action and alternatives involve primarily short-term, temporary research (i.e., collection of biological and ecological data) and stranding response activities. Because the five species of sea turtles being studied are listed under the ESA, the direct, indirect, and cumulative effects of the research on the turtles is focus of this part of the assessment. As described in section 2, the MTRP has developed and over the last 38 years refined many avoidance and minimization measures for handling and working with sea turtles. As described in section 3, the existing baseline conditions within the geographic scope of analysis vary with the level of human activity (i.e., from an uninhabited island to heavily developed beachfront city). This section will discuss the impacts of the Proposed Action and Alternatives on each relevant resource component. These impacts will be compared to the existing baseline conditions by rating them as negligible, minor, moderate, and major. These ratings are made by taking into consideration the context, intensity, and likelihood of the impact.

4.1 Impacts to Sea Turtles

4.1.1 Impacts of Handling and Transporting Live Sea Turtles

Handling and transporting live sea turtles is essential for diagnosis and treatment. All live stranded sea turtles, other than individuals that are lightly entangled (i.e., not injured) in fishing gear and can be disentangled and released on site, are captured by trained staff and collaborators and transported to a facility for diagnosis and treatment by a licensed veterinarian. Whenever possible, turtles are rehabilitated and ultimately released back into their natural environment. Handling and transporting sea turtles will have a minor short-term temporary direct adverse impact on the animal's condition because they are wild animals not accustomed to being restrained by humans. Direct minor adverse impacts of transporting sea turtles, such as over-heating, are minimized by covering the turtle with a wet pad during transport. These impacts are the same for the Proposed Action and Alternative B.

Under Alternative C, an additional 40 turtles may be handled and transported. The additional number of turtles handled and transported would result in a slightly greater magnitude of minor short-term temporary adverse impacts to sea turtles.

4.1.2 Impacts of Capturing Sea Turtles

As with any marine habitat capture program, there is a possibility that captured turtles could experience short- and long-term adverse impacts from capture, ranging from near-drowning to drowning by entanglement. To minimize the potential for adverse impacts, when nets are in the water to capture turtles, they are constantly monitored and turtles are immediately retrieved from the net (Ehrhart and Ogren 1999). Additionally, several field personnel are in the water during all capture activities (hand capture and tangle netting) to ensure that stress to the animal is minimized during capture by passive restraint during hand capture and immediate removal from the net. A veterinarian is on call during all capture activities in the event consultation is required. If a turtle is encountered during capture activities in a comatose state, resuscitation is attempted. Handling time during capture activities is minimized to reduce the potential for additional stress. Turtles are only handled for the amount of time necessary to complete sampling, measuring, examination, and tagging. No stranded tagged turtles have been

determined to have died from capture-related activities over the past 24 years (Balazs, pers. comm.). Therefore, no mortality is predicted to occur from capturing and therefore the direct adverse impacts are considered short-term and minor.

Under Alternative B, an additional 580 hatchlings may be captured and tethered to a line during the predation research. These hatchlings represent a fraction of the number individuals that are hatched each year. However, by tethering the hatchlings to a line it increases the probability they are killed by a predator such as an ulua or frigatebird. These adverse impacts would be minor but adverse and permanent.

Under Alternative C, an additional 40 turtles may be captured; however this represents a fraction of the total number of turtles captured. The number of turtles captured would still result in minor short-term temporary adverse impacts to sea turtles.

4.1.3 Impacts of Collecting Samples

For a complete understanding of sea turtle population dynamics and life history, it is necessary to identify individuals and obtain biological samples for genetics, diet, disease, and habitat use. Turtles are flipper tagged with metal inconel tags and PIT using standard techniques (Balazs 1999); blood samples are taken using a medical grade needle and syringe (Bolten 1999, Owens 1999); diet samples are safely obtained by esophageal lavage (Forbes and Limpus 1993); and tissue biopsies are taken using a biopsy punch (Dutton and Balazs 1996). All methods used are performed by trained personnel and have been peer-reviewed and used by sea turtle researchers worldwide. The collection of these samples has direct minor short-term adverse impacts to sea turtles. The MTRP does not perform unnecessary sampling on sick or injured animals unless a veterinarian determines the animal is sufficiently healthy for samples to be taken. No mortality is expected from tagging, blood sampling, or tissue biopsy. Esophageal lavage, when implemented as proposed will have no long-term adverse impacts to the turtle. Many individual turtles have been lavaged multiple times without any known detrimental effect. Individuals have been recaptured from the day after the procedure up to many years later and appear to be healthy and feeding (Forbes 1999). These impacts are the same for the Proposed Action and Alternatives.

4.1.4 Stress from Capturing Turtles with FP That Are Already Immunosuppressed

Both turtles with and without FP are captured and sampled to document the prevalence of FP disease. The progression or regression of the disease is also studied for previously captured individuals and evaluated at the population level. It has been documented that all turtles experience some level of stress when captured (Jessop and Hamann 2005). However, behavioral indications of capture-related stress have been found to be temporary (T. Work, DVM, USGS, pers. comm. May 2006).

Green turtles severely afflicted with FP were determined to be immunosuppressed and chronically stressed prior to capture (Aguirre et al. 1995). Because capture methods are identical for diseased and non-diseased turtles, any observed differences in blood chemistry are likely related to disease and not attributed to stress from capture. Therefore the stress from capturing turtles with FP has a negligible impact.

Turtles that are lightly or moderately afflicted with the disease appear to function at normal levels once returned to the ocean. This has been documented through the subsequent recapture of many of these individuals. In many instances, turtles initially captured with mild to moderate FP tumors have been recaptured with reduced tumor load or no evidence of tumors at all, further indicating that capture stress was not detrimental to the animal's health and well-being. Turtles with severe FP are removed from the study site and evaluated by two veterinarians, a clinical vet and a wildlife disease pathologist. This is not only done for the welfare of the animal, it also removes potentially infectious agents from the water. Additionally, both tumored and non-tumored turtles have been captured and held in captivity, and no behavioral differences were observed. (T. Work, DVM, USGS, pers. comm. May 2006). These impacts are the same for the Proposed Action and Alternatives.

