CHAPTER 2:

AFFECTED ENVIRONMENT

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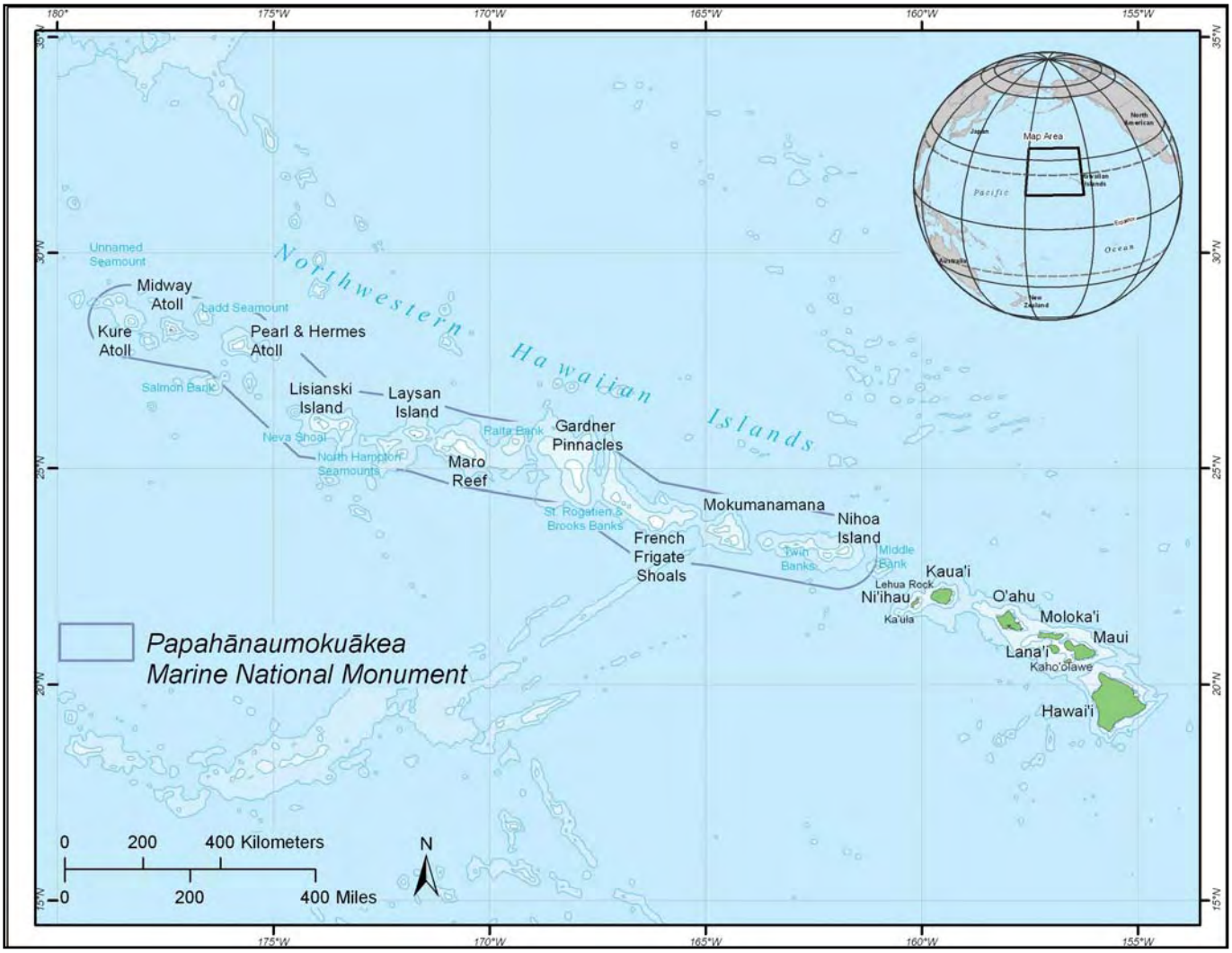
2.1 INTRODUCTION

This chapter describes the physical, biological, social, and economic conditions that occur within the region of influence (ROI) of the Proposed Action alternative. Only those conditions relevant to the Proposed Action alternative are presented. Resource areas discussed include natural resources, cultural and historic resources, human uses and activities, human health, safety, and hazardous materials, land use economic and social conditions, water quality, transportation and communications infrastructure, and utilities.

Chapter 2 is organized by resource area. Each resource area discussion includes an overview of the resource area with background on how the resource is related to the Proposed Action alternative, a general overview of relevant legislative requirements governing the resource, where applicable, and a discussion of the conditions of the resource within the ROI.

The ROI discussed in this report varies for each resource evaluated. For example, the ROI for water resources primarily includes those islands where specific actions take place, whereas the ROI for socioeconomics includes the entire state of Hawai‘i; therefore, the regions of influence are not the same for all potentially affected resource areas. Figure 2.1 includes the Northwestern Hawaiian Islands, the boundaries of the Monument, and the main Hawaiian Islands, all of which may be included in the ROIs for each resource area.

Figure 2.1 Hawaiian Archipelago Including the Northwestern Hawaiian Islands (Nihoa to Kure Atoll) and Main Hawaiian Islands (Hawai‘i to Kaua‘i). Inset shows the Hawaiian Archipelago in the Pacific Ocean.



2.2 NATURAL RESOURCES

2.2.1 Introduction/Region of Influence

The NWHI, together with the main Hawaiian Islands, are classified as the Insular-Pacific Hawaiian Large Marine Ecosystem (LME), one of 64 LMEs in the world (NOAA 2003a). Due to the interconnectivity between land and sea throughout the Hawaiian archipelago, the ROI for natural resources is the Insular-Pacific Hawaiian LME, which includes the Monument. The waters surrounding the NWHI support a diversity of marine life inhabiting a complex array of shallow and deepwater marine environments. Emergent lands include the many small islands and islets of the NWHI; these lands, the surrounding shallow reef, deepwater benthic, and pelagic habitats, form an integrated ecosystem that supports abundant endemic, threatened, and endangered wildlife.

2.2.2 Regulatory Environment

The natural resources within the Monument are protected under numerous federal and state laws and regulations, the most pertinent of which are as follows:

- Antiquities Act (16 USC 431-433);
- Presidential Proclamations 8031, June 15, 2006 (71 FR 36443) and 8112, February 28, 2007 (72 FR 10031);
- Papahānaumokuākea Marine National Monument codifying regulations (50 CFR Part 404);
- National Marine Sanctuaries Act of 1972, as amended (16 USC 1431-1445c);
- Endangered Species Act of 1973, as amended (16 USC 1531-1544);
- Marine Mammal Protection Act of 1972, as amended (16 USC 1361-1421h);
- Migratory Bird Treaty Act of 1918, as amended (16 USC 703-712);
- Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (16 USC 1801-1882);
- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee);
- Refuge Recreation Act of 1966, as amended (16 USC 460k-460k-4);
- Fish and Wildlife Act of 1956, as amended (16 USC 742a-742m);
- Fish and Wildlife Improvement Act of 1978, as amended (16 USC 742l);
- Coastal Zone Management Act of 1972, as amended (16 USC 1451-1465);
- Executive Order 13022—Administration of the Midway Islands, November 1, 1996 (61 FR 56875);
- Executive Order 13112—Invasive Species, February 3, 1999 (64 FR 6183);
- Executive Order 13089—Coral Reef Protection, June 11, 1998 (63 FR 32701);

- Executive Order 13158—Marine Protected Areas, May 26, 2000 (65 FR 34909);
- Executive Order 1019—Hawaiian Islands Reservation, February 3, 1909;
- Executive Orders 13178 and 13196—Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, December 4, 2000 (65 FR 76903) and January 18, 2001 (66 FR 7395);
- State of Hawaii Organic Act of April 30, 1900 (c339, 31 Stat.141 § 2) and Hawaii Admission Act of March 18, 1959 (Pub. L. 86-3, 73 Stat. 4 § 2);
- Constitution of the State of Hawai'i, Article XI, §§ 1, 2, 6, and 9 and Article XII § 7;
- Hawaii Revised Statues, Title 1, Ch. 6E; Title 10, Ch. 128D; Title 12, Chs. 171, 183C, 183D, 187A, 188, 190, 195D, 200; Title 13, Ch. 205A, and Title 19, Chs. 339, 342D, 343;
- Hawaii Administrative Rules, Title 11, Chs. 54, 55, 60.1, 200; Title 13, Chs. 5, 60.5, 75, 76, 124, 125, 221, 275, 277, 280, and 300;
- Hawaii Revised Statues Title 1, Ch. 6E, Sections 1,7,11,12, 43, 43.5, & 46.5 - Hawaii Historic Preservation Program; and
- Hawaii Administrative Rules, Title 13, Ch. 275 - 284, & 300—Hawaii Historic Preservation Assessment Guidelines.

2.2.3 Resource Overview

Natural resources of the Monument are described in detail in the Monument Management Plan. This section provides an overview of the terrestrial and marine resources and special status species in the ROI.

2.2.3.1 Terrestrial Resources

There are ten main islands and atolls in the NWHI. The two southernmost islands, Nihoa and Mokumanamana, are basaltic islands. 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. 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. Included in the 5.5 million seabirds that nest on these islands annually are more than 95 percent of the world's Laysan (*Phoebastria immutabilis*) and black-footed (*Phoebastria nigripes*) albatross (Naughton and Flint 2004). Four endangered endemic bird species that are not seabirds (Laysan duck [*Anas laysanensis*], Laysan finch [*Telespiza cantans*], Nihoa finch [*Telespiza ultima*], and Nihoa millerbird [*Acrocephalus familiaris kingi*]) also breed on the islands (Table 2.2-2).

Nihoa's seabird colony boasts one of the largest populations of Tristam's storm-petrel (*Oceanodroma tristrami*), Bulwer's petrel (*Bulweria bulwerii*), and blue noddies (*Procelsterna*

cerulea) in the Hawaiian Islands and very possibly the world. The island is a unique example of a lowland native community, resembling those lowland communities that once occurred on the main Hawaiian Islands but are now almost completely gone (Wagner et al. 1999). The island's vegetation can be classified as part coastal mixed community (*Sida* mixed shrub and grassland) and coastal dry shrubland dominated by ʻilima (*Sida fallax*), ʻaweoweo (*Chenopodium oahuense*), and ʻohai (*Sesbania tomentosa*). The island supports 21 native plant species, including 3 endemics: a palm or loulu (*Pritchardia remota*), an amaranth (*Amaranthus brownii*), and an herb (*Scheidea verticillata*) (Wagner et al. 1999). The avifauna of the island includes two endemic passerine birds, the Nihoa finch and the Nihoa millerbird, both listed as endangered under the federal ESA and HRS 195D. The arthropod fauna of the island includes 33 species of mites, 3 species of spiders, and 182 species of insects, 17 of which are endemic, including a katydid (*Banza nihoa*), a giant tree cricket (*Thaumatogryllus conantae*), 2 species of endemic seed bugs (*Nysius nihoae* and *Nysius suffusus*), and an endemic trapdoor spider (*Nihoa mahina*) (Evenhuis and Eldredge 2004). Nihoa also has a rich cultural heritage, with at least 88 known wahi kupuna (ancestral sites), constructed by pre-contact Hawaiians, who inhabited the island for 700 years until 1700 AD, and listed on the NRHP. In Nihoa's Loulu Coastal Forest Community, *Pritchardia remota* assumes complete dominance with a closed canopy and thick layers of fallen fronds in the understory. Native plants growing nearby include *Chenopodium oahuense*, *Sesbania tomentosa*, *Solanum nelsonii*, and *Sida fallax.* Lichens grow on the trunks of the trees (U.S. Fish and Wildlife Service 1998). In this system, *P. remota* provides nesting habitat for red-footed boobies (*Sula sula*) and perching space for brown noddies (*Anous stolidus*), which are two resident seabirds at Nihoa (U.S. Fish and Wildlife Service 1998).

Because of its limited size, Mokumanamana supports only 5 indigenous plant species and no land birds but does harbor 3 species of mites, 2 species of spiders, and 70 species of insects, 11 of which are endemic, including a large weevil (*Rhycogonus biformis*), 2 species of seed bugs (*Nysius neckerensis* and *N. chenopodii*), and a trapdoor spider (*Nihoa hawaiiensis*) (Evenhuis and Eldredge 2004). Sixteen species of seabirds breed here, including the black noddy (*Anous minutus*), which historically was called the Necker Island tern.

Hawaiian monk seals utilize most of the Monument, including the atolls, islands, and waters of the Monument, with varying population (numbers and age structure) and some exchange within the NWHI and the main Hawaiian Islands. The sandy islets of FFS provide nesting sites for 90 percent of the threatened green turtle (*Chelonia mydas*) population breeding in the Hawaiian Archipelago. In addition, 19 of Hawaiʻi's 22 seabird species are found on the island, giving it the highest species richness of breeding seabirds within the Monument. The dry coastal shrublands of the larger islets within the atoll also support an endemic seed bug (*Nysius frigatensis*), moth (*Agrotis kerri*), and mite (*Phauloppia bryani*) (Usinger 1942; Nishida 2002).

Due to the limited size of the Gardner Pinnacles, they support only a single species of land plant (*Portulaca lutea*) and a few terrestrial arthropod species, but they are by contrast excellent habitat for seabirds (Clapp 1972). Guano from such seabirds gives the peaks a "frosted" appearance, indicating their importance as roosting and breeding sites for at least 12 subtropical species. Landings and terrestrial surveys rarely take place due to the difficulty of getting ashore under all but the calmest ocean conditions.

Maro Reef is a largely submerged open atoll (Clague 1996), with less than 1-acre (4,046.8 square meters) of periodically emergent land. At very low tide, only a small coral rubble outcrop of a former island is believed to break above the surface; as a result, Maro supports no terrestrial biota.

Laysan Island's ring of sandy dunes surrounds a 173-acre (0.7square kilometers) hypersaline interior lake, a feature unique within the Hawaiian Archipelago and rare within the Pacific as a whole. Because of its elevation of about 40 feet (12 meters), Laysan is well vegetated, supporting at least 30 species of flowering plants, including 5 subspecies that were endemic prior to human contact (Athens et al. 2007), many of which were driven to extinction by the misguided introduction of rabbits (*Oryctolagus cuniculus*) in 1902 during the guano mining era (Ely and Clapp 1973). The plant community is divided into five different associations arrayed in concentric rings around the interior hypersaline lake: coastal shrubs, interior bunchgrass, vines, interior shrubs, and wetland vegetation (Newman 1988). The island also previously harbored five endemic birds, two of which, the Laysan finch and the Laysan duck still survive (Pratt et al. 1987). In addition, approximately two million seabirds nest here, including boobies, frigatebirds, terns, shearwaters, noddies, and the world's second-largest black-footed and Laysan albatross colonies. The island also supports a relatively rich collection of arthropods, including a large endemic weevil (*Rhyncogonus bryani*), four endemic moths, an endemic wasp, and three endemic mites. A successful 12-year eradication project to remove the sandbur (*Cenchrus echinatus*), a plant that had displaced native vegetation over 30 percent of the island, has been completed, and an active ecological restoration project is under way to bring back a number of other plants and animals that were lost after the introduction of rabbits (Morin and Conant 1998).

Lisianski supports no endemic land plant or bird species, although it does harbor an endemic seed bug (*Nysius fullawayi flavus*) and an endemic moth (*Helicoverpa minuta*) (Usinger 1942; Nishida 2002). The island also hosts large Bonin petrel (*Pterodroma hypoleuca*) and sooty tern (*Onychoprion fuscata*) colonies, as well as a variety of other seabirds. Lisianski has the only grove of *Pisonia grandis* trees in the entire Hawaiian Archipelago; this tree is dispersed by seabirds and is favored as a nesting site for many tree-nesting seabird species.

Pearl and Hermes Atoll is a true atoll, fringed with shoals, permanent emergent islands, and ephemeral sandy islets. These features provide vital dry land for Hawaiian monk seals, the Hawaiian population of green sea turtles, and a multitude of seabirds, with 16 seabird species breeding here. The permanent islands with higher dunes support an endemic subspecies of native seed bug (*Nysius fullawayi infuscatus*) (Usinger 1942). Pearl and Hermes also hosts a small population of endangered Laysan finches that were translocated here in the 1960s.

Although Midway's native vegetation and insects have been greatly altered by more than a century of human occupation, the island boasts the largest nesting colonies of Laysan and black-footed albatrosses in the world, forming the largest colony of albatrosses in the world. The Navy, FWS, and U.S. Department of Agriculture-Wildlife Services (USDA Wildlife Services) successfully eradicated black rats (*Rattus rattus*), accidentally introduced during World War II, from Midway, removed a small forest of mature ironwood trees (an alien invasive species) from Eastern Island and new ironwood seedling from the remaining seedbank are removed as they are detected. Currently the cover on all of the islands at Midway is approximately 30 percent paved

or with structures, 23 percent grass and forbs, 18 percent woodland, 7 percent sand and bare ground, 22 percent shrublands, and less than 0.23 percent wetland. Midway Atoll also supports the first successful reintroduced population of endangered Laysan ducks, translocated from Laysan Island in 2004-2005. Laysan ducks utilize both the largely introduced vegetation of Midway Atoll and restored patches of native vegetation. This reintroduction is significant because Island ducks are globally threatened taxa, and because the Laysan duck is the most endangered waterfowl in the Northern Hemisphere and the U.S. Introduced canaries (*Serinus canaria*) breed among historic buildings that mark the beginning of cable communication across the Pacific near the beginning of the 20th century

Kure Atoll is an important breeding habitat for Christmas shearwaters (*Puffinus nativitatis),* Laysan and black-footed albatross. Kure has at least 11 terrestrial arthropods endemic to Hawai‘i and one that is apparently endemic to Kure.

2.2.3.2 Current Status of the Resources

A number of these islands have been significantly altered from their natural state. Tern Island, part of FFS, was transformed from an 11-acre (.04-square-kilometer) sandy island into a 42-acre (.17-square-kilometer) naval airstrip by building a steel retaining wall, blasting and dredging a channel around the island, and using the blasted coral to fill in the wall (Amerson 1971). Barracks, a fuel depot, and a LORAN station were constructed over the years, with the barracks still housing five to ten people, including FWS managers, volunteers, researchers, and Hawaiian monk seal field teams. Laysan Island, at 1,015 acres (4.1 square-kilometers), is the second largest landmass in the NWHI. In the middle of the island lies a 173-acre (0.7 square-kilometers) hypersaline lake. During the late 1800s, Laysan experienced great ecological changes from guano miners and feather harvesters. Introduced rabbits and guinea pigs *(Cavia porcellus)* quickly devastated the island’s vegetation. FWS has undertaken an ecological restoration project that includes eradicating invasive plants and insects and returning native plant, insect, and bird species extirpated previously (Flint and Rehkemper 2002). A short-lived black-lipped pearl oyster (*Pinctada margaritifera*) industry at Pearl and Hermes Atoll led to the construction of several buildings and the harvest of at least 150,000 oysters (Keenan et al. 2006). Today, 70 years after cessation of commercial harvest, only about a thousand individual pearl oysters have been documented in the lagoon. Midway Atoll, the largest landmass in the NWHI, at 1,535 acres (6.2 square-kilometers), has been significantly altered from its natural state. In 1871, efforts were begun to clear a channel into the lagoon. In 1903, workers for the Commercial Pacific Cable Company added 9,000 tons of soil from Honolulu and Guam and introduced hundreds of new species of flora and fauna. Infrastructure was built, including fuel depots, an airstrip, and housing for as many as 5,000 military personnel. The base was closed in 1993, and the atoll was put under Department of the Interior jurisdiction in 1996 (U.S. Fish and Wildlife Service 2005a). Today, approximately 60 people are stationed at Midway. Kure Atoll, a state wildlife refuge with no permanent population, is the northernmost coral atoll in the world. The USCG built a runway and LORAN station on Green Island in 1960 and 1961. The USCG controlled the runway until 1993 and had a peak of 24 personnel. After 1993, the runway began deteriorating and is no longer useable. Biologists conduct wildlife surveys, restore habitat, and remove marine debris.

At Midway and Tern, aircraft pose a risk to wildlife from collisions. At Midway, the greatest risk of bird/aircraft collision is from the two resident albatross species. Nearly two million migratory seabirds, representing 18 species, nest on Midway's three islands each year. The most abundant species is the Laysan albatross, with a population in excess of one million. Because of its size, its distribution on Sand Island, and its flight activity over the 7,900-foot ETOPS runway, the Laysan albatross represents the greatest bird/aircraft collision hazard. Other species that are involved in bird/aircraft strikes, albeit less frequently, are the black-footed albatross, Bonin petrel, black noddy, brown noddy (*Anous stolidus*), and white tern (*Gygis alba*). Very few seals have ever been observed on the runway, so the frequency of this hazard is low. A barrier of the native vegetation *Scaevola* and *Aerograstis* helps to prevent seals from reaching the runway.