4.1.5 Impacts of Nesting Surveys

During nesting surveys, researchers walk the beach to record data, including: identification of the female, date of encounter or nest deposition, date of nest hatching, location of nest, and nest density. Surveys are conducted no more than once per hour to minimize disturbance. Nesting females can become skittish or disturbed if a light is shined on their face during egg deposition, or if they see the researcher or the researcher's shadow. To reduce the likelihood of disturbance, flashlight use is minimized and the light is covered with the hand with the first two fingers spread slightly to focus the beam. Researchers always approach a nesting turtle slowly from the rear. Before contact is made with the turtle, her activity is noted, and an attempt to identify her by shell etching or tag is made. Based on her activity, the researcher decides if it is the appropriate time to safely tag and sample (if necessary) the turtle without disrupting the nesting process. The best time for the researcher to interact with the turtle is after egg laying is complete to minimize adverse impacts. PIT tags are best inserted directly under the skin into the hind flipper after the female has completed egg laying, when she typically goes into a trance-like state. Alternatively, PIT tags are inserted when the turtle is crawling, making a body pit, covering the eggs, or backfilling, but never while excavating the egg chamber or depositing eggs to avoid any potential for nest abandonment. Every pre-sterilized needle used to install the tag is used only once and disposed of properly after the work. PIT tags are minute, and have negligible long-term adverse impacts to the turtle. The presence of researchers conducting the nesting surveys has a negligible impact on turtles while they rest on the beach prior, during, and after nesting as a result of these avoidance and minimization measures. These impacts are the same for the Proposed Action and Alternatives.

4.1.6 Impacts of Stranding Response and Research

The stranding research program of the MTRP has responded to sick, injured, or dead marine turtles in Hawaii since 1982. The stranding response and research has a minor short-term adverse impact from handling stranded sea turtles, but a moderate long-term beneficial effect on the sea turtle population by providing care to approximately 250 sea turtles per year and returning them to the wild. Necropsies of stranded turtles that are found dead provide information on species distribution, stock structure, sex ratio, health and disease, diet, age and growth, and cause of mortality and have been the source of data for numerous scientific publications (Work and Balazs 2002, Work et al. 2004, Work et al. 2005, Zug et

al. 2002, Chaloupka et al. 2008b). The collection of dead turtles in Hawaii provides a short-term benefit to the local community by reducing the adverse impacts to aesthetics and water quality that a decaying turtle would have on the environment. These impacts are the same for the Proposed Action and Alternatives.

4.1.7 Public Perception of Adverse Impacts to Sea Turtles During Research Activities

To prevent misconceptions by the public of potential harm inflicted on sea turtles during research activities, the MTRP has an active public outreach and education program providing pamphlets and literature at all active field sites. Informal and formal presentations at public events, schools, and hospitals are an active and continuous part of the program. The MTRP also supports an extensive marine turtle stranding network and the stranding hotline phone number is made available to the public through magnets, mailings, newspaper advertisements, phonebook listing, television public service announcements, and through long-term cooperation with state agencies. All persons who call the stranding hotline or who are encountered in the field are offered a full explanation of research and conservation activities and their purpose, as well as educational sea turtle literature. As a result of directed outreach effort on turtle research activities, we anticipate minimal, if any, adverse public opinion associated with these activities. These impacts are the same for the Proposed Action and Alternatives.

4.1.8 Impacts of Satellite Tags and Time-depth Recorders

During nesting surveys, satellite tags, time-depth recorders, or both are deployed on green turtles. These instruments are vital in determining habitat use, migration routes between breeding and foraging grounds (Balazs and Ellis 2000), daily and seasonal use of foraging and resting habitat, and localized movements of breeding males and gravid females between nesting and breeding sites and associated basking sites. Installation of these instruments during nesting surveys has a minor adverse short-term impact on sea turtles because the turtles need to be temporarily restrained. The attachment of satellite tags to the shell of a sea turtle may potentially interfere with mating or cause increased drag to sea turtles while they swim. Females with satellite tags from previous years have been observed nesting, however, and post hatching nest inventories indicated these nests contained fertilized eggs (S. Hargrove, pers. comm., July 2010). Certain transmitters, if improperly attached, because of their size, position, and weight increase drag and may substantially interfere with normal migration patterns, disrupting mating (Jones and Seminoff *in press*). To avoid these pitfalls, we follow the recommendations of Jones (2010), to use an array of smaller transmitters (no larger than 6cm x 3cm x 10cm), and apply attachment methods to reduce additional drag. Thus, applying smaller transmitters in the proper methodology diminishes the probability that the animals will be adversely affected. Satellite tags remain on a turtle for less than two years and only four, or 2-3%, of turtles are fitted with satellite tags. Therefore, the attachment of satellite tags to sea turtles results in minor long-term adverse impacts to sea turtles. These impacts are the same for the Proposed Action and Alternative B.

Under Alternative C, an additional 10 turtles may be fitted with GPS tags, within a one year period. Tags would remain on for less than two years. The additional number of turtles tagged would result in a slightly greater magnitude of minor long-term adverse impacts to sea turtles.

4.1.9 Euthanizing Individual Sea Turtles

Humane euthanasia is only performed by a licensed veterinarian if he determines that an individual cannot survive or function in the wild. These animals are typically in extremely poor health and in a condition beyond treatment. Examples of such cases include animals severely afflicted with FP for which there is no cure, or animals with severe physical trauma beyond repair because of shark attack or boat strike. In such cases, euthanasia is performed for humane reasons and the animal is used for furthering scientific understanding of marine turtle disease and basic biology. The adverse impacts of humanely euthanizing sea turtles that are beyond treatment and incapable of surviving in the wild is negligible. These impacts are the same for the Proposed Action and Alternatives.

4.2 Impacts to the Environment

4.2.1 Impacts to Algae and Sea Grass Populations

Green turtles in Hawaii feed primarily on algae and, to a lesser degree, sea grass. Sampling algae and sea grass from foraging grounds is useful for studies such as diet, growth rates, and FP disease. Samples collected would amount to < 1 kg per 100 meter transect per day of study. Up to four transects are sampled per study day. Samples are collected in accordance with guidelines set forth by the State of Hawaii, Department of Land and Natural Resources, Hawaii Fishing Regulations. Algae samples are hand-clipped as required by the regulations, not taken by the holdfast, causing no adverse impact to any algal population. Algae found in green turtle diets can grow at least 10-12% per day, easily replacing any loss from collecting activities (Russell and Balazs 1994). Therefore, the direct adverse short-term impacts of collecting algae samples are minor and the indirect impacts are negligible. These impacts are the same for the Proposed Action and Alternatives.

4.2.2 Potential to Spread Invasive Species

A number of plant and animal species have previously become established on various islands in the NWHI. Alien species can have a profound effect on the native flora and fauna of the NWHI by outcompeting, preying on, and replacing native species, as well as providing habitat for non-native species, requiring large-scale efforts to eradicate these species, although with mixed results.

Strict procedures are used to minimize the potential introduction of alien species by research activities conducted at the remote field sites. All tents are placed and all work is done on the perimeter of the island, generally seaward of the vegetation zone. Stringent protocols are used to ensure that no species are introduced to the islands. These protocols include:

1. 48-hour freezing of all non-sensitive food and equipment,
2. Removal of all packaging materials which may harbor foreign plants or animals;
3. Packing all food, personal effects, and small equipment in plastic bags which are in turn placed in sterilized 5-gallon plastic buckets;
4. Packing all large equipment in either plastic cases or pallet tubs, all of which are fumigated prior to landing;

5. All soft gear (**e.g.,** daypacks, straps, nets, bags, bedding, tents, clothing, footwear) used at each field site is either new or has not been used at any other location; and no use of any fresh food item which either may become established (tomatoes, sunflower, mustard, or alfalfa seeds) or foods which may harbor molds or fungi will be used.

All quarantine and transport procedures between and among NWHI sites are stipulated as Special Rules and Conditions attendant to all permits issued by the Monument, and such procedures will therefore be followed as part of the action.

To prevent spreading invasive species or pathogens within the Main Hawaiian Islands, gear/equipment is not loaned to other projects and it is not used outside of the Main Hawaiian Islands. All gear is cleaned after each use to prevent transfer of organisms between sites.

Therefore, the direct and indirect impacts of invasive species resulting from the proposed action and alternatives are negligible.

4.2.3 Impacts of Nesting Research on Hawaiian Monk Seals

The MTRP has conducted nesting beach research on East Island at FFS every year since 1973. Two researchers are deployed to FFS during the peak of the nesting season, June and July, for approximately 6 weeks to count, tag, identify, measure, and sample nesting females. One person at a time camps at East Island to conduct the field research, while the other is stationed at Tern Island to perform data entry. The two researchers alternate shifts on East and Tern Islands approximately every 4 days. A series of full-season saturation surveys were conducted from 1988-1992, where complete coverage of the nesting season (approximately 120 days) at East Island was achieved (Wetherall et al. 1998). The saturation surveys provide detailed information on the nesting biology of Hawaiian green turtles and updated values for basic biological parameters. One factor that influenced MTRPs decision to minimize the sampling period of the green turtle nesting research season was the strain of staffing more people at FFS during the monk seal pupping season, which coincides with the green turtle nesting season. Since then, standard operating procedures (see Section 2.1.3.3) have been adopted to avoid and minimize disturbance to other species, especially monk seals, while conducting marine turtle research. Prior to deployment, each MTRP researcher must undergo training in standard operating procedures for avoiding impacts to monk seals during MTRP activities. Any sea turtle monitoring activities that would directly affect monk seals are aborted until it is clear to return at a later time.

Currently, monk seal field campers are stationed at FFS from May through September and use small boats to make daily transits between islands. While the majority of monk seal researchers do not actually camp on the islands, special situations have required camping at times. USFWS personnel and volunteers are present at FFS year round.

While the MTRP does not currently conduct marine turtle nesting research on other atolls in the NWHI, it has been done in the past and there may be a need to do it in the future. Monk seal researchers camp at each atoll in the NWHI from May through September and at certain atolls year round. If marine turtle researchers were to expand efforts beyond FFS, the same measures employed at FFS to minimize impacts on other species would be adopted for new locations.

Through the implementation of the standardized avoidance and minimization measures, the direct adverse short-term impacts to Hawaiian monk seals are minor and the indirect impacts are negligible. These impacts are the same for the Proposed Action and Alternatives.

4.2.4 Impacts of Nesting Research on the Physical Resources in the PMNM

The proposed action includes continuous nesting surveys on East Island at FFS for up to 45 days during the summer. East Island is a coral rubble island with no infrastructure and sparse vegetation. Each researcher spends approximately 4 days camping on the island during the nesting season, before rotating with a person stationed on Tern Island. The camping is rudimentary with no electricity or fire. Tern Island has permanent buildings (former Coast Guard barracks), solar panels, a reverse-osmosis water supply system, a runway, a septic system, a small-boat dock, and internet capabilities. Supplies (i.e., all food, water, and sundries) are ferried between Tern and East Islands on small boats. The small boat operators are trained to avoid the corals located between the islands, thereby avoiding direct adverse impacts with the reef. The small boats are maintained in good working order to avoid spills and breakdowns. The boats have the direct adverse impacts of emitting combustion pollutants in the air, but these emissions are negligible considering the small size of the boat engine, infrequent trips between islands, and lack of other emitters in the region. While camping on East Island in a tent, the researchers rely on imported food and collect all trash and other waste. After the nesting surveys are completed, all equipment and supplies are removed from East Island and either sent back to Honolulu or stored on Tern Island until the next season. Therefore, the direct and indirect impacts to the physical environment (i.e., air, water, and soil) are minimal because of the short-term presence on East Island, small-scale tent camping, and removal of all supplies upon completion. These impacts are the same for the Proposed Action and Alternatives.

4.2.5 Impacts on Seabirds

The proposed action will occur along the coast and in the ocean where seabirds will be encountered. However, the Proposed Action does not involve killing, capturing, or intentionally disturbing any seabirds. Seabirds may be indirectly adversely affected by sea turtle survey and capture activities that involve walking along a beach where seabirds are roosting. Surveys and stranding response activities will avoid seabird nests because seabirds generally nest on vegetation or on higher elevation ground where sea turtle do not nest and bask. Overall, these adverse impacts will be short-term, temporary, and negligible because any bird flushed by such activities would either return to the site after the researcher has passed, or the bird would occupy another section of beach. Surveys at FFS are much more likely to temporarily flush seabirds given that many thousands of seabirds breed on FFS each year. To a certain degree the seabirds at FFS have become accustomed to the presence of humans on FFS. Currently NMFS and USFWS staff occupy the island, and each year most birds are captured and tagged by USFWS biologist.

With Alternative B, wild live predatory birds (e.g., frigatebirds), would be captured and forced to regurgitate their crops. No more than 200 birds would be studied during the peak hatching period. After capture, birds will be released on site and mortality is not expected. Therefore the direct adverse short-term impacts to frigatebirds would be minor.