For more than 50 years, the Navy attempted to mitigate the bird/aircraft collision problem by discouraging nesting and bird flight activity near the Sand Island runways. Since Midway became a National Wildlife Refuge in 1988, other steps have been taken to mitigate the collision hazard. Reducing the number of landings and takeoffs during the most hazardous times of day and year has proven to be the most successful mitigation strategy. Albatross are found at Midway in large numbers from November through July, but the peak of activity appears to be in February through May, when both juvenile and adult birds are in abundance.

In March of 2004, the FWS completed a wildlife assessment for the airport operations (American Airports Corporation 2003; Klavitter 2004), as an FAA certification requirement. The objectives of the assessment were as follows:

- Analyze past bird strike data at Midway Atoll;
- Identify the species, numbers, locations, local movements, and daily and seasonal occurrences of wildlife;
- Identify and locate features on and near the airport that attract wildlife;
- Describe the wildlife hazard to air carrier operations; and
- Discuss additional wildlife concerns associated with the airfield.

The primary management implications from this assessment were as follows:

- Runway sweeps are conducted before aircraft departures and arrivals to ensure that all birds are carefully removed from the active runway;
- Flights occur during nighttime from late November to mid-July each year;
- All unnecessary lights are turned off at the airport operations building at night immediately following flight operations; and
- All unnecessary poles, signs, and antennas over three feet (one meter) tall around the airfield are removed.

At Tern Island, FFS, the species most commonly killed during aircraft operations is the sooty tern, but occasionally wedge-tailed shearwater (*Puffinus pacificus*), great frigatebird (*Fregata minor*), and albatrosses of both species are also hit. Tern Island does not have runway lights, so all operations are done during daylight. Just before landings and takeoffs, all the staff on the

island make a sweep to drive the birds from the runway. Flight activities have a slight negative effect on migratory birds, but they have a beneficial effect on all natural resources by facilitating management actions that benefit wildlife and habitats.

Because these island ecosystems have evolved with little contact with the rest of the world, they are particularly vulnerable to the introduction of invasive species. Invasive plants and introduced mammals are a primary threat to nesting seabirds, indirectly by altering the ecosystem and directly by eating eggs and chicks. The number of alien land plants in the NWHI varies from only 3 introduced at Nihoa to 249 introduced at Midway Atoll. The level of threat from introduced plants also varies between species. For example, the invasive plant golden crownbeard (*Verbesina encelioides*) displaces almost all native vegetation in some nesting areas at Kure, Midway, and Pearl and Hermes Atolls. This plant causes entanglement of albatross adults and chicks and increases chick mortality due to heat stress by reducing the birds' ability to use convective cooling for thermoregulation.

A variety of alien plants, animals, and most likely fungi and bacteria have made it to the Northwestern Hawaiian Islands. Some of them have proven to be particularly invasive and dangerous to native species. These include such plants as Sandbur, *Verbesina*, and ironwood (*Casuarina equisetifolia*), and such animals as the black rat, rabbit, gray bird locust (*Schistocerca nitens*), house mouse (*Mus musculus*), and several ant species. Much of the routine management of this area revolves around eradicating or controlling existing invasives and preventing the introduction of new ones.

Marine alien species can be defined as nonnative aquatic organisms that have been intentionally or unintentionally introduced into new ecosystems, resulting in negative ecological, economic, or human health effects. Twelve marine alien invertebrate, fish, and algal species have been recorded in the NWHI. Alien species may be introduced unintentionally by vessels, marine debris, or aquaculture, or intentionally, as in the case of some species of groupers and snappers and algal species (Table 2.2-1). Eleven species of shallow-water snappers (Family *Lutjanidae*) and groupers (Family *Serranidae*) were purposely introduced to one or more of the main islands of the Hawaiian Archipelago in the late 1950s and early 1960s. Two snappers, the bluestripe snapper (taape, *Lutjanus kasmira*) and the blacktail snapper (*L. fulvus*), and one grouper, the peacock grouper (*Cephalopholis argus*), are well established and have histories of colonization along the island chain that are reasonably well documented (Randall 1987). Bluestripe snappers have been by far the most successful fish introduction to the Hawaiian coral reef ecosystem. Approximately 3,200 individuals were introduced on the island of O'ahu in the 1950s. The population has expanded its range by 1,491 miles (2,400 kilometers), until it has now been reported as far north as Midway in the NWHI. These records suggest an annual dispersal rate of about 18 to 70 nautical miles (33 to 130 kilometers). The other two species have been recorded only as far north as FFS and are present in much lower numbers than bluestripe snappers.

Table 2.2-1
Probable Mechanisms of Introduction of Marine Invertebrates to Hawai'i

Mechanism	Species	Percent Established
Hull fouling	212	90%

Solid ballast	21	90%
Ballast water	18	89%
Intentional release	18	28%
Parasites on nonindigenous species	8	88%
Associated with commercial oysters: unintentional	7	100%
Aquarium release	3	67%

Source: Eldredge and Carlton 2002

It is often difficult to determine the specific vector of accidental introduction in the marine environment because there is generally a pronounced lag time between introduction and first observation as an invasive species.

According to the Bishop Museum Hawai‘i Biological Survey, the total observed alien marine species in Hawai‘i is 343, including 287 invertebrates, 24 algae, 12 flowering marine plants, and 20 fish. The presence of any of these or other potentially invasive species, even in their current benign state, illustrates the fact that these pristine reefs can be invaded.

A 2002 survey documented the first example of an invasive species attached to marine debris in the NWHI. The Asian anemone *Diadumene lineata* was identified from a derelict fishing net at the reefs of Pearl and Hermes Atoll (Zabin et al. 2003). To date, only a few of the 582 metric tons of debris collected have been analyzed for attached species. In addition, an estimated 1,000 tons (907 metric tons) of debris have accumulated in the NWHI over the past 20 years, with an estimated annual accumulation rate of 40 to 60 tons (36 to 54 metric tons) (Asher 2006).

In addition to the current threats posed by alien plant and animal species, several historic buildings on Sand Island contain hazardous materials, such as lead-based paint or asbestos. These toxic materials pose health and safety concerns for humans and wildlife. Lead paint flakes are ingested by albatross chicks, causing growth deformities and mortality. Currently, the Old Bulky Waste Landfill on the south shore of Sand Island, Midway Atoll National Wildlife Refuge (NWR) is eroding, and the soil placed on top is sifting into the debris, causing large holes to open up around the edge and in the center of the landfill. As a result, burrowing birds are bringing up buried and potentially contaminated soil and are nesting in that contaminated soil. Over 500 bird burrows have been counted in the landfill.

Marine debris, especially derelict fishing nets and gear, plastics, and hazardous materials, is a severe chronic threat to shallow ecosystems, such as Midway Atoll, and negatively affects albatrosses, Hawaiian monk seals, marine turtles, and other species that become entangled in or ingest these materials.

Recent decades have brought increased awareness of the changing global environment and the implications this change may have on ecological processes. The increase in average global temperatures, sea level rise, and change in chemical concentrations in the world’s oceans are typically cited as the results of global climate change. Changes in the global climate are being brought about by three factors: increasing concentrations of carbon dioxide and other gases in the atmosphere, commonly referred to as the greenhouse effect; alterations in the biogeochemistry of the global nitrogen cycle; and ongoing land use and land cover change. Change in the land use is considered the single most important component of global change affecting ecological systems (Vitousek 1994). While there is some debate about the extent of the

effect these changes will have on Earth's environment, several trends have been well documented. The four areas of impact linked to global climate change that may have the greatest potential effect on the Monument are weather changes, coral bleaching, sea level rise, and oceanic chemical composition change.

2.2.3.3 Marine Resources

Shallow Reef

As with the definition of ecosystem, the depth to which the shallow reef is defined is subjective. For this EA, this ecosystem is defined as all waters to a depth of 98 feet (30 meters). Because reef-building corals have a symbiotic relationship with microalgae that allows them to grow and thrive in the nutrient-poor waters of the tropics, these reefs have a depth limit based on the penetration of sunlight into the water column. Generally, coral reefs grow in water less than 98 feet (30 meters) (Grigg and Epp 1989), although non-reef-building corals are able to grow in much deeper waters (Maragos and Jokiel 1986; Veron 1986). In addition, there is a much better understanding of the shallow reef, as most coral reef assessment and monitoring is done in waters shallower than 98 feet (30 meters) (Maragos et al. 2004).

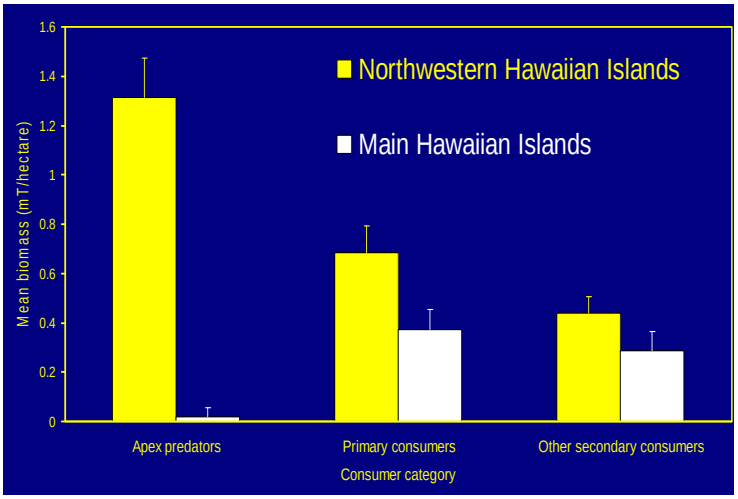
Coral reef ecosystems consist of much more than the reef-building corals for which they are named, including sand and unconsolidated sediments, colonized hardbottom, non-reef-building corals, and macroalgae. Reefs make up approximately 50 percent of the biomass, providing habitat structure, refuge, and food to the diverse group of organisms (Garrison 1999). Even in this relatively pristine coral reef habitat, the percentage of coral cover varies widely. A recent assessment of this habitat determined that coral cover for individual islands ranges from 4.4 percent to 64.1 percent across the chain, and less than 1 percent to close to 100 percent within the various habitats of the islands (Friedlander et al. 2005). The highest diversity and highest percent coral cover occurs in the middle of the Monument, at the large open atolls of FFS and Maro Reef. Reef, hardbottom, and sediment habitat are interspersed to create a variety of environmental niches and resources for the diverse array of species.

The shallow reef is a dynamic environment, experiencing constant wave surges and powerful winter storms. Tropical storms and hurricanes can generate extreme wave energy that can damage shallow coral reef habitat. These events are the primary natural force in altering and shaping coral reef community structure (Dollar 1982; Dollar and Grigg 2004). They represent potential but infrequent threats to the shallow coral reef ecosystems of the NWHI. There is a growing concern that global warming and the concurrent acidification of the ocean may cause drastic changes to corals in the coming century (Hoegh-Guldberg 1999). While the northern extent of the NWHI, from Kure to Pearl and Hermes Atolls, experiences sea surface temperatures from less than 64° Fahrenheit (18° Celsius) in winter to summer highs exceeding 82° F (28° C), a temperature anomaly of only 1.8° F (1ºC) in the summer of 2002 resulted in widespread mass coral bleaching (Hoeke et al. 2006). Acidification, caused by increased levels of CO_2 in the ocean, inhibits the deposition of calcium carbonate, the primary component of the coral skeleton (Kleypas et al. 2006). Events such as these may be more devastating in the NWHI because these reefs grow more slowly than most other reefs (Friedlander et al. 2005).

Fifty-seven species of coral have been identified in the NWHI, with 30 percent of them being endemic. To date, 355 species of algae and 838 species of invertebrates have been documented in a thorough assessment of the Monument's living resources (Friedlander et al. 2005). Characteristics of the shallow water coral reef habitat change with both island geology and reef orientation to the island. Due to strong wave action and currents, the basalt islands in the southern portion of the Monument have no fringing reef. The underwater habitat is composed primarily of vertical walls and wave-cut benches (Friedlander et al. 2005). Caves, overhangs, and trenches provide small-scale habitat for corals, although basalt blocks, boulders, and pavement are the principal bottom cover. Species diversity is low, relative to the middle and northern atolls. The shallow reef habitat in the middle of the Monument (FFS, Maro Reef, and Lisianski Island) is a series of open atolls that exhibit the highest levels of coral abundance and diversity (Friedlander et al. 2005). The largest pod found in the NWHI of spinner dolphins (*Stenella longirostris*) occurs at FFS (Andrews et al. 2006). The northernmost atolls (Pearl and Hermes, Midway, and Kure) are formed by a continuous barrier reef, where the lagoon is connected to the outside ocean through a series of channels and grooves.

Structurally, apex predators, such as sharks and jacks, dominate fish communities on the reefs in the NWHI. In addition, abundance and biomass estimates indicate that the reef community is characterized by a smaller proportion of herbivores, such as surgeonfish (Family *Acanthuridae),* and more carnivores, such as damselfish (Family *Pomacentridae*), goatfish (Family *Mullidae*), and scorpionfish (Family *Scorpaenidae*). A comparison of both biomass and trophic structure between reef fish communities in the NWHI and main Hawaiian Islands (Figure 2.2-1) was conducted in 2000. Across similar habitats, biomass was 260 percent greater in the NWHI (Friedlander and DeMartini 2002). Additionally, 54 percent of the biomass in the NWHI was composed of apex predators, compared to 3 percent in the main Hawaiian Islands.

Figure 2.2-1 Comparison of Biomass in Major Trophic Guilds between NWHI and Main Hawaiian Islands



Source: Friedlander and DeMartini 2002

Deep Reef—Banks, Shoals and Slopes

Approximately 30 submerged banks are within the Monument (Miller et al. 2004). Deepwater banks, seamounts and the abyssal plain are among the least studied environments of the NWHI.

Submersible surveys on South Pioneer Ridge (Pioneer Bank) and two unnamed seamounts, one east of Laysan Island and the other east of Mokumanamana, have revealed the presence of various substrate types, deposited when these geologic features were at sea level (Smith et al. 2004). In some areas, dense communities of corals (ahermatypic [non reef building]) and sponges at depths approaching 1,000 fathoms (6,000 feet, or 1.8 kilometers) obscured the underlying substratum. The deepwater marine plants of the area are a mixture of tropical species, species with cold-temperature affinities, and species with disjunctive distributions, suggesting alternative biogeographical patterns and dispersal routes from the main Hawaiian Islands (McDermid and Abbott 2004).

Mega- to macro-scale descriptions of bottomfish habitats made on Raita Bank, West St. Rogatien Bank, Brooks Bank, and Bank 66 indicate the distribution and abundance of bottomfish are patchy and appear to be associated with high relief and topographic features, including crevices and caves (Kelley et al. 2004). Telemetry studies of Hawaiian monk seals unexpectedly have revealed that these animals spend considerable foraging time at depths on these banks where light does not penetrate, particularly in areas that have high levels of relief, such as pinnacles and walls (Parrish and Abernathy 2006).

Hawaiian monk seals are foragers that eat a broad range of prey items, including bottomfish and associated fish species, as well as other types of fish and animals. Such banks also support populations of spiny (family *Palinuridae*) and slipper (Family *Scyllaridae*) lobsters and colonies of precious gold (*Gerardia* spp.), pink (*Corallium* spp.), and black (Family *Antipathidae*) corals. These deep-living corals, below the depth where enough light penetrates for photosynthesis, rely on the capture of plankton from the water column with their tentacles rather than deriving energy from symbiotic dinoflagellate algae, known as zooxanthellae, that virtually all shallow-water reef-building corals harbor in their cells. Submersible surveys conducted at depths of 656 to 1,148 feet (199.9 to 349.9 meters) on Raita, West St. Rogatien, and Brooks Banks found little evidence of physical disturbances by bottomfishing from anchors and fishing gear (Kelly, Moffit, and Ikehara 2006).

Pelagic and Deep Water Habitats

Most of the Monument's area can be considered pelagic (open sea) habitat. The estimated area of all parts of the Monument with depths greater than 1,000 fathoms (6,000 feet, or 1.8 kilometers) is 117,375 square miles (304,000 square kilometers) or about 84 percent of the entire monument (Miller et al. 2006).

The Final EIS for the Fishery Management Plan: Pelagic Fisheries of the Western Pacific Region states:

> Pelagic species are closely associated with their physical and chemical environments. Suitable physical environment for these species depends on

> gradients in temperature, oxygen, or salinity, all of which are influenced by oceanic conditions on various scales. In the pelagic environment, physical conditions, such as isotherm and isohaline boundaries, often determine whether the surrounding water mass is suitable for pelagic fish, and many of the species are associated with specific isothermic regions. Additionally, fronts and eddies, which become areas of congregation for different trophic levels, are important habitat for foraging, migration, and reproduction for many species (Bakun 1996). Oceanic pelagic fish, including skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and blue marlin (*Makaira nigricans)* or black marlin *(M. indica*), prefer warm surface layers, where the water is well mixed by surface winds and is relatively uniform in temperature and salinity. Other pelagic species—albacore, bigeye tuna (Ahi; *Thunnus obesus*), striped marlin (*Tetrapturus audax*), and broadbilled swordfish (*Xiphias gladius*) — prefer cooler, more temperate waters, often meaning higher latitudes or greater depths.

The oceanic Scombroid fish (billfish, tuna, wahoo) have zoogeographies much more like that of plankton than benthic fish. Most are cosmopolitan and occur in all oceans within the tropical and subtropical zones but may have very specific water temperature preferences (Longhurst and Pauly 1987). The yellowfin tuna, for instance, prefers water no cooler than 64º to 70º F (18º to 21º C), which coincides with the northern boundary of the Monument. All species undertake seasonal and age-related migrations, traveling between spawning grounds and feeding grounds appropriate for their sizes. They prey on medium-sized pelagic fish, crustaceans, and cephalopods. Tagging studies of yellowfin tuna and bigeye tuna have demonstrated that while these species have enormous capacity to travel huge distances, they show very specific attraction to fish-aggregating devices, island reef ledges, seamounts, and other elements of structure (Itano and Holland 2000). Lowe et al. (2006) similarly found that while two species of large sharks, tiger sharks (*Galeocerdo cuvier*) and Galapagos sharks (*Carcharhinus galapagensis*), are capable of long-distance travel, they showed more site fidelity than expected throughout the year, with 70 percent of tiger sharks exhibiting year-round residence at FFS. Some of the study subjects did make long-distance movements, with sharks marked at FFS showing up at Midway and on the Kona coast of the island of Hawai‘i. The tremendous economic value of these fishes has resulted in serious declines of most populations due to industrialized fishing.

The estimated 5.5 million seabirds breeding in the Monument are primarily pelagic feeders that obtain the fish and squid they consume by associating with schools of large predatory fish, such as tuna and billfish (Fefer et al. 1984; Au and Pitman 1986). These fish—yellowfin tuna, skipjack tuna, mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), rainbow runner (*Elagatis bipinnulatus*), broadbilled swordfish, and blue or black marlin—are apex predators of a food web existing primarily in the epipelagic zone. While both the predatory fish and the birds are capable of foraging throughout their pelagic ranges (which encompass the entire Monument and tropical Pacific Ocean), the birds are most successful at feeding their young when they can find schools of predatory fish within easy commuting range of the breeding colonies (Ashmole 1963; Feare 1976; Flint 1990).

The five species of sea turtles that occur in the NWHI are loggerhead (*Caretta carretta*), green, olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*). All of these species are protected by the ESA. The Hawaiian population of green turtles has been monitored for 30 years, following the cessation of harvesting in the 1970s, and has shown a steady recovery from its depleted state (Balazs and Chaloupka 2004). The transition zone chlorophyll front, located north of Monument waters most years, occasionally moves southward, along with one of the species tightly associated with it, the loggerhead turtle. These turtles breed in Japan but feed on buoyant organisms concentrated at the convergent front in these high-chlorophyll waters, which support a complex food web, including cephalopods, fishes, and crustaceans, which albacore tuna and a variety of billfish also feed on (Polovina et al. 2001).

The waters of the Monument are also home to 20 cetacean species, 6 of them federally recognized as endangered under the ESA and recognized as depleted under the Marine Mammal Protection Act (MMPA).