4.2.6 Impacts on Cultural Resources

Island and coastal communities in the U.S. Pacific region are intricately connected with the coral reef ecosystems that surround them. Much of the mythology, legends, and customs of native islanders encompass the surrounding marine environment as crucial components of life, especially sea turtles. Local coral reef resources provide food, cultural activities, subsistence, and revenue through artisanal, recreational, and commercial fisheries. Indigenous Pacific Island communities have a strong cultural and economic dependence on the marine environment. Traditional Hawaiian fishery management activities centered on strictly enforced social and cultural controls on fishing. These fishery management activities were based on time and area closures to keep fisheries from disturbing natural processes and habitats of food resources considered important. Recently, the cultural focus has been reinforced when the state of Hawaii supported the development of community-based subsistence fisheries areas in a few communities. Fisheries management plans have been prepared by these communities and are based on integrating traditional observational methods and modern scientific techniques. Traditional fishing activities are used to restore community values and stewardship while revitalizing a locally sanctioned code of fishing conduct.

Ancient Hawaiians developed a special relationship with the land and sea, which provided them with sustenance and recreation, molded their cultural values, and cultivated their deep connection to ecosystems. Fishing, gathering of ocean algae (*limu*), and subsistence use of ocean resources have been a traditional way of life for native Hawaiians. Fishes also provided the primary source of protein in the Hawaiian diet. The strict enforcement of traditional *kapu* system (forbidden or taboo) was an effective control to prevent overharvesting of ocean resources. *Kuleana* (responsibility), which interweaves honor and duty, describes the approach to Hawaiian resource management, and reinforces the idea of resource stewardship as opposed to resource management.

The longest recorded traditional Hawaiian chant, the *Kumulipo* (source of deep darkness) is a history of how all life forms came and evolved, beginning with the coral polyp as the building block of all life. This creation chant tells the story of Native Hawaiians' ancestral connection with the gods who created the coral polyps, the NWHI, which are seen as *kūpuna* (or respected elders), and everything else in the Hawaiian Archipelago, including Native Hawaiians. The symbolism of the union of earth mother, Papahānaumoku, and sky father, Wākea, is the foundation for the name of the Papahānaumokuākea Marine National Monument.

Punalu'u beach on the island of Hawaii has been an MTRP study location and is the setting for the most well known Hawaiian sea turtle legend (Balazs et al. 1994). As documented by Hawaiian historian Mary Kawena Pukui, in ancient time two sea turtles (honu-po'o-kea and honu-'ea) came to Punalu'u beach where the mother gave birth to an egg she buried in the sand. With her digging, the mother released a freshwater spring that is seen today. Later, the mother's egg hatched becoming the "turtle girl" named Kauila. Kauila the turtle was able to assume human form and play with local children, but would change into a turtle again before going back into the water. "Children used to catch fish and shrimp in the spring, and Kauila watched lest the little ones fall in. The people loved Kauila for this and because her

spring gave them drinking water" (Handy et al. 1972). Local Hawaiians believe Kauila's presence can still be felt at Punalu'u today and that Kauila is the "mystical mother" of all Hawaiian sea turtles.

The MTRP research program recognizes the human cultural and the ecological importance of marine turtles and near-shore ecosystems to Pacific Island cultures. All MTRP personnel are briefed according to local cultural histories and practices to raise appropriate awareness and sensitivity. The MTRP works with the public and local volunteers to avoid and minimize any misconception of the research that the public may have. While these research and stranding response activities have minor short-term, temporary direct adverse impacts on individual sea turtles, the long-term beneficial effects of a greater scientific understanding of the species will contribute to their recovery and therefore be considered a moderate beneficial effect on this cultural resource.

4.3 Cumulative Impact Analysis

The Council on Environmental Quality (CEQ) defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). The size of the Pacific Islands Regions is enormous – the U.S. Exclusive Economic Zone within the Pacific Islands Region covers approximately 1.5 million square nautical miles. While the proposed action includes research, stranding response, and technical collaboration within this entire region, each activity is implemented on a small-scale (e.g., only a few researchers at any one time capturing and measuring a single sea turtle) and for a short time period (e.g., a stranding response may take a couple of hours). Over the last 38 years the MTRP, in conjunction with its collaborators, has witnessed a moderate long-term beneficial impact of the program on green sea turtles as documented by the steady increase in their population in the Hawaiian Archipelago. Still, the five federally listed sea turtle species have not met their recovery goals.

4.3.1 Impacts of Past Actions within the Scope of Analysis

The first human inhabitants of the Hawaiian Islands were Polynesian explorers more than 1,500 years ago. When Captain James Cook arrived in Hawaii in 1778 several hundred thousand Hawaiians lived in the MHI. At that time, the NWHI were unpopulated (Cleghorn 1988). However, prior to Cook's arrival, the islands of Nihoa and Mokumanamana in the NWHI were visited by people from the MHI. Most notably, people sailed frequently between communities located on Niihau, Kauai, and Nihoa Islands (PMNM 2008). It is believed that Nihoa supported a permanent population for several hundred years as evidenced by archeological sites that include substantial habitation sites and agricultural terraces (Cleghorn 1988). Meanwhile, Mokumanamana was believed to be only temporarily inhabited for cultural and religious purposes (Cleghorn 1988). Both islands contain many religious structures such as heiau (places of worship) and platform foundations with upright stones that mark the important journey of the sun through the seasons (PMNM 2008). Nihoa and Mokumanamana Islands also provided valuable natural resources such as birds, bird eggs, loulu palm wood, makiukiu grass, and fish (PMNM 2008).

Since their discovery, the shallow coral atolls of the NWHI have been the sites for many shipwrecks (PMNM 2008). Often stranded sailors slaughtered and ate green sea turtles and Hawaiian monk seals to survive. The first shipwreck on FFS was in 1786. Other early inhabitants of the atoll included feather hunters, sealers, whalers, guano miners, and fishermen. More recently East Island, and then Tern Island, was home to a Coast Guard long-range navigation transmission (LORAN) station. A runway was constructed on Tern Island by the Navy in 1940. After the Navy's departure, the runway was used to transport sea turtles to market. Sea turtles were actively harvested for their meat and shells until 1978 when they were listed on the Endangered Species List. Since 1978 the number of nesting female green sea turtles at FFS has continued to increase (Figure 4).

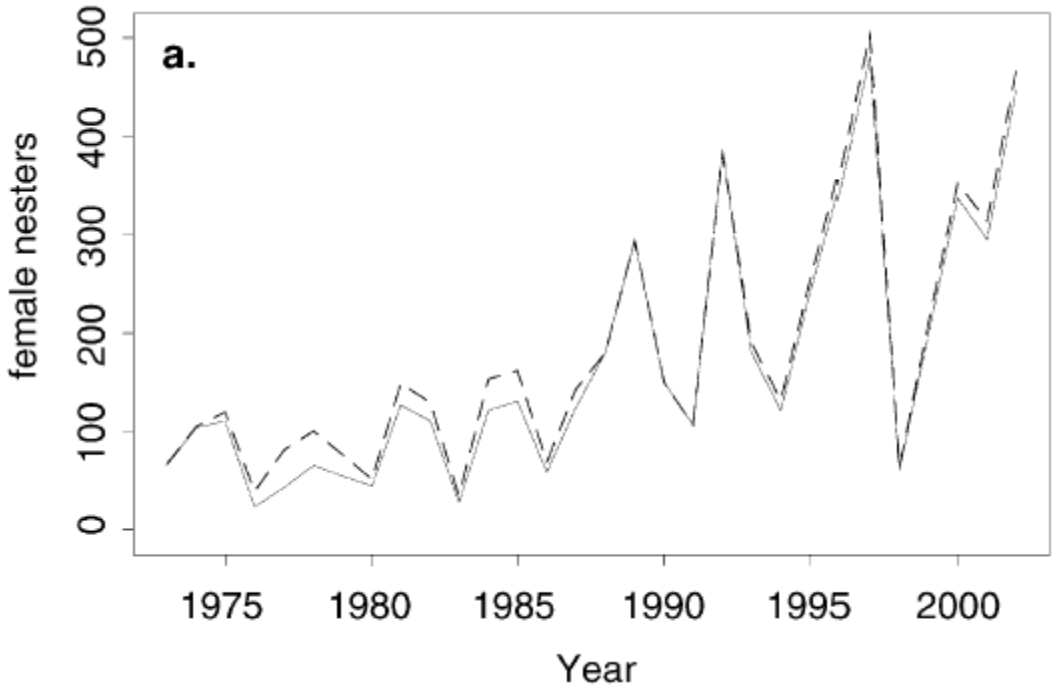

Figure 4. Trends in French Frigate Shoals Green Turtle Nester Abundance (from Balazs and Chaloupka 2004).

These data document the steady increase in the green sea turtle population. The MTRP has conducted nesting surveys on East Island at FFS for 38 consecutive years and provides a critical index of abundance for the Hawaiian green turtle stock. New turtles are tagged, measured, and sampled (i.e., tissues are taken for genetic analysis and health assessments such as FP tumors), and tags of previously tagged turtles are recorded. Research on the MHI has similarly captured, tagged, measured and sampled thousands of green sea turtles in the MHI (Figure 5).

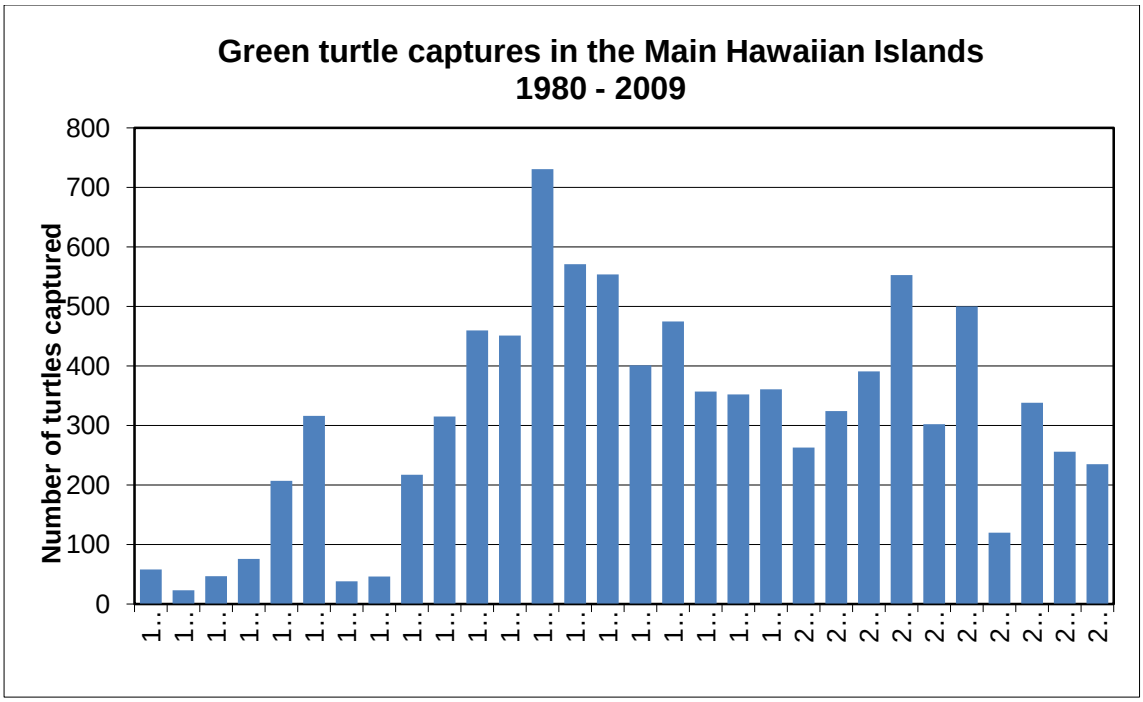

Figure 5. Number of green sea turtle captured during the year (some caught more than once per year).

As a complement to the nesting, foraging, and resting habitat research surveys, the MTRP has responded to sick, injured, and dead sea turtle strandings in the Hawaiian Archipelago. From 1982 through February 2006, the MTRP collected information from 4,451 stranded turtles. Of these individuals, 135 (3 %) were previously tagged by the MTRP. The most common cause of mortality among tagged turtles was FP (21%). Recent trends in the diversity and abundance of sea turtles cared for in the stranding response program is shown in Table 4. Green turtles make up the largest proportion of strandings in Hawaii, with only incidental strandings of hawksbill, olive ridley, loggerhead, and leatherback turtles, which is assumed to be representative of their presence.

Table 4. The number and species of sea turtles stranded in the Hawaiian Islands.

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Green turtle	260	250	269	274	263	288	256	267	237	245
Hawksbill	5	4	5	3	4	7	6	9	6	5
Olive ridley	6	0	1	4	3	0	1	1	1	0
Loggerhead	1	0	0	0	1	0	0	0	0	0
Total	271	254	275	281	270	295	263	277	244	250

4.3.2 Impacts of Present Actions within the Scope of Analysis

PIFSC currently conducts a number of research projects in the Pacific Islands Region. The research is divided over several disciplines including oceanography, fisheries, coral reefs, marine mammals, and sea turtles. Given the long-distance migrations of many pelagic species, and the vital ecological and commercial role that marine resources serve, the PIFSC works with a number of local (e.g., fisherman, universities), national (e.g., U.S. Fish and Wildlife Service), and international (e.g., foreign educational institutes) collaborators.