2.2.3.4 Connections Among Ecosystems

The most obvious connection between the above ecosystem classifications is that many primarily marine species need emergent land for reproduction. Many of the emergent lands within the NWHI have been designated critical habitats. Designated critical habitat is a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery.

FFS is the primary nesting site for the Hawaiian stock of the threatened green turtle. Females lay an average of two nests per season, with a mean time between laying nests of 13 days. The mean incubation period is approximately 65 days (Balazs 1980).

These islands are also vital as the primary haul-out, pupping, and weaning habitat for the endangered Hawaiian monk seal. Hawaiian monk seals give birth on land and begin to teach their pups to swim after about three weeks (NOAA 2003b). Hawaiian monk seals that haul out to rest regularly spend two weeks every year on land to molt.

A total of approximately 5.5 million seabirds nest annually on nearly every island in the NWHI. For seabirds, a parent's proximity to a reliable food source when raising chicks is directly related to their survival (Polovina et al. 1994). Global atmospheric events (such as El Niño and the

Pacific Decadal Oscillation) appear to lower the productivity of the waters around the NWHI and have been correlated to low chick survival rates and the decline in the Hawaiian monk seal population (Polovina et al. 1994). While albatross come to the NWHI to breed, departing for the open ocean after their chicks have fledged, resident seabirds (e.g., boobies, frigates) spend a good percentage of their time on land.

Even the coral claim the islands, as they subside under the sea, creating the atolls that support the abundant and unique ecosystems found within the Monument. The connections between the shallow reef, where light penetration and coral growth dominate the environment, and the deep reef, where algal meadows and bottomfish prevail, are an important area of study. Some species of juvenile bottomfish inhabit much shallower waters than adults (Parrish 1989). The depth range of both spiny and slipper lobsters spans the deep and shallow reef (DiNardo and Marshall 2001). These lobster species are important links between the shallow and deep reef, as they are among the largest mobile invertebrates in the coral reef ecosystem. As such, they may represent a vital link in the trophic food web. Hawaiian monk seals are known to forage in both shallow and deep reef environments and have been documented at 1,640 feet (500 meters) deep, presumably foraging, for a significant duration (Parrish et al. 2000). These are only a few of the known connections that exist between the habitats defined as deep and shallow reef; many more may exist and are yet to be discovered.

The pelagic habitat is the realm of the highly migratory species, including tunas, sharks, billfish, and hatchling green sea turtles. The deep waters are also important insofar as they support an offshore mesopelagic boundary community (Benoit-Bird et al. 2002), a thick layer of pelagic organisms that rest in the deep ocean (1,300 to 2,300 feet [400 to 700 meters]) during the day, then migrate up to shallower depths (from near zero to 1,300 feet [400 meters]) at night, providing a critical source of nutrition for open-ocean fishes, seabirds, and marine mammals. This community is composed of small fishes, shrimps, and squids, which serve as an important food resource for many animals, including spinner dolphins, bottomfish, tunas, and billfish. Future research will provide more details and interconnections between pelagic and shallow water ecosystems.

2.2.3.5 Special Status Species

Table 2.2-2 is a list of selected endangered plant species and resident and/or occasional (transient) bird and/or marine mammal species which can be found at the Monument and which are protected under either the ESA or MMPA. Only species protected under the ESA that are considered to be regularly occurring at the Monument are listed below. Some species protected under the MMPA that are known to occur in the western Pacific and could occur within the Monument are not listed for brevity's sake and because no management action would specifically affect these species.

Plants

Six endangered plant species found in the Hawaiian Islands have populations in the NWHI (Table 2.2-2), and three of these are endemic species on Nihoa. *Amaranthus brownii*, *Pritchardia remota*, and *Schiedea verticillata* were listed as endangered under the ESA in 1996. Critical habitat was designated for five plant species in the Monument in 2003.

Table 2.2-2
Special Status Species in the NWHI

Common Name	Taxonomic Name	Protection	Occurrence
Land plants			
Loulu/fan palm	*Pritchardia remota*	ESA	Resident
Kamanomano	*Cenchrus agrimoniodes*	ESA	Resident
‘Ohai	*Sesbania tomentosa*	ESA	Resident
	Amaranthus brownii	ESA	Resident
	Mariscus pennatiformis	ESA	Resident
	Schiedea verticillata	ESA	Resident
Land Birds			
Laysan duck	*Anas laysanensis*	ESA	Resident
Laysan finch	*Telespyza cantans*	ESA	Resident
Nihoa finch	*T. ultima*	ESA	Resident
Nihoa millerbird	*Acrocephalus familiaris kingi*	ESA	Resident
Seabirds			
Short-tailed albatross	*Phoebastria albatrus*	ESA/MBTA	Rare
Sea Turtles			
Olive Ridley	*Lepidochelys olivacea*	ESA	Occasional
Leatherback	*Dermochelys coriacea*	ESA	Occasional
Loggerhead	*Caretta caretta*	ESA	Occasional
Hawksbill	*Eretmochelys imbricata*	ESA	Rare
Green	*Chelonia mydas*	ESA	Resident
Marine mammals			
Hawaiian monk seal	*Monachus schauinslandi*	ESA/MMPA	Resident
Humpback whale	*Megaptera novaeangliae*	ESA/MMPA	Seasonal
Sperm whale	*Physeter macrocephalus*	ESA/MMPA	Occasional
Blue whale	*Balaenoptera musculus*	ESA/MMPA	Rare
Fin whale	*B. physalus*	ESA/MMPA	Rare
Sei whale	*B. borealis*	ESA/MMPA	Rare
North Pacific right whale	*Eubalaena japonica*	ESA/MMPA	Rare
Spinner dolphin	*Stenella longirostris*	MMPA	Resident
Bottlenose dolphin	*Tursiops truncatus*	MMPA	Resident

Source: NOAA 2004b

A. brownii is the rarest native plant on Nihoa (FWS 1998); its populations are scattered in two valleys, and a few individuals grow at the bases of basaltic cliffs on the steep outer slopes of the two valleys. *P. remota* grows on valley floors and at the bases of basaltic cliffs, areas that are subject to flash floods. *P. remota* is known from approximately 680 plants scattered in four colonies in each of two valleys that are on opposite sides of Nihoa (FWS 1998). *S. verticillata* typically grows in soil pockets and cracks on coastal cliff faces between 100 and 800 feet (30 and 242 meters). All historically known colonies of *S. verticillata* are known to be extant and have remained relatively stable.

Threats to *A. brownii* on Nihoa include competition with the nonnative plant *Portuluca oleracea* (pigweed), herbivory by introduced grasshoppers (*Schistocerca nitens*), alteration of substrate, fire, potential introduction of rats and mice, human disturbances, a risk of extinction from naturally occurring events (such as hurricanes), and reduced reproductive vigor due to the small number of extant individuals (U.S. Fish and Wildlife Service 1998). Although the current

population of *P. remota* appears to be stable, this species may have experienced declines resulting from Polynesian settlement of Nihoa. Contemporary threats may include alien plant, insect, and mammal species. Flash floods, fire, and human disturbances may also pose potential threats. As a consequence of small population sizes, many of these species are at risk to random events and face reduced reproductive vigor (U.S. Fish and Wildlife Service 1998).

Three additional endangered plants that are found in the main Hawaiian Islands are also found in the NWHI—*Cenchrus agrimonioides* var. *laysensis*, *Mariscus pennatiformis* ssp. *bryannii*, and *Sesbania tomentosa* (U.S. Fish and Wildlife Service 1999). *C. agrimonioides* var. *laysensis* was historically known from Laysan, Kure, and Midway but has not been seen since 1973 (U.S. Fish and Wildlife Service 1999). *M. pennatiformis* ssp. *bryannii* is known only from Laysan Island where the population has fluctuated between 1 and 200 since 1980. *S. tomentosa,* the only endemic Hawaiian species in this genus, occurs on Nihoa and Mokumanamana; the largest population occurs on Nihoa and consists of several thousand individuals (U.S. Fish and Wildlife Service 1999). Threats to these species include competition with alien plants, herbivory by introduced grasshoppers (*Schistocerca nitens*) and other invasive animals, risk of extinction from natural events, and reduced reproductive vigor due to the small number of individuals.

Birds

Both the Nihoa finch and the Nihoa millerbird reside year-round on the steep-sided, rocky, and shrub-covered island of Nihoa. Laysan finches are restricted to the low-elevation vegetated area of Laysan Island, although translocated populations have occupied the vegetated areas of Southeast Island and Grass Island at Pearl and Hermes Atoll. The Nihoa millerbird is the least abundant of the endangered passerines, numbering between approximately 150-350 birds (Mitchell et al. 2005). The Laysan and Nihoa finch populations have been surveyed most years since 1966, and their mean populations vary from over 11,000 to over 3,000 respectively (Mitchell et al. 2005). No clear population trends have been observed (Mitchell et al. 2005) Factors limiting Nihoa finch and millerbird populations are primarily weather, variations in food supply, and availability of appropriate nest sites. Additional threats include invasive alien arthropod and plant species, a sudden increase in arthropod population, introduced mammals, small population size, and associated demographic, random, and genetic risks. Landmass loss accompanying sea-level rise also poses a potential risk to the Laysan finch population.

The total Laysan duck population on Laysan Island has fluctuated from seven to more than 600 adult birds in the last century. The most recent (2005) population estimate of adult birds is approximately 600 birds (Reynolds et al. 2006). The population at Midway was founded with a total of 42 wild birds translocated from Laysan in 2004 and 2005. Of this original total, 25 or 26 birds are believed to have bred. After successful breeding seasons in 2005 through 2007, the number of ducks at Midway had increased to nearly 200 animals (Reynolds et al. 2007). Another successful breeding season at Midway in 2008 added significantly to the population, but an outbreak of avian botulism in August 2008 caused the death of more than 130 ducks and a temporary set-back to this new population.

The short-tailed albatross is listed as endangered under the ESA and is the smallest population of any albatross species in the North Pacific. Short-tailed albatrosses once ranged throughout most of the North Pacific Ocean and Bering Sea but were harvested to near extinction at their breeding

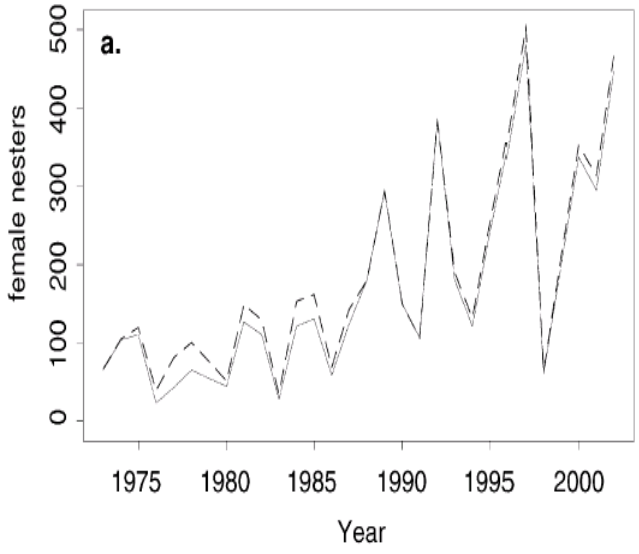
colonies in Japan. The current worldwide population is approximately 1,700 individuals, and due to habitat management and stringent protection, the population has increased by approximately six percent per year (U.S. Fish and Wildlife Service 2000). The primary range of this species is along the coasts, traveling between its breeding colonies in Japan, along Russia, the Aleutian Islands, and down the coast of North America. Land-based sighting records indicate that at least 15 short-tailed albatrosses have visited the NWHI over the past 60 years. Most of these sightings have been at Midway Atoll (U.S. Fish and Wildlife Service 2000), where two individuals are present every breeding season.

Sea Turtles

There are five listed sea turtles that could occur in the waters of the Monument. The Hawaiian population of the green turtle, loggerhead, and olive ridley are listed as threatened under the ESA. The leatherback and hawksbill turtles are listed as endangered under the ESA. The green turtle is common in the NWHI; the other turtles are rarely sighted in the Monument and therefore are not listed in Table 2.2-2 or considered in this analysis.

The NWHI are the primary nesting grounds for the Hawaiian population of the green turtle, while the main Hawaiian Islands are the primary foraging grounds. Although scattered low-level nesting occurs throughout the Hawaiian archipelago, over 90 percent of the nesting is at a few sandy islets within FFS (NMFS and U.S. Fish and Wildlife Service 1998). Nearshore waters contain adults that migrate to breed at these key sites. Mating occurs in the water, yet both males and females arrive on land to bask. Approximately 200 to 700 adult green turtle females nest on FFS annually. Since protection by state law in 1974 and by the ESA in 1978, the nesting population of the Hawaiian population of the green turtle has increased dramatically, as shown in Figure 2.2-2.

Figure 2.2-2 Trends in French Frigate Shoals Green Turtle Nester Abundance



Source: Balazs and Chaloupka 2004

Hawaiian Monk Seal

The Hawaiian monk seal is listed as endangered under the ESA and as depleted under the MMPA. It is the most endangered pinniped in U.S. waters and the second most endangered marine mammal after the northern right whale. The Hawaiian monk seal is so named for its solitary nature, with the closest social bond being between mother and pup (Reeves et al. 1992).

Little is known about the Hawaiian monk seal population before the 1950s, although the species is thought never to have numbered more than a few thousand (Ragen and Lavigne 1999). Reduction of the seals' range may have begun with the arrival of the first Polynesians to Hawai'i. Two activities in historic times are believed to have caused major declines in population: a short-lived sealing venture of the 1800s and military activities on Kure, Midway, and FFS in the second half of the twentieth century. Population surveys conducted since 1959 indicate that non-pup populations have declined by 60 percent (NOAA 2003d). Today, the total population is estimated at 1,200 individuals (NOAA 2004g). A variety of management actions have been implemented to improve the population trends, including removing aggressive males, relocating males to equalize the sex ratio, and rehabilitating undersized pups to improve survival.

Other Marine Mammals

The great whales occur throughout the Pacific. Five baleen whales—blue whale, fin whale, humpback whale, sei whale, and Pacific right whale—and one toothed whale, the sperm whale, are listed under the ESA. Four of the five baleen whales are known to occur in this area of the north Pacific, but with the exception of the humpback whale, they are all considered relatively rare in Hawaiian waters. Humpback whales occur consistently in the winter but are found mainly in waters surrounding the seven main Hawaiian Islands. Recent research by Johnston et al. (2007) reveals that the Monument hosts many more humpback whales than originally thought. Sperm whales have been sighted around several of the Northwest Hawaiian Islands, and their sounds have been recorded throughout the year in Hawaiian waters. A summer/fall 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone of the Hawaiian Islands resulted in 43 sperm whale sightings throughout the study area (NOAA 2004).

Spinner and bottlenose (*Tursiops truncates)* dolphins are year-round residents of the Hawaiian Islands. They are not considered threatened or endangered under the ESA or depleted under the MMPA though they are protected under the MMPA. While both species are widely distributed throughout the world in tropical and warm temperate waters, they are considered separate stocks from other populations due to their isolation in the Hawaiian archipelago (NOAA 2000). Both species occur from the island of Hawai'i to Kure Atoll. There are an estimated 743 bottlenose dolphins and 3,184 spinner dolphins within 28.7 miles (25 nautical miles, 46.3 kilometers) of the main Hawaiian Islands. Because waters beyond 28.7 miles (25 nautical miles, 46.3 kilometers) of the coast or the waters of the NWHI were not surveyed, this number is considered an underestimate of the population size (NOAA 2000). The largest pod of spinner dolphins within the Monument occurs at FFS, with approximately 500 individuals (Andrews et al. 2006). Smaller pods occur at Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll. While spinner dolphins have a capacity for high mobility, it appears that movements between islands are relatively infrequent, with each pod having a high affinity to a specific atoll (Karczmarski et al. 2005).

2.3 CULTURAL AND HISTORIC RESOURCES

2.3.1 Introduction/Region of Influence

The ROI or area of potential effect for cultural and historic resources includes all lands and waters within and adjacent to the Monument. Historic and current maps, cultural resources reports, public meetings, and archival records were reviewed to identify cultural resources. The NRHP and state and local inventories of historic places were reviewed for prehistoric and historic resources. Native Hawaiian groups were consulted, and public meetings were held to identify and locate traditional Hawaiian resources. In addition to the cultural properties formally evaluated within the Monument, the NWHI contains resources that, from a broad cultural perspective, have added meaning and significance to Native Hawaiian groups and other members of the public.

2.3.2 Regulatory Environment

Cultural resources are defined as historic properties, landscapes, cultural items, archaeological resources, sacred sites, or collections subject to protection under the NHPA, the Archaeological Resources Protection Act (ARPA), and the guidelines on Curation of Federally Owned and Administered Collections (36 CFR Part 79).

Cultural and historic resources are regulated through a number of laws, beginning with the NHPA, which is the basis for a process that considers the effects of federal undertakings on cultural and historic resources. The procedure an agency takes to comply with this legislation is commonly called the Section 106 process. Although the NHPA was created primarily in response to numerous federally funded urban renewal projects in which old neighborhoods and historic homes were demolished, it also applies to any actions an agency may take that would affect historic or cultural resources, as they are defined in the law. The intent of the process is to require the federal agency, in consultation with other affected parties, to make an informed decision as to the effect its actions would have on something that may be important to our heritage. In addition to the federal regulations, there are also state regulations protecting cultural resources. These regulations, administered under the DLNR's Historic Preservation Division, not only protect the cultural resources but more importantly also provide a process for reinterring *iwi*, or bones of Native Hawaiians. Included in this process is consultation with the islands' burial councils and affected parties. Depending on the resources identified, the following legislation could apply within the Monument:

- Abandoned Shipwreck Act of 1987 (PL 100-298; 43 USC 2101-2106);
- Sunken Military Craft Act (HR 4200, Title XIV, Sec. 1401-1408);
- Preserve America Executive Order (2003);
- National Marine Sanctuary Act (16 USC 1431 et seq.);
- American Antiquities Act of 1906 (16 USC 431-433);
- Archaeological and Historic Preservation Act of 1974 (16 USC 469-469c);
- Archaeological Resources Protection Act of 1979, as amended (16 USC 470aa-mm);

- Historic Sites, Buildings, Objects, and Antiquities Act of 1935 (16 USC 461-467);
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001-3013);
- Department of the Interior Secretary's Order 3217 – Battle of Midway National Memorial, September 13, 2000;
- Protection and Enhancement of the Cultural Environment Executive Order 11593;
- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-ee);
- Hawai'i Historic Preservation Program (HRS Title 1, Ch. 6E, Sections 1, 7, 11, 12, 43, 43.5, and 46.5);
- Hawai'i Historic Preservation Assessment Guidelines (HAR, Title 13, Ch. 275-284, and 300);
- Executive Order 13022 – Administration of the Midways Islands, November 1, 1996 (61 FR 56875);
- National Historic Preservation Act of 1966 (16 USC 470 et seq.); and
- American Indian Religious Freedom Act, as amended (42 USC 1996 and 1996a).

Monument regulations define Native Hawaiian practices as cultural activities conducted for the purposes of perpetuating traditional knowledge, caring for and protecting the environment, and strengthening cultural and spiritual connections to the NWHI that have demonstrable benefits to the Native Hawaiian community. In addition to the findings that must be made for any category of Monument permit (see 404.11[d]), permits for conducting Native Hawaiian cultural practices may be issued (50 CFR 404.11 [c][4] and [e]; Presidential Proclamation 8112), provided that activities are noncommercial and do not involve the sale of any organism or material collected. The purpose and intent of a Native Hawaiian practice or activity must be appropriate and deemed necessary by traditional standards in the Native Hawaiian culture, must benefit the resources of the NWHI and Native Hawaiian community, and must support traditional knowledge and ancestral connections of Native Hawaiians to the NWHI. Any Monument resource harvested from the Monument must be consumed in the Monument.

2.3.3 Resource Overview

Cultural and historic resources of the Monument are described in detail in the Monument Management Plan. This section is an overview of these resources in the ROI.

2.3.3.1 Native Hawaiian History in the Northwestern Hawaiian Islands

Native Hawaiians' ancestors were the first discoverers of the Hawaiian archipelago. They inhabited these islands for thousands of years before Western contact. The NWHI are considered a sacred place, a region of primordial darkness from which life springs and spirits return after death (Kikiloi 2006). Much of the information about the NWHI has been passed down from generation to generation through oral and written histories, genealogies, songs, dance, and archaeological resources.

In the past, Nihoa played an important role in a larger subsistence network between Niʻihau and Kauaʻi. The traditions of Niʻihau tell of how the people would frequent Nihoa to collect loulu palm wood for spears and mākiukiu grass, which could be used for cordage and stuffing (Tava and Keale 1989). A reciprocal and interdependent relationship developed between these three islands (Tava and Keale 1989; Maly 2003). Annual visits from Niʻihau and Kauaʻi to Nihoa were made during the spring and summer trade wind season. Niʻihau traditions suggest that "the Niʻihauans sailed to Nihoa in the spring, returning to Niʻihau in the fall on the Kona winds" (Tava and Keale 1989; Maly 2003). Other documented accounts tell of how fishermen in the late 1800s from Oʻahu and Hawaiʻi island would make special trips to the NWHI for four months at a time, from May to August, which was the special sailing season. They fished for ʻōpelu (mackerel scad, *Decapterus macarellus*) and aku (skipjack tuna, *Katsuwonus pelamis*) (Johnson and Mahelona 1975). These accounts highlight the importance of the NWHI in the lives of pre-contact Native Hawaiians who regularly sailed to and from this region.

During the post-contact historical period of Hawaiʻi, the Kingdom of Hawaiʻi exhibited strong interest in the NWHI, as title to the islands and waters were acquired throughout the 1800s through the Doctrine of Discovery (Mackenzie and Kaiama 2003). During this time, there were a number of written records of visits to the NWHI made by monarchs of the Hawaiian Kingdom. In 1822, Queen Kaʻahumanu organized and participated in an expedition to locate and claim Nihoa under the Kamehameha Monarchy. On March 16, 1856, Nihoa was reaffirmed as part of the territory of the Kingdom of Hawaiʻi in a circular by authority of Alexander Liholiho, Kamehameha IV (March 16, 1856, Circular of the Kingdom of Hawaiʻi). In April of 1857, Kamehameha IV traveled to Nihoa and instructed Captain John Paty on the Manuokawai to explore the rest of the northwest region to verify the existence of land. Kamehameha IV instructed him to annex any lands he discovered on his expedition. Captain Paty traveled to Nihoa, Mokumanamana, Gardner, Laysan, Lisianski, and Pearl and Hermes. Later that year, the Privy Council passed a resolution declaring the islands of Laysan and Lisianski as new lands to be included into the domain of the Kingdom (Kingdom of Hawaiʻi 1857). By authority of Kamehameha IV, a notification of annexation ran for a period of three months announcing possession of the islands. In 1885, the most famous visit by any Hawaiian royalty was made by Lydia Liliʻuokalani (princess at the time) and her two-hundred-person party that visited Nihoa on the ship Iwalani. Finally in 1886, King David Kalākaua, through Special Commissioner Colonel James Harbottel, annexed Kure Atoll (Ocean Island) and announced formal possession of the island (Boyd 1886). While Nihoa and Mokumanamana are thought to have been frequented until about 700 years ago, voyages to these islands and others in the NHWI for gathering turtles, fish, bird feathers, and eggs continued into the 20th century, particularly from Kauaʻi and Niʻihau (Tava and Keale 1989; Maly 2003).

Today, Native Hawaiians maintain their strong cultural and spiritual ties to the NWHI. In recent years, Native Hawaiian cultural practitioners traveled there to honor their ancestors and to perpetuate traditional practices. In 1997, Hui Mālama I Nā Kūpuna O Hawaiʻi Nei repatriated sets of human remains to Nihoa and Mokumanana that were collected by archaeologists in the 1924-1925 Bishop Museum Tanager Expeditions (Ayau and Tengan 2002). In 2003, a cultural protocol group, Nā Kupuʻeu Paemoku, traveled to Nihoa on the voyaging canoe *Hōkūleʻa* to conduct traditional ceremonies. In 2004, *Hōkūleʻa* sailed over 1,200 miles (1,043 nautical miles, 1,931 kilometers) to the most distant end of the island chain to visit Kure Atoll as part of a

statewide educational initiative called Navigating Change. In 2005, *Nā Kupu'eu Paemoku* sailed to Mokumanamana to conduct protocol ceremonies on the longest day of the year, June 21, the summer solstice. Cultural practitioners from the Kamakakūokalani Center for Hawaiian Studies and the Edith Kanaka'ole Foundation continued this in 2006 and in 2007.

2.3.3.2 Recent History

In more recent history, the NWHI were used for their natural resources, and commercial fishing began in the 1800s. Whaling ships and sampans had fishing ranges that included the NWHI. Westerners recorded their discovery of Midway Atoll in 1859 and claimed the atoll for the U.S. based on the Guano Act of 1856, which authorized Americans to temporarily occupy uninhabited islands to obtain guano. The U.S. took formal possession of the atoll in 1867. Transformation began almost immediately, with projects to blast the reef and create a port on Sand Island. Other islands and atolls were discovered and rediscovered by crews of various sailing ships.

Due to a lack of quality charts for the area, the NWHI and its low-lying reefs and atolls were a navigational hazard for ships and navigators, and shipwrecks were common. Maritime activities by the American, British, French, and Japanese during the nineteenth and twentieth centuries are marked by submerged historic resources and wreck sites found throughout the archipelago (VanTilburg 2002). There are 52 known shipwreck sites throughout the NWHI, the earliest dating back to 1822 (NOAA 2005).

In 1867 the U.S. took possession of Midway and in 1940 constructed a naval air facility there. From 1939 to 1943, Midway functioned as a naval air base, but by 1943 it had been converted to a major submarine base. During World War II, the NWHI played an important role as a strategic location. Following the Battle of Midway, the U.S. Navy established a Naval Air Facility at FFS and created a 3,300-foot landing strip at Tern Island. The facility operated until 1946. Between 1952 and 1979, the USCG operated a LORAN station on Tern Island, FFS.

The naval air facility at Midway was closed in 1992 under the Base Realignment and Closure Act of 1990. As part of the base closure process, the Navy was obligated to consider the effects of the closure on historic sites and structures. The Navy determined that 78 structures, buildings, or objects were eligible for inclusion on the NRHP, including the structures associated with the Battle of Midway NHL, which were designated in 1986 under the World War II in the Pacific theme (U.S. Fish and Wildlife Service 2005a). In 2000, the entire National Wildlife Refuge was designated as the Battle of Midway National Memorial.

2.3.3.3 Other Areas of Importance

There are areas within the Monument that are of cultural importance to native, aboriginal, or local groups that might not otherwise be recognized as significant under the NHPA. These areas have been identified through initial research or are associated with other cultural or natural sites and features. These areas are not historic or cultural properties, which are defined as sites that have undergone formal analysis, evaluation, and consultation in accordance with Sections 106 and 110 of the NHPA, but may be of cultural significance and they may or may not qualify as historic or cultural properties once they undergo formal evaluation and consultation.

Other areas of importance in the Monument may include the following:

- Cultural landscapes (defined below);
- Areas of traditional religious, spiritual, or ceremonial importance to a Native Hawaiian group that are used for maintaining connections to ancestors, nature, cosmology, and creation;
- Areas meant to be kapu (prohibited), which are often wild areas that are meant to be off limits through consecration and are valued for their restrictions;
- Areas of cultural importance for the perpetuation of traditional practices and use or for reviving old practices that are used for subsistence, access for gathering resources, taking care of resources for arts, crafts, and ho‘okupu (offerings), ceremonies, inspiration, meditation, and ‘ike (insight and traditional knowledge); and
- Areas of archaeological importance and prehistoric and historic sites, which may include dwellings and burials, that contribute to western knowledge about the indigenous peoples of the past.

Some natural features and resources may have cultural significance, although they can be difficult to specify and to describe in terms of location and physical place; thus, they may be specific landforms and places that cannot be physically identified, yet clearly have significance in oral traditions. Some areas can derive traditional importance from oral histories that describe ancestral or mythical events, many of which explain how places or landscapes were named or created. These affiliations also illustrate how Native Hawaiian spirituality and worldview intertwines Hawaiian ancestry with life history of islands, landforms, plants, waters, oceans, skies, mountains, and all things natural and supernatural. Many of these intangible elements or connections may not be readily apparent by people unfamiliar with the native worldview or traditional cultural practices.

These areas also may be associated with flora and fauna. For example, Native Hawaiians recognize a spiritual and even genealogical connection to natural resources, specifically kalo (*Colocasia esculata*), or taro, because it plays a large role in some of their creation stories (concerning the sky and earth). One version of this story describes how Wākea, the sky father, coupled with his daughter, resulting in a stillborn and misshapen male fetus named Hāloanakalaukapalili (the quivering leaf of Hāloa) that was buried in the earth on the east side of their house (Enos 1998). From out of the ground where the baby was buried the kalo grew, nourished by the tears of his mother. When Wākea’s daughter became pregnant again, she bore another child that was human and was named Hāloa in honor of his older brother. All future Hawaiians descended from Hāloa, highlighting Native Hawaiians’ familial relationship with the kalo as their older brother, and also teaching the responsibility of mālama ‘āina (Enos 1998; Kameeleihiwa 1992).

More appropriately, in regard to the NWHI, the Kumulipō also highlights man’s relationship and responsibility to nature (Beckwith 1951). This creation chant begins in a time of darkness, and born first is the coral polyp, which became the eldest sibling in a long line of evolution of biological species. While the Kumulipō chant has largely been interpreted as a lineal account for the evolution of biological species through time, this chant also highlights biogeographically the

migration and distribution of these species spatially throughout the Hawaiian archipelago, moving eastward. The western half of the archipelago holds a position of prominence in Hawaiian traditions because it represents the ancestral beginnings of Native Hawaiians and the source of origin for all life (Kikiloi 2006).

Native Hawaiian oral traditions often refer to the islands beyond the main Hawaiian Islands and recall the travels of seafaring ancestors on their way to and from the Hawaiian archipelago. In one significant journey, Pele, the Hawaiian goddess of fire and volcanoes, migrates with her family from their distant homeland to Ni'ihau in the main Hawaiian Islands. They travel by way of Mokumanamana (Emerson 1915). Other oral traditions recall migrations of Native Hawaiians passing through the Northwestern shoals. Therefore, these areas may include more than specific areas where identifiable activities occurred. Because of the interconnected nature of Native Hawaiian beliefs, they may represent links in a chain of places, such as the entire NWHI.

2.3.3.4 Native Hawaiian Cultural Landscapes

Federal guidelines recognize four cultural landscape categories; the following three are most relevant to this discussion (Stoffle et al. 1997):

- Historic vernacular landscapes that illustrate peoples' values and attitudes toward the land and that reflect patterns of settlement, use, and development over time;
- Historic sites that are significant for their association with important events; and
- Ethnographic landscapes associated with contemporary groups that are typically used or valued in traditional ways.

National Park Service (NPS) Cultural Resource Management Guidelines describe cultural landscapes as complex resources that range from rural tracts to formal gardens, further defined by the way the land is organized and divided, settled, and used, including the types of structures that are built on it (Stoffle et al. 1997). Natural features, such as landforms, soils, and vegetation, provide the framework within which the cultural landscape evolves. In its broadest sense, a cultural landscape is a reflection of human adaptation to and use of natural resources (Stoffle et al. 1997).

In Western cultures, it is difficult to define what cultural landscapes mean to Native Hawaiians; labeling and evaluating geographic units that are usually loosely defined and based on interdependent and intermingled cultural traditions present only a part of the overall picture. Although a number of different terms may be used to describe these cultural areas, the term cultural landscape is used here because it is widely understood and has official standing in federal cultural resources law and regulation.

Applying federal guidelines to Native Hawaiian cultural landscapes, a culturally specific set of components reflecting Native Hawaiian spiritual, religious, and cultural values has been identified. In *Kalo Kanu o Ka 'Āina*, a report on the cultural landscape for Ke'anae and Wailua Nui, five somewhat overlapping types of sites were identified (McGregor 1998). These categories necessarily reflect the importance of culturally significant natural resources, in addition to human-made archaeological sites (McGregor 1998), and include the following:

- Areas of naturally occurring or cultivated resources used for food, shelter, or medicine;
- Areas that contain resources used for expression and perpetuation of Hawaiian culture, religion, and language;
- Places where known historical and contemporary religious beliefs or customs are practiced;
- Areas where natural or cultivated endangered terrestrial or marine flora and fauna used in Native Hawaiian ceremonies are located or where materials for ceremonial art and crafts are found; and
- Areas that provide natural and cultural community resources for the perpetuation of language and culture, including place names and natural, cultural, and community resources for art, crafts, music, and dance.

Before Western contact, Native Hawaiians developed a complex system of resource management and a specialized set of skills to survive on remote islands. Resource management revolved around a native worldview that guided the actions and practices of the people. Lands were divided vertically from mountain to ocean into resource management parcels known as ahupua‘a, primarily on the main Hawaiian Islands. These divisions typically included the ridges on both sides of a valley and the offshore area to hundreds of miles from shore. The inclusion of both mountain and ocean lands in a typical ahupua‘a ensured residents access to resources from the mountains and the sea and provided a balance between the two regimes (Abbott 1992). Certain areas were designated to be left alone and wild in their naturally occurring state and were called wao akua (realm of the gods), a pristine region of the mountains, which contained a greater variety of trees and biodiversity. The wao akua regions were seldom accessed by people because of the priority of promoting new growth by not disturbing seed-producing forest areas (Kanahele 2003). On a larger scale of resource management, the NWHI may have functioned in much the same way traditionally, because it too was designated as wao akua, or divine islands (or realm of gods). In essence, this remote region was left wild and pristine because it was viewed as having an important role in the continual cycle of life (creation) and death (afterlife) (Kikiloi 2006).

2.3.3.5 Traditional Cultural Properties

The NPS defines Traditional Cultural Properties (TCPs) as those of traditional religious and cultural significance that, at a minimum, are “eligible for their inclusion in the [NRHP] because of [their] association with cultural practices or beliefs of a living community that (a) are rooted in the community’s history and (b) are important in maintaining the continuing cultural identity of the community” (Parker and King 1990).

Remnants of human presence can be found on the islands of Nihoa and Mokumanamana, all of which are listed on the NRHP. Nihoa has at least 88 archaeological sites and Mokumanamana has at least 52, which include residential features, ceremonial sites, shelters, agricultural terraces, and cairns.

Cultural research involving archival searches, ethnographic interviews, cultural practices, and archaeological studies are ongoing and have identified a number of areas of importance, as discussed above, that may be eligible as TCPs. The process for determining this includes

consultation among FWS, NOAA, the Hawai‘i State Historic Preservation Officer (SHPO), and other interested groups. Special consideration is given to those properties designated as having national significance.

2.3.3.6 Archaeological Sites

The Monument contains a significant number of archaeological sites. Nihoa and Mokumanamana are recognized as culturally and historically significant and are listed on the National Register of Historic Places and are protected by the U.S. Fish and Wildlife Service in accordance with the NWRSAA of 1966, as amended. Archaeological surveys on Nihoa and Mokumanamana have documented numerous archaeological sites and cultural material (Emory 1928; Cleghorn 1988; Ziegler 1990; Graves and Kikiloi, in prep.).

Nihoa, the closest of the islands from the main Hawaiian chain, contains over 88 archaeological sites (including residential features, shelters, ceremonial features, agricultural terraces, and cairns) (Emory 1928; Cleghorn 1988; Kawaharada 2001; Kikiloi and Graves 2005). The island has significant soil development, and the number of constructed terraces suggests some expenditure for agricultural production. The diversity in site types has led archaeologists to conclude that a wide range of cultural activities took place on Nihoa. Previous surveys also uncovered two burials containing the remains of adults and children (Emory 1928). This has led to the conclusion that Nihoa once had a resident population that was either permanent or semipermanent, spanning a period from AD 1000 to 1700 (Emory 1928; Cleghorn 1988).

Mokumanamana (Necker Island), the second closest island to the main Hawaiian chain, has very limited soil development. There are 52 archaeological sites (33 of which are ceremonial structures*)* that have been recorded; there are no substantial habitation sites or agricultural sites on the island. Mokumanamana has the highest concentration of ceremonial sites anywhere in the Hawaiian archipelago. Researchers have hypothesized that this island plays a significant role in the Native Hawaiian tradition regarding the process of creation and afterlife, as it lies directly on the Tropic of Cancer and on an axis between two Hawaiian spiritual realms (Liller 2000; Kikiloi 2006).

A number of artifacts have been collected from both islands, including fishhooks, sinkers, cowry shell lures, hammerstones, grindstones, adzes, coral rubbing stone, and unique stone images (Emory 1928; Cleghorn 1988; Kikiloi and Graves 2005). These artifact collections are stored at the Bernice Pauahi Bishop Museum and at the University of Hawai‘i Archaeology Laboratory. More recent paleo-botanical research by Athens (2007) on Laysan Island has revealed the possibility that coconuts (*Cocos nucifera*) may have been brought to the island by Native Hawaiians who ventured up the archipelago. The presence of coconut pollen from deep within a salt lake in the middle of the island has led to two possible alternatives: This plant was brought purposefully by humans or it arrived on Laysan by itself accidentally. This would be the first and earliest documented case of either accidental or purposeful introduction of the coconut in the Hawaiian Islands (TenBruggencate 2005b).

At present, evaluations are continuing for archaeological sites throughout the Monument. According to NPS regulations (36 CFR § 60.4), a property could be eligible for listing on the NRHP if it meets the following criteria:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

A. that are associated with events that have made a significant contribution to the broad patterns of our history;

B. that are associated with the lives of persons significant in our past;

C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. that have yielded, or may be likely to yield, information important in prehistory or history.

Identified archaeological sites can have additional cultural importance as locations where Hawaiian ancestors lived, worked, worshipped, or engaged in other activities. It has been clearly documented through archival research and ethnographic studies that Native Hawaiians were consistently going to the Northwestern Hawaiian Islands in pre-contact times and into the post-contact historic period (NOAA 2004b; Tava and Keale 1989; Maly 2003; Kikiloi 2006). Archaeological features on the landscape, as well as the numerous artifacts collected, are also indications of maritime seafaring and resource gathering throughout the region. Furthermore, historic western-made anchors and fishing implements can be found throughout the ROI (Van Tilburg 2002). Lisianski, Nihoa, and Mokumanamana have been formally surveyed for pre-contact Hawaiian archaeological sites (Emory 1928; Cleghorn 1988; Zeigler 1990; Graves and Kikiloi, in prep.), and paleo-botanical studies were conducted on Laysan Island (Athens 2007).

Cultural resources in the Monument are being studied through a historical landscape study, in contrast to site-specific individual and unrelated projects, in which a high priority is placed on the interaction between these resources and the immediate environment. Wrecks can provide artificial reef environments but can also leach metals, cargo, and fuel into the ecosystem. A broader historical approach is more compatible with an ecosystem approach to management that examines human impacts on the ecosystem rather than just the individual events. Ongoing work emphasizes a low-impact approach.

2.3.3.7 Paleontological Resources

Paleontological resources in the form of flora remnants can be expected to be present in the Monument. In paleo-botanical studies conducted at Laysan Lake, coconut pollen was found in sediment cores. Evidence of pollen could be interpreted as proof that early Hawaiians extended their explorations of the Hawaiian chain beyond Nihoa and Mokumanamana.

2.3.3.8 Submerged Cultural and Historic Resources

Hawai‘i has approximately 1,500 years of continuous and intensive maritime activities, and hundreds of wreck sites from the nineteenth and twentieth century are scattered throughout the whole Hawaiian archipelago (NOAA 2004b).

For the purposes of this document, submerged cultural resources is defined as submerged archaeological or culturally significant sites over fifty years old. These sites may include shipwrecks, downed airplanes, or submerged structures within the more recent historic period, or may include harder to identify prehistoric sites, consisting of campsites with stone tools or stones used for grinding. Because of their low and uncharted nature, the NWHI have numerous historic shipwrecks (Van Tilburg 2002). Field surveys and management for historic shipwreck and aircraft sites are ongoing. Because of the vast expanse of the NWHI, plans for the maritime heritage survey and management are projected to five and ten years. Shipwrecks are treated as potentially eligible for the NRHP (Van Tilburg 2002).

2.3.3.9 Buildings and Historic Sites

Midway Atoll NWR's lands and water were designated as a National Memorial in 2000 because of their significance in American history. The NPS began studying Midway's heritage resources in 1986 when it conducted a survey of World War II-era properties eligible for designation as a NHL. Nine structures, all defensive positions, were identified on Midway that convey a close association with the pivotal Battle of Midway (June 4-6, 1942), including ammunition magazines (ARMCO huts), a pillbox, and gun emplacements (Thompson 1986). All of the resources are on the west side of Sand Island, on relatively undisturbed terrain. A buffer zone around the individual structures was included in the NHL. No resources were identified on Eastern Island for inclusion in the NHL.