PIFSC oceanographic research spans the Pacific Islands Region and includes both insular and pelagic habitat and ecological research. Oceanographic data collection generally involves measuring ocean and atmospheric variables using several different platforms. Ship-based instruments, such as CTD systems and echosounders, are used to measure ocean conditions ranging from temperature to micronekton density. Submersibles and remotely operated vehicles are used to collect data in remote parts of the Pacific Ocean. The majority of oceanographic research has negligible direct impact on marine resources because it conducted using remote sensing technology. The collection of small amounts of ocean water, such as samples used to study plankton, have minimal, localized, and only temporary adverse impacts on the ocean and negligible impacts on sea turtles.

PIFSC fisheries research involves collecting and analyzing data on the regional fisheries. Data are collected from the log books of fishing vessels, during targeted fishing surveys, and through socio-economic studies of the fishing industry. One of these programs specifically measures the bycatch of sea turtles, seabirds, and marine mammals in the regional fisheries and identifies methods to minimize this incidental capture. These bycatch reduction efforts have a small though beneficial effect on the environment in general and sea turtles in particular. The largest potential for direct and indirect adverse impacts to the environment is from the active fishing data collection component. However, these fishing activities are conducted infrequently, on a very limited scale, and targeted to the species being studied thereby resulting in only short-term temporary adverse impacts to marine resources. The potential direct and indirect adverse impacts of the fisheries research on sea turtles is negligible.

PIFSC coral reef research focuses on long-term ecological monitoring surveys, biodiversity research, and marine debris removal. These activities occur across the Pacific Islands Region. Surveys are conducted from research ships using echosounders, autonomous underwater vehicles, and cameras, or underwater by SCUBA divers and snorkelers. In general, research cruises range for couple days to couple months in length, and occur a few times per year. A number of instruments are also temporarily deployed on the ocean floor to remotely study coral reef communities and ecological processes. These include: ecological acoustic recorders, autonomous reef monitoring structures, calcification acidification units, acoustic Doppler current profilers, wave and tide recorders, ocean data platforms, and transect markers. These instruments may be temporarily secured to the substrate using metal stakes or heavy weights. During monitoring surveys voucher specimens of algae, invertebrates, substrate, fish, and coral are collected for identification and genetic analysis. The voucher samples are collected on a small scale and

represent a fraction of the biomass being studied. Occasionally, cores of corals are collected and analyzed using computed tomography (CT or CAT) scans. These cores are only taken from massive corals by skilled biologist to analyze growth patterns to minimize impacts. Marine debris removal has a short-term adverse on coral reefs because pieces of the reef may be broken when derelict fishing nets and fishing line are removed, however there is long-term beneficial effect on the coral reefs and marine life after the debris is removed from the ecosystem. Sea turtles may be encountered during the monitoring surveys, but the direct and indirect adverse impacts of coral reef research on sea turtles will be negligible.

PIFSC marine mammal research focuses on cetaceans (i.e., whales and dolphins) of the central and western Pacific Ocean, as well as Hawaiian monk seals in the Hawaiian Archipelago. Cetacean abundance and distribution surveys are conducted aboard ships and boats using visual and acoustic scan. Passive acoustic surveys of cetaceans are conducted by temporarily deploying a high-frequency acoustic recording package on the ocean floor. Genetic samples are episodically collected by taking a small piece of skin without long-term harm to the animal. The Hawaiian monk seal research includes field camps in the NWHI and surveys in the MHI. Sea turtles have been and will be encountered during the marine mammal monitoring surveys. These encounters result in no greater than short-term disturbance and it is unlikely the research will have any long-term or indirect adverse affects to sea turtles because the biologist are trained to minimize interactions with sea turtles.

The U.S. Fish and Wildlife Service and State of Hawaii, Department of Land and Natural Resources, also staff field camps in the NWHI to collect ecological data and conduct other management activities. The U.S. Fish and Wildlife Service works on FFS, Midway Atoll, and Laysan Island in conjunction with NMFS. The focus of USFWS research is seabirds, while the focus of their ecological restoration is the revegetation of native plant communities. Seabirds are a natural predator of recently hatch sea turtles. The State activities are based on Kure Atoll and they work with both the USFWS and NMFS to collect ecological data, conduct revegetation activities, and remove marine debris. These activities in the NWHI are regulated by the Papahanaumokuakea Marine National Monument. Access to the Monument and each research site is by ship, small boat, or airplane (i.e., to runways located on Tern Island at FFS and on Sand Island at Midway Atoll). The principle ships used as a platform for the research are NOAA research vessels Oscar Elton Sette and Hi'ialakai. Occasionally chartered ships are used to conduct the necessary support trips. Small boats (approximately 20 feet in length) transport people and gear from the ships at sea to the islands when there are not dock facilities. Each NOAA ship spends approximately 100 days per year in the PMNM. The diesel-powered ships operate as efficiently as possible (i.e., drives directly from point to point) to minimize fuel consumption because supplies are limited in this remote area. Consequently, the amount of diesel air pollution (e.g., NOx, SOx, particulate matter) is negligible, especially considering the vast size of the Pacific Ocean and lack of other air pollution emitters in the island region. Furthermore, the State of Hawaii is considered to have one of the best air quality records in the nation, with criteria pollutant levels below state and federal ambient air quality standards (Hawaii 2007). The contribution of these few research ships to greenhouse gas emissions is negligible relative to other emitters. Given that the ships rarely anchor when stopped to conduct small boat operations (e.g.,

on- and off-loading supplies), impacts to coral reef habitat is avoided. The ships are equipped with Type 2 marine sanitation device wastewater treatment systems. To minimize the short-term adverse impacts to water quality, treated wastewater is discharged outside of Special Preservation Areas and Special Management Areas (PMNM 2008). These direct adverse impacts to water quality are negligible considering the relatively small size of the ships, limited number of sea days, and volume of water in the Pacific Ocean. The number of ship days in the MHI is small fraction of the commercial and recreation shipping industry ship days. The ships are relatively slow, cruising at less than 10 knots. The small boats similarly operate at slow speeds and are required to look for sea turtles swimming in their path so that they can be avoided. There are approximately 70 flights into the Monument per year by airplane. Researchers that live on each island for one to six month periods are required to abide by strict conditions. All food and most of the water is imported. The remaining water is generated by reverse-osmosis. The researchers burn a limited supply amount of propane to cook and generate electricity. The direct and indirect adverse impacts of non-MTRP research activities in the NWHI on sea turtles is minor.