Between 1992 and 1994, the U.S. Navy sponsored studies of the Naval Air Facility on Midway carried out in conjunction with the Department of Defense Legacy Resources Management Program. These investigations, which consisted of archival research, interviews, and field surveys, are presented in several documents, including *Cultural Resources Overview Survey at Naval Air Facility, Midway Island* (Yoklavich 1993), a *Supplemental Cultural Resources Overview Survey* (Yoklavich et al. 1994), and the *Cultural Resources Management Plan* (Helber, Hastert, & Fee 1995). The following is a synopsis of the results as reported in these documents.

Architectural Studies

The initial field effort consisted of an architectural history survey of the structures, buildings, and objects located on Sand and Eastern Islands. A military historian specializing in Cold War history performed archival research and surveyed resources on Eastern and Sand Islands that were constructed after 1945. The historian concluded that none of the Cold War facilities at Midway were eligible for the NRHP because they lacked the exceptional importance necessary for resources less than 50 years old (Yoklavich et al. 1994). Severe weather conditions prohibited the study of Eastern Island during the fieldwork phase in 1992. Therefore, a supplemental survey was conducted in 1994 to complete work on Eastern Island. The 1994 fieldwork included large-format photography of historic properties following standards of the

Historic American Buildings Survey (HABS). In addition to the nine NHL structures, the NRHP determined as eligible under its criteria 69 buildings, structures, and objects from the 1903-1945 period on Sand and Eastern Islands. The properties evaluated as significant are associated with three major themes—colonization, initial years of base construction and the Battle of Midway, and 1942-1945 base construction.

Colonization: The first evidence of habitation on Midway is the buildings associated with the Commercial Pacific Cable Company, constructed in 1903-1904. San Francisco-based architect Henry H. Meyers designed these unique two-story buildings. The innovative design advanced the use of concrete with an embedded steel frame and steel posts. The main four buildings are arranged around a courtyard and are reminders of technological innovations in communication, colonial expansion, and early steel and concrete architecture.

Initial Years of Base Construction and Battle of Midway: Defensive construction before World War II includes more than just the NHL structures. An example is the Power Station building that was hit during the December 7, 1941, attack, which stands as a reminder of that pivotal moment when the United States entered World War II. Approximately half of the historic properties inventoried on Midway are related to this period between 1940 and 1942. Eastern Island sustained heavy damage during the Battle of Midway; historic resources from this period are limited to the runways, a couple of defensive positions, and revetments. Construction of Midway Naval Air Base began in earnest in 1940, with construction battalions and civilian contract workers. Detroit architect Albert Kahn developed plans for many of the buildings, including barracks, Senior Officers Quarters, shops, the motor pool, the seaplane hangar, and the theater. Kahn was well known for his steel and concrete factories. His use of natural light to create buildings with comfortable interior spaces is reflected in the shop buildings on Midway. The Officers Quarters reflects Kahn's design versatility; the houses are functional and stylish, with covered patios, fireplaces, large sliding doors and windows, servant's quarters, and portal window porch details. Most of the buildings designed by Kahn are still in use.

1942-1945 Base Construction: Between 1942 and 1945, after the Battle of Midway, emphasis shifted to creating a Naval Air Station on Sand Island. Eastern Island was heavily damaged during the battle and was left in rather rough condition, although it continued to be the base of operation for marine air squadrons. Only a few buildings remain on Sand Island that were constructed during this period; these include an electric switch station, public works storehouse, radar buildings and radar tower base, diesel power plant, brackish water reservoirs, and command post. Properties that transcend a particular theme or period include the three Japanese grave markers, the cemetery, and the Midway Mall Memorial. The Japanese markers date from about 1911 to 1916. Translations of the markers indicate that they are memorials to fishermen who died and were buried at sea. The location of the markers is not original; they were moved in the early 1970s. The small cemetery is an anomaly because all U.S. military personnel killed in battle or during duty were either buried at sea or transported back to Pearl Harbor. The dates on the gravestones range from 1906 to 1950. Four of the five individuals buried there were medical doctors. The Midway Memorial Mall encompasses several plaques, a large gooney bird statue, and two five-inch guns. One of the plaques was erected in 1941, just a few months after the battle. The guns were probably used during the battle and later were moved to this location.

Archaeological Studies

Dr. Fred Reinman conducted an archaeological survey of Sand Island in 1992 as part of the *Cultural Resources Overview Survey* (Yoklavich 1993). The field investigations consisted of a pedestrian survey of Sand Island, augmented by 20 subsurface core samples. The surface inspections and core samples produced no indication of prehistoric settlement on Sand Island. A literature review of Hawaiian legends was conducted to determine if Midway was included in any travel accounts. While references to distant low-lying islands with abundant birds and turtles were found, no clear tie to Midway was detected (Maly 1994, in Yoklavich et al. 1994:A-1 to A-4). The poor field conditions that hindered study of Eastern Island in 1992 prompted an additional study in 1994 by Paul H. Rosendahl, PhD, Inc., on both Sand and Eastern Islands for the *Supplemental Cultural Resources Overview Survey* (Yoklavich et al. 1994). The intent of this supplemental survey was to achieve uniform coverage of Eastern Island. The sample included 45 auger cores and two contiguous 1.0-meter by 1.0-meter shovel-test units excavated on Eastern Island and three auger cores and three 1.0-meter by 2.0-meter shovel-test units excavated on Sand Island (Yoklavich et al.1994:7). No evidence of Polynesian/Hawaiian or pre-AD 1900 historic period cultural remains was found.

The conclusion of the studies was that there is no evidence of prehistoric Polynesian/Hawaiian occupations or historic period occupations on either island. The subsurface archaeological investigations observed very disturbed deposits, with as much as two meters of fill or redeposited sediment over a thin layer of undisturbed sand.

Polynesians/Hawaiians may have used Midway in their extended travels, but the atoll has experienced such pervasive ground-disturbing activities that finding evidence of prehistoric use is problematic. Even before the mid-twentieth century construction, the low-profile islands were periodically scoured by storms and high winds that may have removed or buried evidence of use.

Tern Island of the FFS was developed as a naval air facility, and the USCG operated LORAN stations there between 1949 and 1970. Many of these structures remain in use for refuge and partner operations.

Past activities at many sites in the Monument, combined with known shipwrecks and sunken naval aircraft, can be defined by state and federal preservation law as historically and nationally significant (NOAA 2004b).

2.4 SOCIOECONOMICS

2.4.1 Human Uses

2.4.1.1 Introduction/Region of Influence

This section describes human uses and activities in the Monument. The ROI for human uses and activities includes all lands and waters within and adjacent to the Monument. This section of the DEA also fulfills the resource assessment requirements of 16 USC 1434 (a)(2)(B) by documenting present and potential uses of the area.

The waters of the NWHI are used for a variety of activities, such as research and management, Navy and DoD training and testing activities, cultural practices, fishing, recreation, ecotourism, and education.

2.4.1.2 Regulatory Environment

While the following description of the regulatory environment describes the separate and often overlapping responsibilities of the Co-Trustees, the No Action alternative includes the December 2006 MOA, which has a primary purpose of facilitating coordinated management. This coordination includes developing a single overarching set of regulations for the Monument, a single permitting system for Monument users, and sharing resources to enforce regulations and carry out management activities. The Co-Trustees are currently addressing these issues. This coordinated management is considered part of the No Action alternative.

Federal Regulations

Monument regulations promulgated in 50 CFR Part 404 primarily relate to prohibiting or regulating human uses within the Monument to ensure the protection of Monument resources. Section 404.4 addresses how access will be granted into the Monument and requires notification prior to entering and after departing. All U.S. vessels passing through the Monument without interruption will be required to provide notification at least 72 hours before entering and within 12 hours of leaving the Monument and must include intended and actual route through the Monument and general categories of any hazardous cargo on board. Section 404.5 describes the VMS requirements for all vessels operating in or transiting through the Monument. Section 404.6 lists all prohibited activities within the Monument. Prohibited activities include exploring for oil, gas, or minerals or using poison or explosives. Section 404.7 describes all regulated activities that are prohibited unless specifically allowed by one of the Monument-issued permits. Sections 404.8 and 404.9 provide exemptions from prohibited activities for emergency response and law enforcement activities (404.8) and armed forces actions (404.9). Section 404.10 describes Monument-specific regulations for commercial fishing activities, essentially prohibiting all commercial fishing immediately, except for bottomfishing, which will be prohibited as of June 15, 2011. Section 404.11 describes the six permit types issued to access and conduct activities otherwise prohibited by Monument regulations. These permit types are 1) research, 2) education, 3) conservation, 4) Native Hawaiian practices, 5) special ocean uses, and 6) recreational activities. Specific requirements for issuance of Native Hawaiian practices,

special ocean uses, and recreational activities are included in the regulations. Section 404.12 ensures that these regulations will be carried out in accordance with international law.

In addition to Monument-specific regulations, FWS has regulations specific to Midway Atoll NWR (50 CFR Part 38), special conditions for cruise ship visits to Midway, and permitting requirements for both Midway Atoll and Hawaiian Islands NWRs under 50 CFR Parts 13, 18, and 25 (general permitting procedures, marine mammal permitting, and administrative provisions, respectively).

NOAA, in association with the Western Pacific Fisheries Management Council, has jurisdiction over the ongoing bottomfish fishery through 50 CFR Part 665. As this permitted activity will be prohibited as of June 15, 2011, as discussed above, prohibition of bottomfishing is considered part of the No Action alternative and effects from fishing will not be analyzed.

On April 3, 2008, the IMO designated the Monument as a PSSA. The PSSA and associated protective measures were adopted to provide additional protection to the exceptional natural, cultural and historic resources in the Monument. Requiring vessels to notify NOAA upon entering the reporting area will help make the operators of these vessels aware that they are traveling through a fragile area with potential navigational hazards such as the extensive coral reefs found in many shallow areas of the Monument. Sovereign immune vessels are not subject to the reporting requirements but all vessels are encouraged to participate.

State Regulations, Policies, and Programs

The DLNR has stewardship responsibility for managing, administering, and exercising control over the coastal and submerged lands, ocean waters, and marine resources under state jurisdiction around each of the NWHI, except Midway Atoll, under Title 12, Chapter 171 Hawaii Revised Statutes. The State is the lead agency for management of the emergent lands at Kure Atoll, a State Wildlife Sanctuary. DLNR's Division of Conservation and Resources Enforcement (DOCARE) maintains full police powers, including the power of arrest, within all lands and waters within the state's jurisdiction. In 2005, the DLNR's Division of Aquatic Resources established the Northwestern Hawaiian Islands Marine Refuge (0-3 nm [3.5 mi, 5.5 km] around all emergent lands, except Midway Atoll) through Hawaii Administrative Rules, Chapter 13-60.5. Unless otherwise authorized by law, it is unlawful for any person to enter the refuge without a permit except for freedom of navigation, passage without interruption, interstate commerce, and activities related to national defense, enforcement, or foreign affairs and in response to emergencies.

The state currently holds the submerged and ceded lands of the NWHI in trust. Established by a 1978 amendment of the Constitution of the State of Hawai'i, OHA serves as the principal agency working for Native Hawaiians. OHA was created for various purposes including bettering the conditions of Native Hawaiians. OHA manages a property and monetary trust, creating its fiduciary duty to Native Hawaiians. The OHA trust is funded in part by a pro rata share of income derived from the ceded lands portion of the public land trust.

2.4.1.3 Resources Overview

The area the Monument encompasses has a long history of use. Native Hawaiians explored these waters, established settlements, and conducted religious ceremonies for hundreds of years prior to the arrival of the first Europeans. Most extractive uses, including guano mining, egg and feather collection, rabbit farming, whaling, and a variety of fishing ventures, ended by the early 1900s. The U.S. military used FFS and Midway Atoll, which are equipped with runways, as permanent bases during and after World War II. The USCG built a LORAN station with a 4,000-foot runway at Kure Atoll in 1960. The Navy conducts training and testing within the Hawai‘i Operating Area, which includes a portion of the Monument. In addition, the DoD conducts missile defense testing, including missile intercepts, in and around the Monument. The earliest intensive scientific expedition in the Northwestern Hawaiian Islands was the Rothschild Expedition in 1891 (Ely and Clapp 1973). Research continues to be one of the primary activities occurring within the Monument. Management activities conducted by the State of Hawai‘i, FWS, and NOAA have been ongoing for decades. Human activities and use of the Monument resources are carefully managed, considering historical uses and new threats through permitting, enforcement, and managing specific human uses, including Native Hawaiian cultural practices and visitors at Midway Atoll.

Historical Uses

The waters and islands of the Monument have been visited and inhabited by Native Hawaiians since at least 1000 AD. Other documented accounts tell of how fishermen in the late 1800s from the main Hawaiian Islands would make special trips to the NWHI for four months at a time – from May to August, which was the special sailing season. These accounts highlight the importance that the waters of the NWHI played in the lives of pre-contact Native Hawaiians who regularly sailed to, through and from this region. Further details on Native Hawaiian uses of the Monument are available in section 2.3, Cultural and Historic Resources.

The impacts of guano mining, egg and feather collection, rabbit farming, dredge and fill, importation of soil to Midway, and invasive species that occurred in a few of the islands in the late 1800s and 1900s caused serious environmental damage to these fragile places (NOAA 2005). In the 1800s and 1900s, western sailing ships exploited the area for seals, whales, reef fish, turtles, sharks, birds, pearl oysters, and sea cucumbers (WPFMC undated). The pearl oyster population (*Pinctada margaritifera*) on Pearl and Hermes Atoll was nearly extirpated in a few short years and has yet to recover to pre-exploitation levels (Keenan et al. 2006). Japanese vessels harvested bird skins, eggs, and feathers until 1909, when the area was designated the Hawaiian Island Reservation by President Theodore Roosevelt. Fishing continued largely unregulated until the late 1970s, when the Magnuson-Stevens Act established U.S. sovereignty over fishery resources in the Exclusive Economic Zone, out to 200 nm, leading to the development of four federally administered fishery management plans for precious corals, crustaceans, pelagic species, and bottomfish. Today, only eight bottomfish vessels are grandfathered in and allowed to continue fishing until June 15, 2011, after which all commercial extraction of Monument resources will be prohibited. Additional regulations limiting the total allowable catch, areas open to the fishery, and general vessel conditions are aspects of the baseline conditions.

The first military presence occurred at Midway Atoll, which President Theodore Roosevelt put under the control of the U.S. Navy in 1903. Midway was subsequently managed by the Commercial Pacific Cable Company, which laid the first trans-Pacific communications cable. Prior to World War II, Pan American World Airways flew weekly Clipper plane flights to Midway. On August 1, 1941, U.S. Naval Air Station Midway was commissioned. Midway was the site of two major battles, the attack on December 7, 1941, and the Battle of Midway on June 4 to 7, 1942. On July 15, 1942, the submarine base at Midway was commissioned, providing a strategic outpost in the Pacific during World War II and the Cold War. After World War II, Midway was an active navy base supporting a population of up to 4,000 people. The naval air facility was closed in 1992, and in 1997 the last U.S. Navy personnel departed, following the completion of environmental cleanup and mitigation measures (NOAA 2003a).

In 1942, the Navy transformed the 11-acre (4.5-hectare) Tern Island in FFS into a 42-acre (17-hectare) airstrip and fuel depot, housing 118 servicemen. It served as an emergency landing strip and refueling stop and provided surveillance of the surrounding area. The atoll was swept clean by a tidal wave in 1946, after which the Navy closed its base there. In 1952, the USCG built a LORAN beacon tower on Tern, along with a 20-person support facility. Several cold war operations were conducted at FFS such as the recently declassified 'Corona Project,' the first operational space photo reconnaissance satellite system. FFS served as a tracking and recovery station for this project in the early 1960s. An additional 100 people were stationed at FFS to monitor the aboveground nuclear testing at Johnston Atoll. During the Cold War, FFS housed up to 300 personnel at a time in support of the different classified and unclassified missions (Wood 2001). The USCG continued to operate the installation until 1979, when it was turned over to FWS (Amerson 1971). In 1960, the USCG built a LORAN C station with a single 625-foot-high (190.5-meter-high) transmitter tower. In addition to the transmitter tower, the USCG built a 4,000-foot runway, a pump house, a pier, seven aboveground storage tanks, and living and working quarters for 24 personnel. The station was decommissioned in 1992 and was abandoned in 1993. Today, all but two buildings and a cistern have been demolished and buried on the island.

Current Human Uses and Activities

Compared to the past, there is little human activity in the Monument today. With the departure of the military and the phasing out of all commercial fishing by 2011, the main marine-related activities are research, wildlife management, and transiting ships (for a discussion of transiting ships please refer to section 2.8). Regulations in 50 CFR Part 404 provide access to the Monument under six types of permitted activities: 1) research, 2) education, 3) conservation, 4) Native Hawaiian practices, 5) special ocean uses, and 6) recreational activities. In addition, access by the armed forces for emergency response, enforcement, and passage without interruption are allowed without permit by regulation. Commercial bottomfishing by eight federally permitted vessels will be allowed to continue through June 15, 2011, after which it will be prohibited.

Understanding and Interpreting the Northwestern Hawaiian Islands

In order to best protect the NWHI, the need for understanding and documenting the historical significance of the area has been growing. Research efforts in ethnographic studies, archaeology,

and archived information have provided a wealth of cultural information pertaining to the practices and traditions of Native Hawaiians in the NWHI. In order to allow access to this historical information, steps have been taken by NOAA, FWS, the State of Hawai‘i, and other partnerships through the program “Navigating Change” to provide students with engaging materials that convey the importance of these traditions and cultural values. In addition to the cultural research conducted on the NWHI, research has been done on historic resources (nonmarine sites, structures, artifacts, culture, and places) within the Monument associated with the period after 1778 when Western contact was made with Native Hawaiians. The Midway Atoll Historic Preservation Plan, implemented in 1999, focuses on long-term management and treatment of historic sites and identifies procedures for new historic finds. This plan also offers ways of interpreting historic data and releasing it through public outreach. With the exception of Midway Atoll, the current historical record of the NWHI is minimal because limited historical research has been conducted in this area.

Reducing Threats to Monument Resources

A variety of management practices to reduce threats to Monument resources have been implemented. This includes alien species control conducted by FWS and a multi-agency effort to remove marine debris led by NOAA. Between 1996 and 2006, 563 tons of marine debris was removed from the NWHI. Areas considered “High Entanglement Risk Zones” for Hawaiian monk seals are cleaned and have been designated accumulation rate zones. The Marine Debris Program, established in 2005 under NOAA’s Office of Response and Restoration, was made permanent in 2006 by the Marine Debris Research, Prevention, and Reduction Act. NOAA is to work in conjunction with other agencies such as the EPA and the USCG to find sources of marine debris pollution and act in removing this debris. Awareness of this threat to the NWHI, in particular to the coral reef ecosystem, is fostered through publications and public outreach displays in NOAA’s Mokupāpapa Discovery Center, as well as in the “Navigating Change” program Teacher’s Guide.

FWS has an ongoing program to eradicate invasive terrestrial species and restore native ecosystems. This effort focuses on the most invasive and harmful pest species of plants such as sandbur, golden crownbeard, and ironwood; insects such as various ant species and the gray bird locust; and introduced mammals such as black rats.

Research and monitoring conducted by federal and state agencies, academic institutions, and other organizations over the last 30 years have increased our understanding of the structure and function of ecosystems of the NWHI and the interconnectedness between the NWHI and the main Hawaiian Islands. Early research efforts include the Tanager expedition in 1923, the Smithsonian’s Atoll Research Bulletin publications of the mid 1960s, and the Tripartite expeditions of the late 1970s and early 1980s. The integrated research by the Tripartite Cooperative Program, led by NMFS, FWS, Hawai‘i Division of Fish and Game (now Division of Aquatic Resources), and the University of Hawai‘i Sea Grant College Program, encompassed all resources on land, in the air, and in the sea. The research that resulted from this multi-agency effort provided a seminal understanding of the NWHI ecosystem and continues to inform research efforts.

Monitoring select stocks of commercially fished species, such as bottomfish and lobsters, and of protected species, such as Hawaiian monk seals and the Hawaiian population of green sea turtles, has been conducted by NMFS Pacific Islands Fishery Science Center for several decades. Ecosystem-level characterization and monitoring has been a more recent endeavor. The Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NOWRAMP, now known as NWHIRAMP) was a multi-agency program initiated in 2000 to characterize and monitor the coral reefs of the NWHI using a consistent set of sampling protocols and to establish a baseline for future data gathering and for monitoring change over time. Similar annual multi-agency efforts have been supported by a variety of agencies and institutions in the ensuing years. Mapping efforts, led by NOAA, have provided detailed maps of the NWHI seafloor and are consolidated into two documents, *The Draft Atlas of the Shallow-Water Benthic Habitats of the NWHI* and *The Bathymetric Atlas of the NWHI*. These documents begin to describe the marine habitats and bathymetry of the NWHI and establish important baseline information for resource managers. This high interest in research and mapping activities in the NWHI, concurrent with the availability of more funds for coral reef ecosystem research, has increased the activity level in the Monument.

In May 2003, a multi-agency partnership workshop was convened to identify information and science needs and resources for effective conservation and management of the NWHI. The results were analyzed and summarized in the report *Information Needs for Conservation Science and Management of the Northwestern Hawaiian Islands* (Gittings et al. 2004). In November 2004, the *Third Scientific Symposium on Resource Investigations in the NWHI* was convened to provide a forum for the review and synthesis of recent research and to identify knowledge gaps and delineate future research needs. This symposium highlighted the need for agencies to develop more cooperative research programs. Most participants recognized the need to develop a more coordinated research plan in the NWHI that will address the management needs of the Monument Co-Trustees. These efforts have provided a foundation for the development of a coordinated Monument Natural Resources Science Plan, which is being drafted.

Managing Human Uses

NOAA, FWS, and the State of Hawai‘i have played a major role in organizing research expeditions that serve dual purposes of collecting necessary baseline data and information for management combined with media coverage to introduce the region’s resources to the general public. Multi-agency educational programs include outreach for the 2002 and 2004 NOWRAMPs, the “Navigating Change” program, and “Hawai‘i’s Living Reef” program. A five-part video, educational curriculum, and teleconferences with the traditional Polynesian voyaging canoe Hōkūle‘a during its 2004 expedition to the NWHI were completed in partnership with several agencies and organizations. Teacher workshops on the “Navigating Change” program have been held since 2003 across Hawai‘i, and an outreach coordinator has been hired to launch the curriculum in schools statewide. The Co-Trustees and other partners also created and facilitated a number of education-at-sea initiatives and developed new standard-based curriculum on the NWHI now being introduced to Hawai‘i’s fourth and fifth grade teachers. In addition to educational programs, the MMB currently develops informational materials such as fact sheets and brochures for educational purposes that are able to reach those that are not participating in these programs.

NOAA also built a visitor center collocated with its Hilo office to spur greater public awareness of the region and ocean conservation issues. Mokupāpapa: Discovery Center for Hawaii's Remote Coral Reefs was conceived and built in 2003 to interpret the natural science, culture, and history of the NWHI and surrounding marine environment. The 4,000-square-foot (372-square-meter) center brings the region to people by proxy, since most will never have the opportunity to visit it. The center has served as a physical hub of learning, regularly hosting well attended educational talks and activities, while drawing a constant stream of field trips co-organized by Monument staff and by school and community groups from around the state and beyond. To date, nearly 100,000 visitors have been exposed to the wonders of the NWHI and have developed an informed appreciation of the region's resources and the Monument's ongoing effort to restore and preserve them.

In conjunction with a private contractor, FWS operated Midway Atoll NWR as a combined refuge and ecotourism/historical destination between 1996 and 2002. The contractor provided the infrastructure and visitor services to operate ecological and historic preservation service projects, guided tours, diving and snorkeling trips, and sport fishing operations. In all, 12,262 people visited Midway between 1997 and 2001, with an average visitation of around 200 people per month. In 2002, FWS and the contractor ended their cooperative agreement. In May 2007, FWS approved an interim visitor services program to guide a small-scale visitor program. A regularly scheduled visitor program was established in January 2008 that allows limited visitor opportunities for people to experience the wildlife and history of Midway and the Monument. Recreational activities in this interim visitor service plan include wildlife observation, photography, environmental education, and interpretation.

Remote location and hazardous environmental conditions in the NWHI have discouraged recreational activities in the past. Since the departure of the USCG from FFS, ocean recreation has been limited to offshore snorkeling by resident staff and researchers. Anecdotal reports indicate that trans-Pacific yachts may occasionally traverse the NWHI, possibly lingering at various reefs and atolls along the way.

The size, remote location, and hazardous navigational conditions of the Monument present significant enforcement challenges. The USCG has long been the primary enforcement agency conducting surface and aerial patrols in the NWHI. However, with their broad mandates and large enforcement area, the USCG has few resources to allocate to NWHI patrols. In addition to frequent aerial patrols, each year the USCG sends a buoy tender to the NWHI (Havlik 2005). USCG operations in this region cover a broad range, including search and rescue, servicing aids to navigation, response to oil and hazardous chemical spills, inspecting commercial vessels for safety and environmental regulations compliance, interdiction of illegal narcotics and migrants, and enforcement of fisheries management laws (Mathers 2005). In addition to the USCG, NOAA, the State of Hawai‘i, and FWS all have authority to enforce regulations within the Monument. These entities are expected to share resources to fulfill the common goals discussed in the December 2006 MOA.

2.4.2 Human Health, Safety and Hazardous Materials

2.4.2.1 Introduction/Region of Influence

This section addresses issues related to the Proposed Action alternative that are associated with human health and safety, hazardous material management, hazardous waste management, and environmental contamination. The ROI is the marine waters within the Monument, adjacent open-ocean areas outside of the Monument, and islands within the Monument as they may affect the marine environment.

2.4.2.2 Regulatory Environment

Human safety in the work place and the management of hazardous materials and waste are already highly regulated under a number of federal and state laws. These laws are administered by various federal agencies, including the U.S. Department of Labor Occupational Health and Safety Administration (OSHA), the U.S. Department of Transportation (DOT), the U.S. Environmental Protection Agency (EPA), the State Department of Labor and Industrial Relations, and the State Department of Health.

Hazardous and toxic substances are defined as those workplace chemicals that are capable of causing harm. In this definition, the term "chemicals" includes dusts, mixtures, and common materials, such as paints, fuels, and solvents. A hazardous chemical, as defined by the Hazard Communication Standard, is any chemical that can cause a health hazard. This determination is made by the chemical manufacturer, as described in 29 CFR Section 1910.1200(d).

Hazardous material is defined by the DOT as a substance or material that is capable of posing an unreasonable risk to health and safety or property when transported in commerce and has been designated as hazardous under the federal Hazardous Materials Transportation Law (49 USC 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table, 49 CFR, Section 172.101, and materials that meet the defining criteria for hazard classes and divisions in 49 CFR Part 173. The Resource Conservation and Recovery Act (RCRA) specifically defines a hazardous waste as a solid waste (or combination of wastes) that, due to its quantity, concentration, physical, chemical, or infectious characteristics, can cause or significantly contribute to an increase in mortality. RCRA further defines a hazardous waste as one that can increase serious, irreversible, or incapacitating reversible illness or pose a hazard to human health or the environment when improperly treated, stored, disposed of, or otherwise managed. A solid waste is a hazardous waste if it is listed in 40 CFR Part 261 as a hazardous waste or if it exhibits any ignitable, corrosive, reactive, or toxic characteristics, as defined in 40 CFR Part 261.

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, on December 11, 1980, and the Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986. Superfund is the federal government's program to clean up the nation's uncontrolled hazardous waste sites.

In addition, Monument regulations specifically prohibit some activities, such as exploration for oil, gas, or minerals and use of poisons or explosives to collect or harvest Monument resources, that could affect human safety or result in the release hazardous materials or wastes into the environment (50 CFR Section 404.6). Monument regulations require a permit for all access to and activities conducted in the Monument. All vessels operating in the Monument must possess VMS. VMS enables law enforcement to monitor and identify unauthorized entry of vessels to the Monument and to respond quickly to emergencies involving human safety or hazardous material release.

Emergency response in the NWHI is coordinated under a series of plans and systems, including the National Response Plan and the National Incident Management System. The National Response Plan establishes a comprehensive all-hazards approach to enhance the ability of the United States to manage domestic incidents, including oil and hazardous chemical spills. This plan incorporates the National Contingency Plan and its regulations governing how pollution response is conducted by the USCG, EPA, the affected state, and resource trustees, including NOAA and FWS. The NWHI are also covered by a more specific Area Contingency Plan for the Hawaiian Islands.

FWS and NOAA have designated representatives who are federal members of the Regional Response Team, which makes response recommendations to the Federal On-Scene Coordinator. DLNR and the Hawai‘i Department of Health are the designated state representatives for all marine injury events. The Department of Health is the State On-Scene Coordinator. These representatives work closely with all parts of FWS, NOAA, the state, and the MMB in making recommendations on the use of alternative response technologies, such as dispersants. Unlike the state, NOAA and the Department of the Interior can only make consultative recommendations; they do not have a formal vote in that process.

While the Monument and state regulations regulate access, they also provide a general exemption for activities necessary to respond to emergencies. The general exemption for emergencies allows for individuals responding to emergencies threatening life, property, or the environment to conduct necessary activities without the need for a permit. The general exemption only applies to the emergency response activity itself and does not apply to ancillary activities such as training for emergency response, salvage operations, remediation, or restoration. These ancillary actions also require timely response and would be covered under the appropriate agency’s conservation and management permit.

2.4.2.3 Resources Overview

This section provides an overview of the human health and safety in marine and land areas within the region of influence.

Activities within Marine Areas in and adjacent to the Monument

Diving Safety

Self-Contained Underwater Breathing Apparatus (SCUBA) diving for research and management activities is routinely conducted in the Monument. Co-Trustee agencies and other partner organizations have diving requirements specific to that agency; however, these requirements are

aligned through reciprocity agreements. The Monument supports coordinated dive operations through such agreements.

Hazardous Material and Hazardous Waste Management

All hazardous material and hazardous waste management activities within the marine areas of the Monument are on marine vessels. With the prohibition of commercial bottomfishing in the Monument, research vessels and vessels used in restoration activities, such as the removal of marine debris, make up the predominant vessel activity. In addition, no more than three cruise ships per year are permitted entry to the Midway Atoll Special Management Area. The controlled environment onboard these vessels allows for proper containment of chemical substances. In a shipboard environment there are numerous engineering and management controls that prevent hazardous chemicals or materials from contaminating crew, passengers, and the environment. Any hazardous waste generated aboard a marine vessel, such as mercury-containing light bulbs, waste paint, dry cleaning and photo-processing operations, batteries, or solvents, is required by RCRA to offload hazardous waste to land-based treatment or disposal facilities (NOAA 2004a). Monument regulations and permit conditions provide additional safeguards on hazardous material and waste management including requirement for VMS and reporting all incidents.

Environmental Contamination

Maritime accidents are the only known major source of environmental contamination within the waters of the Monument. The first known Western shipwrecks in the NWHI occurred in 1822. Since then, many more known and unidentified marine vessels have been lost in the NWHI. A maritime cultural survey conducted by NOAA in 2002 lists over 50 shipwreck sites (NOAA 2002). At least five of these ships were lost within the past 25 years.

The three most notable recent wrecks in the NWHI are the Swordman I, the Paradise Queen II, and the Casitas. The 85-foot-long (26-meter-long) line fishing vessel Swordman I, carrying more than 6,000 gallons (22,712 liters) of diesel fuel and hydraulic oil, ran aground at Pearl and Hermes Atoll in 2000. In October 1998, the Paradise Queen II ran aground off Kure Atoll after catching 3,000 pounds (1,360 kilograms) of lobster. The boat was carrying about 11,500 gallons (43,530 liters) of diesel fuel and oil, over a thousand plastic lobster traps with lead weights, 11 mi (9.5 nm; 18 km) of fishing line, and an assortment of boating equipment (Parks 2004). The 145-foot ship Casitas ran aground on the northern side of Pearl and Hermes Atoll on July 2, 2005 with more than 33,000 gallons (124,900 liters) of diesel fuel on board (TenBruggencate 2005a). Very little data are available on the extent or effects of contamination from shipwrecks in the NWHI. However, iron that erodes from ships acts as a nutrient in marine waters, causing localized growth of "blue-green algae" (cyanobacteria) and invasive soft corals that can smother reefs and surrounding wrecks.

Activities in Land Areas within the Monument

Hazardous Material and Hazardous Waste Management

Most of the hazardous materials and hazardous wastes in the Monument are at FWS facilities within the Midway Atoll Special Management Area. Facilities at Midway are maintained and operated by a FWS contractor, Chugach Industries. Facilities and infrastructure at Midway are similar to any small city or town. A variety of hazardous materials are used to maintain and

operate the facilities and infrastructure at Midway Atoll. Material safety data sheets and a hazardous material inventory are kept at each location where hazardous materials are stored, in compliance with OSHA hazardous communication requirements (Christenson 2005). All hazardous waste generated by Chugach Industries at Midway is shipped by an EPA-approved transporter to an EPA-approved disposal or treatment facility. Chugach Industries manages the airfield, wastewater treatment facility, electrical power plant, potable water storage and delivery system, harbor, housing areas, dining facilities, and the fuel farm, with a capacity of 450,000 gallons. Chugach Industries manages a spill prevention, control, and countermeasures plan and an aboveground storage tanks monitoring program for the fuel farm, as required by the EPA (Christenson 2005).

The maintenance of the smaller FWS facility at FFS and the DLNR facility at Kure Atoll requires some hazardous material and generates small amounts of hazardous waste. Both FWS and DLNR have an environmental compliance program and properly transport hazardous waste to the main Hawaiian Islands, in compliance with hazardous material and hazardous waste regulations (Horvath 2005; Smith 2005). The other islands have seasonal camps that require very little hazardous materials, and all wastes are shipped back to Honolulu at the end of each season.

Environmental Contamination

Building Materials

Green Island at Kure Atoll and Tern and East Islands at FFS have former USCG stations and associated PCB contamination. Pearl and Hermes Atoll served as a refueling site for seaplanes. Midway Atoll bears the most contamination of any of the NWHI, most of which is associated with previous military activities. Several buildings on Sand Island contain hazardous materials such as lead-based paint, arsenic-treated wood, or asbestos. These toxic materials pose potential health and safety concerns for humans and wildlife. Lead-based paint flakes are ingested by albatross chicks, causing growth deformities and mortality. Some of the other islands had guano mining operations on them during the late 1800s, but no known contamination was left behind.

At Midway Atoll, the Navy excavated and treated 1,390 cubic yards of PCB-contaminated soils that was excavated from five sites (U.S. Navy 1998). Long-term monitoring revealed PCB contamination leaking from the landfill and around a beached tug and barge, which have been removed along with the surrounding soil (U.S. Navy 2001a, 2001b).

During Navy base closure, 111 buildings and other structures were demolished. Large amounts of metal debris were removed from shorelines and other wildlife habitats, and deteriorating asbestos materials and lead-based paint were removed from dozens of structures. Hundreds of batteries, compressed gas cylinders, and other metal debris were removed from nearshore waters (U.S. Fish and Wildlife Service 2005b).

A USCG LORAN station operated on East Island, FFS, from 1944 to 1952. LORAN is a terrestrial-based navigation system using low-frequency radio transmitters. Before the popularity of satellite-based global positioning system, LORAN was a widely used marine navigation system. Cleanup activities at the USCG station took place in 1965 and 1973. The USCG initiated a geophysical investigation of the island in 1998, looking for possible landfills. Based on the anomalies recorded, 23 five-foot-deep pits were dug. No contamination requiring cleanup was

found (Silberman 2005). A USCG LORAN station operated on Tern Island, FFS, from 1952 until 1979, when it was turned over to FWS. The USCG removed part of the landfill containing high levels of PCB-contaminated soil in October 2001 (Silberman 2005). The remaining portion of the dump contains PCB-contaminated soil that is tidally washed and visited by turtles, seals, and migratory birds.

Storage Tanks

At Midway Atoll, the Navy removed 132 underground and aboveground storage tanks, some as large as 2.2 million gallons (8.327 million liters). Several miles of petroleum pipeline was drained and removed, and 10,657 cubic yards (8,438 cubic meters) of petroleum-contaminated soils were excavated and treated. Ninety thousand gallons (340,650 liters) of petroleum product were extracted from the groundwater (U.S. Fish and Wildlife Service 2005b). In addition, beach erosion exposed two underground storage tanks on Eastern Island, both of which have been removed (USDOD 2003).

In early February 2003, monitoring results from an aboveground storage tank indicated a release of approximately 100,000 gallons (378,500 liters) of JP-5 aviation fuel on Sand Island. This release did not come in contact with the marine environment and caused no effect to wildlife. The cause of the leak was identified as corrosion failure of fittings on a fuel delivery line. Dozens of test pits were dug to define the limits of the release. Recovery trenches and recovery and monitoring wells were then put in place. An automated product recovery system was installed to automate and enhance recovery. From January 20-27, 2005 the WS and its contractor deactivated the fuel recovery system following recovery of 80,000 gallons of fuel. A Remedial Investigation Report was submitted documenting that additional remediation was not necessary. All but eight wells were removed or abandoned in place. The remaining eight wells were cut off six inches below the surface and fitted with surface-mounted well boxes. These were then designated as monitoring wells. Based on the high costs of off-site disposal of both fuel and recovered product, soils were remediated by aerobic biodegradation in an aboveground soil farm, and recovered fuel was used for cogeneration to burn other wastes at the island in a customized incinerator. All recovered fuels were disposed of in this manner by early 2007 (Ragain 2004; Christenson 2008) (Jan. 25, 2005 Project Close-Out Activities Report, Geo Engineers).

Pesticides

With the exception of an uncontrolled release of insecticide at Laysan Island, the other islands and atolls have not been significantly contaminated by insecticides. In 1988, biologists first detected unexplained mortality of carrion flies and ghost crabs at a beach crest site on Laysan Island. These scavengers were coming in to feed on dead albatross chicks, commonly seen in summer months at Laysan. Upon entering the area later referred to as the "Dead Zone," they would abruptly die. The cause was finally identified by FWS as the pesticide Carbofuran, and the area was cleaned by removing and treating on-site contaminated sand. In 2001, insecticide-contaminated soil was removed from Laysan Island and transported to the mainland for disposal. FWS suspects that the release resulted from an abandoned container, which washed ashore and deteriorated, releasing its contents (Woodward 2005).

During Navy closure at Midway Atoll, 1,578 cubic yards of DDT-, DDE-, and DDD-contaminated soil were excavated from six sites (U.S. Navy 1998).

Landfills

'No Dig' areas are Land Use Controls (LUCs) remaining from the closure of the Navy base. These areas had soil contamination removed to a depth of 4 feet and backfilled with clean soil. The remaining control is that no digging may occur below 4 feet, or the Service assumes all responsibility. Additionally, Midway has several landfills left behind by the Navy. Some of these landfills were created during base closure for the disposal of construction rubble and asbestos. Other landfills were created during Navy occupancy for disposal of materials associated with operations. Two active landfills at Midway Atoll were investigated, capped, and closed (U.S. Fish and Wildlife Service 2005b).

There are 'No Dig' areas on both Sand Island and Eastern Island. One area on Sand Island that needs continued monitoring and potentially further remediation is known as the Old Bulky Waste Landfill. This site is an uncharacterized landfill that was created by the disposal of scrap metal, used equipment, and unconsolidated waste off the south shore of Sand Island to create a peninsula approximately 1,200 feet long by 450 feet (average) wide by 9 feet high (Navy 1995). It is surrounded on the three seaward sides by an approximately 10-foot-thick band of concrete and stone rip-rap. Wastes known to have been deposited in the landfill are metals (lead, cadmium, chromium, and nickel), gasoline, battery acid, batteries, mercury, lead-based paint, solvents, waste oil (including burning of petroleum, oil, and lubricants), PCBs, dioxins, furans, transmission and brake fluids, vehicles, equipment, tires, and miscellaneous debris (BRAC SI 1996 Volume 1). The landfill was covered in approximately 2 to 2.5 feet of soil in an attempt to contain the waste. The Old Bulky Waste Landfill is eroding, and the soil placed on top is sifting into the debris, causing large holes to open up around the edge and in the center of the landfill. Additionally, burrowing birds are bringing up buried soil and nesting below the cover.

The USCG Kure Atoll LORAN station landfill, on Green Island, was used to dispose of old electrical components and scrap metal during the USCG's 33-year tenure, which ended in 1993. The landfill was cleaned out as part of the station closure process. The USCG remediated the landfill on Kure in 1994. The USCG excavated and put into containers soil from the landfill that exhibited a concentration equal to or greater than 25 mg/kg PCB. A total of 36 cubic yards of soil were removed from the landfill. This soil, along with six 95-gallon overpack drums of corroded capacitors, was transported off-island for disposal at the TSCA-permitted U.S. Ecology Facility at Beatty, Nevada. Scrap metal, cable, non-liquid-containing drums, and the remaining soil in the landfill that contained debris were removed from the landfill and reinterred in a reburial pit (USCG 1994b). The depth of the reburial pit was set 15 feet bgs, which was 2 feet above the groundwater. All metal debris and soils with concentrations below 25 mg/kg PCB were placed in the reburial pit, which was then graded to a minimum depth of 5 feet bgs, covered with a nonwoven puncture-resistant geotextile fabric, then covered with clean soil from 5 feet bgs to original grade (USCG 1994b). The clean up level at Tern Island was 2 mg/kg.