Within the Pacific Ocean a number of other public and private organizations also conduct sea turtle research under the jurisdiction of NMFS. A review of the NMFS Authorizations and Permits for Protected Species (APPS) website (accessed May 11, 2011, last updated February 2, 2011) identified a total of eight permits (Table 5). Stretching approximately 6,000 miles from CNMI to California, these permits cover all five listed sea turtle species.

Table 5. NMFS APPS active listed sea turtle research permits in the Pacific Ocean.

File Number	Project Title	Organization	Location	Expiration	Species
10027	Research in the Palmyra Atoll National Wildlife Refuge	American Museum of Natural History	Palmyra Atoll	7/31/2013	Green and hawksbill sea turtles
14097	NMFS SWFSC pinniped, cetacean, and sea turtle studies	SWFSC	North Pacific Ocean	6/30/2015	Green, hawksbill, leatherback, loggerhead, and olive ridley sea turtle
14381	Sampling sea turtle bycatch in the Hawaiian longline fisheries	PIRO	Hawaiian and American Samoa longline fishery	3/1/2015	Green, hawksbill, leatherback, loggerhead, and olive ridley sea turtle
14510	Scientific research in Sam Gabriel River and Los Alamitos Bay, CA; strandings; and power plant entrainments	SWFSC	Coastal California	4/30/2015	Green, hawksbill, leatherback, loggerhead, and olive ridley sea turtle
1556	Scientific Research	CNMI	Saipan, Tinian, and Rota	6/1/2011	Green and hawksbill sea turtles
1581	Scientific Research	PIFSC	Hawaiian Islands	12/31/2011	Green and hawksbill sea turtles
1591	Scientific Research	SWFSC	San Diego Bay, CA	10/31/2011	Green, loggerhead, and olive ridley sea turtle
1596	Scientific Research	SWFSC	Pacific Ocean	2/1/2012	Leatherback sea turtle

Non-research activities within the Pacific Islands Region that occur in vicinity of the Proposed action range from commercial fisheries, to trans-Pacific commercial shipping, to recreational activities such as fishing, boating, and snorkeling. In particular, the incidental capture (i.e., bycatch) and mortality of sea turtles in commercial fisheries has been well documented (Lewison and Crowder 2007). Sea turtles are either caught directly in fishing gear by hooks or in nets (both gillnets and trawlnets), or indirectly in derelict fishing gear floating in the ocean. Commercial fisheries in the Pacific Ocean for highly migratory species (e.g., tunas and billfish) are managed by the Western and Central Pacific Fisheries Commission because they cross international boundaries. Commercial domestic fisheries (i.e., fisheries within the U.S. Exclusive Economic Zone) are managed by the NMFS Pacific Islands Regional Office and Western Pacific Regional Fisheries Management Council. Historically, fisheries in the Western Pacific Region were managed with species-specific Fishery Management Plans (FMP) (i.e., Pelagics, Bottomfish and Seamount Groundfish, Crustaceans, Precious Corals, and Coral Reefs), but beginning in 2010 are being managed under Fishery Ecosystem Plans (FEP) (WPRFMC 2009). These FEPs include: the Hawaii Archipelago, American Samoa Archipelago, Mariana Archipelago, Pacific Remote Islands Areas, and the Pacific Pelagic. These FEP are intended to accomplish the objectives of the Magnuson-Stevens Act through the incorporation of ecosystem science and principles. Furthermore, each of these organizations has implemented measure to reduce the bycatch of sea turtles. For example, in Hawaii sea turtle bycatch was reduced in the longline swordfish fishery by replacing traditional J-hooks with circle, and squid bait with fish bait, while maintaining target species catch rates (Gilman et al. 2007). Furthermore, the WPRFMC has banned the use of drift gillnets and increased the number of trained observers on fishing boats. PIFSC and PIRO also actively search for and remove marine debris from within the Pacific Islands Region. Together, these management activities and the MTRP stranding response program have reduced the unintentional mortality of sea turtle compared with historical levels.

4.3.3 Reasonably Foreseeable Actions in Scope of Analysis

This level of PIFSC research will likely continue into the near future given the existing statutory requirements and Executive Orders for fisheries, coral reefs, marine mammals, and sea turtles. It is also anticipated that the same non-federal actions will continue into the future. No information is available to suggest these actions will change substantially in the reasonably foreseeable future that would be related to sea turtles.

5 Environmental Permits and Regulatory Requirements

MTRP activities conducted within the land and waters in the jurisdictions of marine protected areas, marine national monuments, wildlife refuges, or areas managed by federal, state, or local agencies will be conducted under established scientific research and collection permits issued by the responsible managing agencies. These include:

5.1 Activities in the United States, the U.S. Insular Areas, or upon the high seas

5.1.1 Endangered Species Act

Research that would "take" (i.e., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct) a federally threatened or endangered species for scientific purposes or to enhance the propagation or survival of listed species:

- Section 10(a)(1)(A) Permit from NMFS or USFWS.

  The NMFS Protected Resources Division issued a Section 10(a)(1)(A) permit to the MTRP on December 13, 2006. The permit includes water-based activities for green and hawksbill sea turtles and is valid until December 31, 2011, (renewed every 5 years). The USFWS issued a Section 10(a)(1)(A) take permit (TE739350-4) for hawksbill sea turtles on December 4, 2007. The permit is valid until December 4, 2011. The USFWS confirmed on May 26, 2011 that the take of green sea turtles on land (i.e., nesting surveys) in the State of Hawaii is covered by the exceptions to prohibitions relating to threatened sea turtles for research or conservation (50 CFR 223.206(a)(2)(c) and 50 CRF 17.31(b)).

Any federal action that may affect a federally listed threatened or endangered species or its designated critical habitat:

- Section 7 Consultation with the National Marine Fisheries Service or U.S. Fish and Wildlife Service. An action that may adversely affect a listed species requires formal consultation, which concludes with a biological opinion (BO; states the opinion of the Service as to whether or not the Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat). A BO may include an incidental take statement for an otherwise legal action.

  Critical habitat has not been designated for any of the five sea turtles within the boundary of the proposed action. The MTRP has established (in cooperation with the Hawaiian monk seal research program at PIFSC) and implements standard practices to avoid harassing or taking Hawaiian monk seals. On June 13, 2011, NMFS PIRO concurred with the MTRP determination that that the annual nesting survey at FFS is not likely to adversely affect the Hawaiian monk seal or its designated critical habitat.

The proposed action would not be located near the federally listed Nihoa finch, Nihoa millerbird, or Laysan finch, therefore would not affect these species.

5.1.2 Animal Welfare Act

Research that would use live marine mammals or sea turtles may require a:

- Approved Protocol and Assurance from the Animal Care and Use Committee (IACUC).

  The MTRP has an approved IACUC protocol dated July 1, 2010 (renewed annually).

5.1.3 Marine Mammal Protection Act

Research that would "take" (i.e., harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal) an ESA-listed marine mammal or involve Level A Harassment (i.e., has the potential to injure a marine mammal or marine mammal stock in the wild) of a non-ESA-listed marine mammal for scientific or enhancement purposes:

- Scientific Research and Enhancement Permit from the NMFS.

Research that would involve Level B Harassment (i.e., has the potential to disturb a mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild) of a non-ESA-listed marine mammal:

- General Authorization from the NMFS.

For maritime activities that may result in the incidental take of a marine mammal:

- Incidental Take Authorization or Letter of Authorization (LOA) from NMFS.

For maritime activities that may incidentally take small numbers of marine mammals by harassment (i.e., any act of pursuit, torment, or annoyance).

- Incidental Harassment Authorization (IHA) from NMFS.

  The MTRP has established (in cooperation with the Hawaiian monk seal research program at PIFSC) and implements standard practices to avoid harassing or taking Hawaiian monk seals.

5.1.4 Migratory Bird Treaty Act

Research that would take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter any migratory bird, or the parts, nests, eggs, or product.

- Scientific Collecting Permit from USFWS.

The proposed action would not, nor attempt to, take or possess any migratory birds or products. Under Alternative B, a scientific collecting permit would be necessary to capture frigatebirds.

5.1.5 Magnuson-Stevens Fishery Conservation and Management Act

Research that may adversely affect Essential Fish Habitat (EFH) in the U.S. Exclusive Economic Zone requires consultation with NMFS. EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EFH has been designated for the Pelagics, Bottomfish and Seamount Groundfish, Crustaceans, Precious Corals, and Coral Reef Ecosystems Management Unit Species. Within the Pacific Islands Region, this designated EFH includes the water column down to 1,000 meters and other specific habitats within that range.

- EFH Conservation Recommendations from NMFS.

  The proposed action would not adversely affect EFH because it only involves short-term temporary data collection activities in the Pacific Ocean.

5.1.6 Clean Water Act

Research that involves discharging dredged or fill material (e.g., placing rock or concrete) into waters of the U.S. may require a:

- Section 404 permit from the U.S. Army Corps of Engineers.

  The proposed action would not discharge dredged of fill material into waters of the United States.

5.1.7 River and Harbor Act

Research that involves work (e.g., placing equipment on the sea floor or in the water column) that could affect navigation, or the construction or maintenance of structures such as any permanent mooring structure may require a:

- Section 10 permit from the U.S. Army Corps of Engineers.

  The proposed action would not involve work or structures in navigable waters of the United States.

5.1.8 Papahānaumokuākea Marine National Monument (PMNM)

All activities within the PMNM require a permit and must be categorized under one of six permit types: research, education, conservation and management, Native Hawaiian practice, special ocean use, and recreational (Midway only). Research within the PMNM may require a:

- Research, or Conservation and Management Permit issued by Co-Trustees of the PMNM.

The proposed action has been included as part of the annual Conservation and Management Permit.

5.2 Activities in the Hawaiian Islands

5.2.1 Hawaii Revised Statutes and Administrative Rules

Research in Hawaii state waters that collects aquatic life or uses certain fishing gear and methods may require a:

- Special Activity Permit from Hawaii Department of Land and Natural Resources, Division of Aquatic Resources.

  The MTRP has received a Special Activity Permit No. 2011-03 for scientific activities on sea turtles in state waters through June 30, 2011, (renewed annually), per Hawaii Revised Statute 187A-6.

6 List of Agencies and Persons Consulted

6.1 Federal Agencies

6.1.1 National Oceanic and Atmospheric Administration

- Ms. Patty Miller, HIHWNMS, Maui: Coordinates volunteers for stranding response on Maui.
- Mr. Justin Vizbeicke, HIHWNMS, Kona: Coordinates volunteers and provides stranding response in Kona.

6.1.2 U.S. Geological Survey

- Dr. Thierry Work: Veterinarian, Wildlife Disease Specialist; conducts necropsies, performs euthanasia, participates in ocean capture research.

6.1.3 U.S. Fish and Wildlife Service

- Ms. Susan White, PMNM, Mr. Mike Silbernagle and Mr. David Ellis, James Campbell NWR, and Ms. Glynnis Nakai, Maui: All are involved in the coordination of nesting research activities in either the NWHI or MHI.

6.1.4 National Park Service

- Ms. Sallie Beavers, Kaloko-Honokohau National Historic Park: Long-term collaborator in ocean capture research.
- Mr. Will Seitz, Hawaii Volcanoes National Park: Manages Hawksbill nesting beach project on the Big Island. Provides MTRP with biological samples from nest remains and strandings.

6.2 State Agencies

6.2.1 State of Hawaii

- Mr. Alton Miyasaki, Department of Land and Natural Resources, Division of Aquatic Resources (DAR), Oahu: Provides assistance with State of Hawaii permitting.
- Mr. Skippy Hau, DAR, Maui: Strandings and nesting beach research on Maui.
- Mr. Don Heacock, DAR, Kauai: Strandings and nesting beach research on Kauai.
- Mr. John Coney and Dr. Jason Turner, University of Hawaii (UH) at Hilo: Big Island stranding response.
- Mr. Jeffrey Kuwabara, UH at Manoa, Marine Option Program: Coordinates student employees for after hours, weekend, and holiday stranding response on Oahu.
- Ms. Donna Brown, UH, Maui College, Marine Option Program: Coordinates student employees for stranding response on Maui.

6.3 Non-governmental Agencies

6.3.1 Local

- Mr. Alan Hong, Hanuama Bay, Manager: Collaborator on ocean capture research.

- Mr. Jeffrey Pawlowski, Sea Life Park Hawaii: Collaborator on research related to captive-bred and reared green turtles.
- Ms. Joanne Pettigrew, Malama na Honu (MnH): Non-profit group providing education outreach at Laniakea Beach on Oahu's north shore.
- Mr. Marc Rice, Hawaii Preparatory Academy: Long-term collaborator on ocean capture research and responds to strandings north of Kona.
- Dr. David Hyrenbach, Hawaii Pacific University: Collaborator on ocean capture research.
- Dr. Robert Morris, DVM: Contract veterinarian, provides veterinary care/treatment for sick or injured marine turtles.

7 List of Preparers

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