Emergency Medical and Aviation Infrastructure

Monument staff have access to resources-at-risk information that is of interest during contingency planning and spill response through the Sanctuaries Hazardous Incident Emergency Logistics Database System, a web-based decision support tool commonly referred to as "SHIELDS." This tool includes regulatory information, contact lists, geographic information system (GIS) maps, environmental sensitivity indexes, information on resources at risk, and

significant terrestrial and submerged historic and cultural resource and hazards data. Environmental Sensitivity Indices were last produced by NOAA for this area in 2001. Environmental Sensitivity Indices identify resources at risk on a seasonal and location basis and facilitate decisions about response options given threats to specific resources at risk.

FWS facilities at Midway Atoll serve as an emergency stop for marine vessels in distress in the mid-Pacific Ocean. The deep draft harbor at Sand Island can handle large vessels, and Henderson Airfield at Midway has the only runway that can handle large aircraft within a large swath of the mid-Pacific Ocean. Marine vessels periodically bring fishers and researchers with medical emergencies to Midway. FWS maintains emergency medical supplies, and an on-island medic can treat patients with emergency problems before the USCG transports them to Honolulu for treatment (Honolulu Advertiser 2003; Associated Press 2004).

Henderson Airfield is an FAA Part139-certified airport and is an important emergency landing site for aircraft en route from the west coast of North America to East Asia. Extended twin-engine aircraft operations (ETOPS) over the mid-Pacific Ocean use routes that keep them close enough to an FAA Part139-certified airport to meet FAA requirements for alternate landing sites. According to the FAA Advisory Circular 120-42A on ETOPS, "These suitable en route alternates serve a different purpose than the destination alternate airport and would normally be used only in the event of an engine failure or loss of primary airplane systems."

Though the focus of en route alternate airports is primarily for twin-engine aircraft, these airports are important for the safety of all long-range operations regardless of the number of engines. Alternate airports support unscheduled landings from such emergencies as cargo fire, decompression, fuel leak, passenger illness, or severe turbulence. On several occasions, aircraft on non-ETOPS routes have diverted to various islands in the Pacific, namely Adak, Midway, Shemya, and Wake. Reasons for these diversions included passenger or crew medical emergency, an unanticipated headwind requiring additional fuel, and an engine fire warning (Boeing Company 1998). As recently as January 2004, a commercial passenger jet used Henderson Field for an emergency landing after suffering oil pressure drop in one engine (Honolulu Advertiser 2004).

2.4.3 Land Use

2.4.3.1 Introduction/Region of Influence

This section addresses issues related to the Proposed Action alternative that are associated with land use. The ROI for land use includes all lands within the Monument. This section of the DEA also fulfills the resource assessment requirements of 16 USC 1434(a)(2)(B) by documenting present and potential uses of the area.

2.4.3.2 Regulatory Environment

Federal Regulations

Monument regulations promulgated in 50 CFR Part 404 primarily relate to prohibiting or regulating human uses within the Monument to ensure the protection of Monument resources.

Section 404.4 addresses how access will be granted into the Monument and requires notification prior to entering and after departing. All U.S. vessels passing through the Monument without interruption will be required to provide notification at least 72 hours before entering and within 12 hours of leaving the Monument and must include intended and actual routes through the Monument and general categories of any hazardous cargo on board. Section 404.5 describes the VMS requirements for all vessels operating in or transiting through the Monument. Section 404.6 lists all prohibited activities within the Monument. Prohibited activities include exploring for oil, gas, or minerals or using poison or explosives. Section 404.7 describes all regulated activities that are prohibited unless specifically allowed by one of the Monument-issued permits. Sections 404.8 and 404.9 provide exemptions from prohibited activities for emergency response and law enforcement activities (404.8) and armed forces actions (404.9). Section 404.11 describes the six permit types issued to access and conduct activities otherwise prohibited by Monument regulations. These permit types are 1) research, 2) education, 3) conservation, 4) Native Hawaiian practices, 5) special ocean uses, and 6) recreational activities. Specific requirements for issuance of Native Hawaiian practices, special ocean uses, and recreational activities are included in the regulations. Section 404.12 ensures that these regulations will be carried out in accordance with international law.

In addition to Monument-specific regulations, FWS has regulations specific to Midway Atoll NWR (50 CFR Part 38), special conditions for cruise ship visits to Midway, and permitting requirements for both Midway Atoll and Hawaiian Islands NWRs under 50 CFR Parts 13, 18, and 25.

State Regulations, Policies, and Programs

The DLNR has stewardship responsibility for managing, administering, and exercising control over the coastal and submerged lands, ocean waters, and marine resources under state jurisdiction around each of the NWHI under Title 12, Chapter 171 Hawaii Revised Statutes. The State is the lead agency for managing the emergent lands at Kure Atoll, a state wildlife sanctuary. DLNR's Division of Conservation and Resources Enforcement (DOCARE) maintains full police powers, including power of arrest, within all lands and waters within the state's jurisdiction. In 2005, the DLNR's Division of Aquatic Resources established the NWHI State Marine Refuge (0-3 nm [3.5 mi, 5.5 km] around all emergent lands, except Midway Atoll) through Hawaii Administrative Rules, Chapter 13-60.5. Unless otherwise authorized by law, it is unlawful for any person to enter the refuge without a permit except for freedom of navigation, passage without interruption, interstate commerce, and activities related to national defense, enforcement, or foreign affairs and in response to emergencies.

The state currently holds the submerged and ceded lands of the NWHI in trust. Established by a 1978 amendment of the Constitution of the State of Hawai‘i, OHA serves as the principal agency working for Native Hawaiians. OHA was created for various purposes including bettering the conditions of Native Hawaiians. OHA manages a property and monetary trust, creating its fiduciary duty to Native Hawaiians. The OHA trust is funded in part by a pro rata share of income derived from the ceded lands portion of the public land trust.

The Hawai‘i Coastal Zone Management Program (HCZMP) was promulgated in 1977 in response to the federal CZMA. The coastal zone area encompasses the entire state, including all

marine waters seaward to the extent of the 14-mi (12-nm, 22-km) territorial sea and all archipelagic waters. The HCZMP is charged with protecting waters within the coastal zone and includes a permit system to control development within a coastal zone and a shoreline setback area, which serves as a buffer against coastal hazards and erosion and protects views. The CZMA requires direct federal activities and development projects to be consistent with approved state coastal programs to the maximum extent practicable.

In compliance with the federal Coastal Zone Act Reauthorization Amendments of 1990, the State of Hawai‘i prepared the Hawai‘i Coastal Nonpoint Pollution Control Program in 1996, the year that NOAA and EPA approved the program. In July 2000, the state completed an implementation plan for polluted runoff control, which established long-term and short-term goals and activities to control nonpoint source pollution, as required for implementing the Coastal Nonpoint Pollution Control Program. It also established five-year implementation plans to address polluted runoff in six categories: agriculture, forestry, urban, marinas and recreational boating, hydromodification, and wetlands and riparian areas. The nonpoint source pollution control programs are intended to be consistent with the Native Hawaiian approach to resource management.

The State Department of Health has regulatory oversight for maintaining high standards of water quality throughout the NWHI, which is classified as Class AA waters, via the Clean Water Branch. In addition, the Department of Health’s Hazard Evaluation and Emergency Response Office is the on-scene coordinator for all responses to hazardous material, chemical, and oil spill response.

2.4.3.3 Resources Overview

Current Land Use

Land use in the Monument has been minimal throughout history, although some areas, such as Midway Atoll and the FFS, were used during World War II and after for military training and exercise grounds. Most of the islets and reef formations of the Monument have small land areas and do not offer much area for development or human use. Under the Proposed Action alternative, the ROI would require permits for visiting the islands and reefs.

Kure Atoll

Kure Atoll is an oval-shaped atoll located at the farthest northwestern end of the NWHI chain. Green Island is the only permanent island within the atoll. In 1960, the USCG built a LORAN station with a 4,000-foot runway, a 625-foot transmitter tower, and working and living quarters for 24 personnel. The station was decommissioned in 1992 and was abandoned in 1993. Today all but two buildings and a cistern have been demolished and buried on the island.

Midway Atoll

In 1996 the remaining Naval base on Midway Atoll was turned over to FWS to be managed as Midway Atoll National Wildlife Refuge. Today, full-time NWR staff administer a small visitors program, care for wildlife, restore native plant life, and protect historic resources. Those historic resources that remain on Midway Atoll are protected under the Midway Atoll Historic Preservation Plan, approved in 1999, that focuses on long-term management and treatment for

the 63 historic properties. The airstrip on Midway Atoll is still active and averages about 45 flights per year. The USCG also uses Midway as a refueling stop. Today approximately 65 people reside on Midway year round. The maximum capacity for all overnight people is 150 with no more than 50 visitors at any one time. The Midway Atoll Visitor Services Plan also allows 3 large group (50-800 people) day-use visits per year, with no more than 400 people on the island at a time unless refuge management has approved a higher number (e.g. for very limited and special circumstances such as to participate in a ceremony commemorating the anniversary of the Battle of Midway.

Pearl and Hermes Atoll
The low islets of Pearl and Hermes Atoll are exposed to occasional overwashing by high seas. Resource managers occupy a seasonal field camp at the atoll.

Lisianski Island
Lisianski is a small island; its highest point is a sand dune that rises 40 feet above sea level and is relatively undisturbed. Resource managers occupy a seasonal field camp on the island.

Laysan Island
Laysan Island was used by guano traders and feather harvesters in the late 1800s and early 1900s but these activities were stopped after President Theodore Roosevelt declared the Hawaiian Islands Reservation in 1909. A year-round field camp of three to six people supporting ecological restoration work has been maintained at Laysan Island since 1992.

French Frigate Shoals
The FFS is an open atoll with several small, sandy islets. One of the small islands, Tern Island, was formed into a 42-acre airstrip in 1942 to serve as a refueling stop for planes going to Midway Atoll during World War II. Today, the original seawall, runway, and some buildings remain. The FFS average about 27 charter flights per year on the existing runway. FWS maintains a field station that is staffed by two permanent year-round employees and some volunteers.

Mokumanamana (Necker Island)
The Tanager Expedition came to Mokumanamana, also known as Necker Island, in 1923 for biological and cultural research. There is significant evidence of human habitation on Mokumanamana, with 52 archaeological sites. Mokumanamana is visited occasionally on day trips for wildlife monitoring, Native Hawaiian practices, and cultural research.

Nihoa
Native Hawaiians are thought to have used Nihoa at least between AD 1000 and AD 1700, as over 88 archaeological sites have been found on the island. The Tanager Expedition stopped at Nihoa, in addition to Mokumanamana, for biological and cultural research. Occasionally, short-term field camps are established for wildlife monitoring and invasive species management.

2.4.4 Economics

2.4.4.1 Introduction/Region of Influence

The State of Hawai‘i forms the economic ROI and defines the geographic area in which the predominant economic and social effects from the Proposed Action alternative are likely to take place. The geographic area of the ROI was defined based on the home location of individuals directly affected by research, management, recreation, education, and cultural activities or other activities in the Monument.

The baseline year for the effects analysis is 2005, except for fishing, which is 2011; however, most of the economic and demographic data for the ROI are available only through 2003. Wherever possible, the most recent data available are presented so that the affected environment descriptions reflect current conditions in the ROI.

2.4.4.2 Resources Overview

Population

The population of Hawai‘i increased by almost nine percent between 1990 and 2000 and by another 5.4 percent between 2000 and 2005 (Table 2.4-1). Among the fifty states and the District of Columbia, Hawai‘i was ranked the forty-first most populous state, as of the 2000 Census (U.S. Census Bureau 2001). By 2030, Hawai‘i’s population is projected to increase to 1.63 million people, an average rate of growth of slightly less than 1.0 percent per year between 2000 and 2030. The natural population growth—the net increase from births over deaths—has previously been the more important contributor to total population growth. However, Hawai‘i’s population is aging, and forecasts project that in-migration will provide the larger share of population growth over the next 25 years (DBEDT 2004a).

Table 2.4-1
Hawai‘i Population

	1990	2000	2005 (estimated)	% Change 1990-2000	% Change 2000-2005
Hawai‘i	1,113,491	1,212,670	1,277,950	8.9	5.4

Sources: DBEDT 2004a

Employment and Industry

State Overview. Total earnings by industry for Hawai‘i was about $30 billion (BEA 2005). The state has a civilian labor force of almost 626,000 people (Table 2.4-2). The state’s civilian labor force and number of persons employed has increased between 1990 and 2005. The unemployment rate is at a low 2.7 percent, compared to the national unemployment rate of 5.4 percent (BLS 2005). Total civilian employment in Hawai‘i is expected to increase to 725,850 by 2030, an annual growth rate of 0.8 percent (DBEDT 2004a).

Table 2.4-2
Hawai‘i Labor Market Information

Year	Civilian Labor Force	Employment	Unemployment	Unemployment Rate
1990	550,300	534,300	16,000	2.9
2000	604,000	578,200	25,800	4.3
2005	625,950	608,900	17,050	2.7

Source: HIWI 2005
Note: 2005 data as of February 2005.

The State of Hawai‘i calculated employment and industry forecasts by major industry for 2005. Table 2.4-3 presents the distribution of employment among the various industry sectors and the changes projected in these sectors between 2003 and 2005. Education and health services, trade, leisure and hospitality, professional and business services, and the government sector will employ the greatest number of workers in 2005. Between 2003 and 2005, construction and mining, professional and business services, educational and health services, leisure and hospitality, and trade, transportation, and utilities will account for 92 percent of the job growth over the two-year period. Educational and health services and trade, transportation, and utilities will be the major contributors in job expansion, adding nearly half of the employment growth. Construction is projected to have the largest percentage of growth of all industries. Employment losses are expected in information and in agriculture, forestry, and fishing (HIWI 2004).

Table 2.4-3
Hawai‘i Industry Employment and Growth Rates, 2003–2005

Industry	2003	2005	Change in Employment	Average Annual Growth Rate
Agriculture, forestry, and fishing	7,460	7,350	-110	-0.7%
Construction and mining	27,780	29,390	1,610	2.9%
Manufacturing	14,840	14,950	120	0.4%
Trade, transportation, and utilities	109,300	113,200	3,890	1.8%
Trade	79,940	82,830	2,890	1.8%
Wholesale	16,680	17,120	440	1.2%
Retail	63,260	65,710	2,450	1.9%
Transportation	26,660	27,650	990	1.9%
Utilities	2,700	2,720	20	0.4%
Information	11,070	10,630	-450	-2.0%
Financial activities	28,210	28,750	540	1.0%
Professional and business services	69,010	71,700	2,690	1.9%
Educational and health services	109,650	114,070	4,420	2.0%
Leisure and hospitality	98,870	101,250	2,380	1.2%
Other services	23,140	23,490	360	0.8%
Government	67,900	68,730	840	0.6%
Federal	28,700	29,090	390	0.7%
State	22,290	22,690	400	0.9%
Local	16,900	16,960	60	0.2%
Total employment	567,230	583,510	16,290	1.4%

Industry	2003	2005	Change in Employment	Average Annual Growth Rate

Source: HIWI 2004

Note: Data as of the end of second quarter 2003 and 2005. Totals are rounded to the nearest ten. Totals may not add up to 100 percent due to rounding.

Retail trade will account for nearly two-thirds of the boost in employment in the trade, transportation, and utilities industry sector, with several shopping centers undergoing renovations and upgrades and the opening of big-box retailers (HIWI 2004).

Increasing military presence in Hawai‘i, driven by national counterterrorism efforts, will add to the demand for jobs in the construction industry. In addition, the relocation of the Army’s Stryker Brigade to Hawai‘i has created a need for construction projects such as residential housing, which will bring further economic benefits to the industry (HIWI 2004).

Employment in the agriculture, forestry, and fishing industry is predicted to decline by 0.7 percent. This general trend is a result of the transition from large-scale plantation crops to smaller crops in diversified farming (HIWI 2004).

Hawai‘i industry employment and growth rate projections through 2012 predict that construction, professional and business services, and education and health services sectors will continue to expand and will have the largest percentage increases of the state’s total employment growth. The agriculture, forestry, and fishing industry sector is projected to decline by 0.2 percent between 2002 and 2012, losing 180 jobs (DLIR 2005). The agriculture, forestry, and fishing industry employs the smallest share of the state’s workforce at 1.3 percent.

Research and Management in the Monument. Research and management activities in the Monument include assessment and long-term monitoring of resources, genetic and ecological research, restoration activities such as marine debris removal, listed species recovery and protection, enforcement, and other conservation activities. An estimated $7.5 million is spent annually in research and management of the Monument. All access to the Monument is regulated through permits issued by the Monument Management Board.

Commercial Fishing in the Monument. Commercial bottomfishing in the Monument is prohibited after June 15, 2011. Until that date, Monument regulations establish total landings for the eight permitted fishermen at 350,000 pounds of bottomfish and 180,000 pounds of pelagic species. The NWHI commercial bottomfishing industry has on average landed approximately 300,000 pounds of bottomfish each year, with an ex-vessel value of about $1 million (WPFMC 2004a). Twenty people are directly employed in the NWHI commercial bottomfish fishery. Four of the bottomfish operations are on O‘ahu, two are on Kaua‘i, one is on Maui, and one is on the island of Hawai‘i. No other commercial fishing is allowed in the Monument. Commercial fishing is not considered in the socioeconomic baseline for the Monument, as it has already been prohibited by Monument regulations.

Tourism Industry in Hawai‘i. Ocean tourism and recreation in the Monument are regulated under special ocean use and recreational permits. Due to the remote location of the Monument, few ocean tourism and recreational activities have occurred in the NWHI. FWS permitted a

cooperator to operate an ecotourism operation based on Midway Atoll from 1996 to 2002, drawing approximately 250 sportfishers and divers to the refuge each year. FWS has completed a tourism feasibility study and a visitor's services plan for Midway, which will guide future decisions on these types of activities in the area. Tourist and recreational opportunities on the eight main Hawaiian islands, in particular on O'ahu, Maui, Hawai'i, and Kaua'i, are abundant and satisfy the demand for tourism and recreation activity. Almost 6.4 million people visited the main Hawaiian Islands in 2003, spending more than $10 billion (DBEDT 2004b).

Income

Total personal income for the State was about $37 billion in 2002. The average annual personal income growth rate was 7.5 percent from 1969 through 2002, just below the national average growth rate of 7.7 percent. The per capita personal income for Hawai'i was $29,875 in 2002, slightly below the national per capita personal income of $30,906 (BEA 2004).

Hawai'i's median annual family income was $67,564 as of 2002, thirteenth among the fifty states and the District of Columbia. The cost of living in Hawai'i for a family of four has been estimated to be about 25 percent higher than the United States average for a comparable standard of living (DBEDT 2004b).

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2.5 OTHER RESOURCES

2.5.1 Water Quality

2.5.1.1 Introduction/Region of Influence

This section addresses issues related to the Proposed Action alternative that are associated with the water quality of marine and terrestrial waters and water resources. Due to the continuous mixing of water masses within the marine environment, the ROI for water quality includes Monument waters. Additionally, the ROI for water quality includes the terrestrial waters and water resources of the NWHI. This section also identifies threats to water quality in the affected environment.

2.5.1.2 Regulatory Environment

Federal Regulations

The regulations promulgated in 50 CFR Part 404 during the establishment of the Monument include numerous specific regulations aimed at the protection of water quality. In addition to monitoring vessel traffic through the issuance of permits, all U.S. vessels passing through the Monument without interruption will be required to provide notification at least 72 hours before entering and within 12 hours of leaving the Monument and include intended and actual route through the Monument and general categories of any hazardous cargo on board. In addition, prohibited activities, including exploring for oil, gas, or minerals or using poison or explosives, specifically protect the water quality of the Monument. Regulated activities, including discharging or depositing material into Monument waters, are designed to minimize the effect of vessel activity on water quality.

In addition, general federal regulations relevant to marine water quality include the following:

- Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), as amended (33 USC 1251-1382);
- Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the Ocean Dumping Act, as amended (33 USC 1401-1421, 1441-1445, and 2801-2805 and 16 USC 1447-1447f);
- Oil Pollution Control Act (OPA 90), as amended (33 USC 2701-2761);
- Act to Prevent Pollution from Ships (APPS) (33 USC 1901-1912);
- Coastal Zone Management Act of 1972 (CZMA), as amended (16 USC 1451-1465);
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended (42 USC 9601-9675);
- Resource Conservation and Recovery Act (RCRA), as amended (42 USC 6901-6992k);
- Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 USC 4701-4728);

- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee); and
- Toxic Substances Control Act of 1976, as amended (15 USC 2601-2692).

Congress passed the Federal Water Pollution Control Act in 1972, and amended it with the Clean Water Act in 1977. Under CWA Section 402, anyone discharging a pollutant from a point source to the navigable waters of the U.S. must obtain a National Pollutant Discharge Elimination System permit, which requires compliance with technology- and water quality-based treatment standards. The State of Hawai‘i has been delegated authority over discharges to state waters (HAR Chapter 11-55).

Under CWA Section 403, any discharge to the territorial seas or beyond also must comply with the Ocean Discharge Criteria established under CWA Section 403. CWA Section 312 contains regulations protecting human health and the aquatic environment from disease-causing microorganisms that may be present in sewage discharged from vessels. A marine sanitation device (MSD) on board a vessel is designed to receive, retain, treat, control, or discharge sewage. Pursuant to Section 312 of the CWA, all recreational boats with installed toilet facilities must have an operable MSD on board (33 USC 1322). Vessels 65 feet (20 meters) and under may use a Type I, II, or III MSD. Operators of vessels over that length must install a Type II or III MSD. The USCG must certify all installed MSDs.

The MPRSA regulates the dumping of wastes into marine waters and is the primary federal environmental statute governing transportation of dredged material for disposal into ocean waters. CWA Section 404 governs the discharge of dredged or fill material into waters of the U.S. In 1983, a global ban on dumping radioactive wastes was implemented. The MPRSA and the CWA regulate materials that are disposed of in the marine environment, and only sediments determined to be nontoxic by U.S. Environmental Protection Agency (EPA) standards may be disposed of in the marine environment. The EPA and the U.S. Army Corps of Engineers share responsibility for managing the disposal of dredged materials.

The Oil Pollution Control Act of 1990 requires extensive planning for oil spills from tank vessels and onshore and offshore facilities and places strict liability on parties responsible for oil spills.

The discharge of solid wastes is regulated under the CWA and the APPS, as amended by the Marine Plastic Pollution Research and Control Act of 1987. The APPS regulates the disposal of plastics and garbage for the U.S. Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78). Under these regulations, disposing of plastics is prohibited in all waters.

The CZMA provides incentives for coastal states to develop and implement coastal area management programs. It is significant with regard to water pollution abatement, particularly concerning nonpoint source pollution. In 1990, Congress enacted the Coastal Zone Act Reauthorization Amendments by adding Section 6217, entitled Protecting Coastal Waters. It requires that states with coastal zone management programs develop and implement coastal nonpoint pollution control programs. Section 6217 requires states to submit a coastal nonpoint pollution control management plan and is intended to strengthen links among federal, state, and

county coastal zone management and water quality programs. The purpose of the plan is to describe the programs and actions taken to control polluted runoff and to maintain water quality standards.

CERCLA addresses cleanup of hazardous substances and mandates liability for environmental cleanup on those who release hazardous substances into the environment. In conjunction with the CWA, it requires preparation of a National Contingency Plan for responding to oil or hazardous substances release.

RCRA addresses hazardous waste management, establishing duties and responsibilities for hazardous waste generators, transporters, handlers, and disposers. The NWRSAA and the regulations and policies developed to implement the act address the quality and quantity of water impacting management of fish and wildlife and their habitats on refuges. The TSCA was enacted by Congress to give EPA the ability to track industrial chemicals currently available, produced, or imported into the United States. EPA controls these chemicals for health and human safety.

State Regulations, Policies, and Programs

In Hawai‘i, key state regulations relevant to marine water quality are as follows:

- Water Quality Standards (Hawaii Administrative Rules [HAR] Chapter 11-54);
- Water Pollution Control (HAR Chapter 11-55);
- Coastal Zone Management Program;
- Point-Source Discharge Requirements; and
- Ballast Water Management (HAR Chapter 13-76).

The regulations governing water quality in Hawai‘i are primarily contained in Title 11, Chapter 54 of the Hawaii Administrative Rules (HAR Chapter 11-54), Water Quality Standards. The Hawai‘i State Department of Health, Clean Water Branch administers and enforces state water pollution laws and regulations that are outlined in Hawaii Administrative Rules Chapter 11-55. The State of Hawai‘i also has delegated authority under the CWA for any discharges into state waters through the administration of the National Pollutant Discharge Elimination System (NPDES) permits.

All waters are subject to an anti-degradation policy, which states that “Waters whose quality [is] higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated to the director [of the Department of Health] that the change is justifiable as a result of important economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently in, those waters” (HAR Section 11-54-01.1).

In general, all waters must be free of substances resulting from domestic, industrial, or other controllable sources of pollution. This includes sediments resulting from erosion caused by construction or agricultural activities, floating or sinkable materials, thermal pollutants, pathogens, biocides, excessive nutrients, toxic compounds, and other pollutants. All discharges

to state waters are subject to laboratory testing to determine if the discharge meets standards for acute or chronic toxicity. These standards are published in HAR Title 11, Chapter 54.

Marine waters are classified as either Class AA or Class A, based on protection of water quality (HAR Chapter 11-54). The open coastal waters around the NWHI are classified as Class AA waters (HAR Section 11-54-6[b][2][A][ix] and [x] from the shoreline to a depth of 183 meters or 600 feet). The objective of Class AA waters is that they remain as nearly as possible in their natural pristine state, while Class A waters are maintained for multiple uses, with lower water quality standards applied to them.

The water quality standards regulations also contain special classifications and standards for marine bottom ecosystems, and these areas are designated as Class I or Class II areas. All beaches, marine pools and protected coves, and reef flats and reef communities (e.g., Kure Atoll Lagoon, Pearl and Hermes Lagoon, Lisianski Island, Maro Reef, Laysan Island, and French Frigate Shoals Lagoon) in the NWHI are considered Class I areas. The objective of Class I marine bottom ecosystems is to keep them in the most pristine and natural state possible, and only nonconsumptive uses are allowed in these areas. Class II marine bottom ecosystems allow for multiple uses.

The Hawai‘i Coastal Zone Management Program (HCZMP) was promulgated in 1977 in response to the federal CZMA. The coastal zone area encompasses the entire state, including all marine waters seaward to the extent of the 14-mi (12-nm, 22-km) territorial sea and all archipelagic waters. The HCZMP is charged with protecting waters within the coastal zone and includes a permit system to control development within a coastal zone and a shoreline setback area, which serves as a buffer against coastal hazards and erosion and protects views. The CZMA requires direct federal activities and development projects to be consistent with approved state coastal programs to the maximum extent practicable.

In compliance with the federal Coastal Zone Act Reauthorization Amendments of 1990, the State of Hawai‘i prepared the Hawai‘i Coastal Nonpoint Pollution Control Program in 1996, the year that NOAA and EPA approved the program. In July 2000, the state completed an implementation plan for polluted runoff control, which established long-term and short-term goals and activities to control nonpoint source pollution, as required for implementing the Coastal Nonpoint Pollution Control Program. It also established five-year implementation plans to address polluted runoff in six categories: agriculture, forestry, urban, marinas and recreational boating, hydromodification, and wetlands and riparian areas. The nonpoint source pollution control programs are intended to be consistent with the Native Hawaiian approach to resource management (ahupua‘a management).

In 2007, Chapter 76, Non-Indigenous Aquatic Species (Subchapter 2, Ballast Water Management) was added to Hawaii Administrative Rules. These rules are intended to work in coordination with and complement federal regulations to prevent the introduction and spread of invasive species in Hawai‘i waters by regulating vessel ballast water. Regulations include the adoption of a ballast water management program, ballast water exchange program, reporting requirements, and compliance monitoring.

2.5.1.3 Resources Overview

Existing Water Quality Conditions

Water quality in the marine and terrestrial environments of the Monument is important to the survival of the various species of biota and the coral reef ecosystems.

Marine

The marine environment in the ROI is generally considered to be relatively pristine. This is due to the remoteness of the NWHI, the fact that most of the islets and shoals remain uninhabited, and the oceanographic conditions of the central Pacific Ocean. While there have been very few studies done on contamination in the ROI, the lack of major pollution sources and the health and productivity of the coral reef ecosystems in the area are strong evidence of the relatively unpolluted marine environment (Friedlander et al. 2005a). However, several localized areas of contamination exist along the shorelines and islands in the NWHI. This contamination includes PCBs, dioxin, PAHs, and metals. Some fish and other biota sampled in these areas have PCB levels that rivaled levels found in fish near major PCB manufacturers on the mainland.

A considerable amount of research has been done on the oceanographic conditions of the NWHI. Characteristics of the marine environment of the ROI include highly variable sea surface temperatures, both nutrient-rich and nutrient-poor waters, and seasonal high-energy waves (Friedlander et al. 2005a). Sea surface temperatures around the NWHI fluctuate greatly, particularly in the northwest end of the island chain, ranging from less than 64 °F (18 °C) in the winter to greater than 82 °F (28 °C) in the summer. Sea surface temperature also varies greatly from year to year over longer periods, including those characterized by ENSO (Friedlander et al. 2005a).

Satellite observations of the ROI indicate a significant chlorophyll front in the area, with seasonal and annual migrations (northward in the summer and southward during the winter). When these nutrient-rich waters cross through the NWHI, productivity in the coral reef ecosystems is expected to become elevated, and trophic changes in the ecosystem may occur (Friedlander et al. 2005a).

There is a pronounced annual cycle of ocean wave energy in the ROI, with over 10-foot (3.3-meter) waves occurring annually, resulting from extratropical winter storms. Most storms approach the NWHI from the northwest, shaping the assemblages of species that exist in the northwest-facing reef areas. There is also evidence of variability in cumulative wave energy and wave energy events between years and over longer periods, including Pacific Decadal Oscillation (PDO) events (Mantua et al. 1997).

However, despite the rare pristine conditions of the ROI, the area has not been completely untouched by human influences. Vessel discharges, spills, shipwrecks, marine debris, and land-based military activities have all contributed to contamination in the ROI. These sources and their effects on water quality are discussed in the Pollution Sources section below.

Terrestrial

The terrestrial environment in the ROI varies among the different islands in the Monument. The only permanent surface water in the NWHI is on Laysan Island. Laysan Island has a 173-acre (0.7square-kilometer) hypersaline interior lake. A small brackish groundwater lens exists below the surface of some of the islands (U.S. Fish and Wildlife Service 2007a [IVSP, Midway Atoll NWR]). Freshwater sources are found at Nihoa, Mokumanamana, and Laysan Island, and Midway and Kure Atolls. Rainwater percolates through the sand rapidly. Fresh water, being slightly lighter, tends to float on salt water below the ground or is trapped by cap rock of phosphatized coral. The coral cap rock overlays the basaltic volcanic base. Historic records reveal that potable brackish water could be found 5 to 10 feet below the ground surface on several of the sandy NWHI. On the rocky islands, rain water percolates though the porous basalt until it reaches layers of dike material. Groundwater flows along the upper surface of dense materials, and fresh water seeps are found where it reaches the ground surface (U.S. Fish and Wildlife Service 1986).

Water Resources

The potable water is supplied via rainwater catchment and treatment systems on Midway, Tern, and Laysan and is imported or made from sea water using reverse osmosis at camps on other islands. See the Utilities section for further information on potable water systems.

Marine Pollution Sources

Marine Sources

Cargo vessels and research vessels transit the ROI regularly, and cruise ships, USCG ships, and recreational boats pass through the ROI occasionally. Research vessels sometimes anchor in designated areas near the shore of various islands, while recreational boaters and cruise ships occasionally visit Midway. During the course of normal operations, seagoing vessels produce a multitude of wastes, which, when disposed of into the marine environment, can affect the water quality of the Monument. Potential discharges from vessels include sewage, gray water, bilge water, hazardous wastes, and solid materials and toxic compounds. These are discussed below.

Sewage

Sewage includes vessel sewage and other wastewater. Sewage discharge may contain bacteria or viruses that cause disease in humans and in other wildlife. Chemicals and deodorants often used in MSDs include chlorine, ammonia, or formaldehyde and may also affect water quality. The CWA requires the use of MSDs for all offshore vessels 3.5 mi (3 nm, 5.5 km) or closer. Monument regulations prohibit the discharge of MSD effluent within the Special Preservation Areas (SPA) or Midway Atoll Special Management Area (SMA) but allow discharge in the rest of the Monument; dumping of raw sewage is prohibited throughout the Monument and in waters outside the Monument if the sewage would subsequently drift into Monument waters.

Type I MSDs shred and disinfect the waste prior to its discharge into the water. Type II MSDs provide an advanced form of the same type of treatment used by Type I devices and discharge wastes with lower fecal coliform counts and reduced suspended solids. Type III MSDs, commonly called holding tanks, flush sewage into a tank containing deodorizers and other chemicals. The contents of the holding tank are stored until they can be properly disposed of at a shore-side pump-out facility. Type III MSDs can be equipped with a discharge option, usually

called a Y-valve, that allows the boater to direct the sewage either into the holding tank or directly overboard.

Gray water
Gray water from vessels includes wastewater from kitchens, showers, and laundries. Pollutants in gray water include suspended solids, oil, grease, ammonia, nitrogen, phosphates, copper, lead, mercury, nickel, silver and zinc, detergents, cleaners, oil and grease, metals, pesticides, and medical and dental wastes. Monument regulations prohibit the discharge of gray water in all SPAs and the SMA.

Bilge Water
Bilge water may contain fuel, oil, wastewater, other chemicals, and materials that collect at the bottom of the ship's hull with fresh water and sea water. Under the Oil Pollution Act and the CWA, vessels are prohibited from releasing any water with an oil content of greater than 15 parts per million (ppm) of oil to water within 14 mi (12 nm, 22 km) of the coastline. Beyond 14 mi, discharges with oil content greater than 100 ppm are prohibited.

Hazardous Materials
Various hazardous materials are generated during the course of vessel operations, including cleaning and photo processing chemicals, paints and solvents, batteries, and fluorescent light bulbs containing mercury. RCRA requires that vessels generating or transporting hazardous wastes offload these wastes at treatment or disposal facilities (NOAA 2003b). Release of any of these materials is prohibited within the Monument and in waters outside the Monument if these materials would subsequently drift into Monument waters.

Spill and Release Incidents
There is a persistent threat to water quality from an accidental oil spill or cargo release from a vessel within or outside of Monument boundaries. Offshore spills have the potential to severely impair water quality and sensitive nearshore ecosystems. Floating debris from vessels is also a significant threat to the resources of the Monument, and there have been a number of such incidents. The most noteworthy example was in 1987, when a container of the pesticide Carbofuran is believed to have washed ashore at Laysan Island. The pesticide killed all invertebrates and the endangered Laysan finches that came into contact with or consumed contaminated sand.

Ship and Aircraft Wrecks
The NWHI region has been a significant center of maritime activity historically and of aircraft activity during World War II. As such, a number of ships and aircraft have been wrecked in the area. There are 52 known shipwrecks, 14 of which have been located. There are also 67 known aircraft wrecks in the area, only two of which have been located. While most of the shipwrecks are sailing vessels and pose little threat to the marine water quality, more modern ship and aircraft wrecks are likely to pose a threat of petroleum contamination (Friedlander et al. 2005a).

One of the more harmful ship groundings occurred in 1998, when the Paradise Queen II, an 80-foot (24-meter) lobster fishing vessel, ran aground on a coral reef at Kure Atoll, spilling approximately 4,000 gallons (15,140 liters) of diesel fuel and other petroleum hydrocarbons into the marine environment. The remaining 7,000 gallons (26,500 liters) of fuel were recovered from

the vessel during salvage operations (Maragos and Gulko 2002). More recently, the 85-foot-long (26-meter-long) line fishing vessel Swordman I, carrying more than 10,000 gallons (37,800 liters) of diesel fuel and hydraulic oil, ran aground at Pearl and Hermes Atoll in 2000 (NOAA 2001a). The 145-foot (45-meter) ship Casitas ran aground on the northern side of Pearl and Hermes Atoll on July 2, 2005, with more than 33,000 gallons (124,900 liters) of diesel fuel on board (TenBruggencate 2005a). Additionally, iron that erodes from the ships acts as a nutrient in the marine waters, often causing growths of invasive algae and soft corals that smother the reefs surrounding the wrecks.

Land-Based Sources

Early extractive activities in the NWHI occurred around the turn of the twentieth century, with guano mining at Laysan Island. Later, the islands became strategically important for the U.S., which constructed a naval base at Midway Atoll and FFS during the first half of the twentieth century. During World War II, FFS and Pearl and Hermes Atoll were used for seaplane refueling. After World War II, the USCG constructed LORAN stations at Kure Atoll and FFS. Midway Atoll's U.S. Navy Airfield, which was in operation from 1941 to 1996, is the island's most significant source of land-based marine pollution (Friedlander et al. 2005a).

Land-based pollution sources from these early developments include lead and mercury batteries, transformers, capacitors, barrels, and landfills (uncharacterized and unlined). There is suspected petroleum on FFS and Pearl and Hermes Atoll from the historic refueling operations on those islands. Kure Atoll, Midway Atoll, and FFS are known point sources for PCBs from the former LORAN stations (Friedlander et al. 2005a).

On Midway Atoll, historic contamination includes petroleum in groundwater and coastal waters, pesticides, PCBs, metals, including lead and arsenic, and unknown contaminants that continue to leak and erode from landfills. As part of the base realignment and closure process, the U.S. Navy remediated much of the historic contamination. PCBs, dichloro-diphenyl-trichloroethane/ dichloro-diphenyl-dichloroethylene- (DDT/DDE-), and petroleum-contaminated soils were excavated and treated, and petroleum-contaminated groundwater was remediated. In addition, a large number of underground and aboveground storage tanks and several miles of petroleum pipeline were drained and removed. However, despite extensive remediation efforts, several areas may warrant continued monitoring for potential releases (U.S. Fish and Wildlife Service 2005b; Friedlander et al. 2005a). In 1997, a FWS contractor installed a septic system for Sand Island and closed the Navy's sewage outfall pipe.

Some pollution studies in the NWHI have been performed in areas where conditions and historical use indicate the potential for elevated levels of contaminants (Miao 2000a, Miao 200b, Miao 2001). In addition, the U.S. Navy and USCG conducted investigations to document the scope and extent of contamination at their installations to aid in remediation efforts. Evidence of terrestrial and aquatic contamination is present in wildlife in the NWHI (PCBs, PAHs, lead, and other metals).

There are several point sources of pollution throughout the Monument. It appears that most of the negative effects of these contaminants are localized. Studies are on-going to determine upper trophic level effects of some of the persistent compounds. The remoteness of the NWHI, the low level of development on the islands, and the oceanographic conditions of the region have

ensured that the marine environment remains relatively pristine, as strongly indicated by the health of the coral reef ecosystems in the NWHI. Potentially, the most persistent and significant threat to water quality in the ROI is the vessels that transit the area. Vessel traffic presents the risk of a large oil spill or release of cargo that could greatly impair the marine water quality of the affected environment.

2.5.2 Transportation and Communication Infrastructure

2.5.2.1 Introduction/Region of Influence

The ROI for the marine transportation and communication infrastructure analysis is the area inside the Monument and open ocean areas within the U.S. EEZ, which extends 230 mi (200 nm, 368 km) from land.

2.5.2.2 Regulatory Environment

A number of acts in Congress govern the movements of commercial vessels in specified waterways. These acts include the Ports and Waterways Safety Act (1972), the Port and Tanker Safety Act (1978), and the Oil Pollution Act (1990). However, these acts have little jurisdiction in the open seas. For this reason, the traffic lanes used by commercial vessels transiting the waters surrounding NWHI are the result of vessels following the most direct routes (great circle routes) to and from major ports between the west coast of North America and East Asia (Franklin 2006). The first international law to address submarine cables was the 1884 Convention for the Protection of Submarine Cables. This agreement is still in force today and has provisions to ensure the safety of cable repairs and to prevent interference with and from other ocean uses.

Entering the Monument is prohibited except for passage without interruption, when responding to emergencies, for law enforcement, and activities and exercises of the armed forces (50 CFR, Sections 404.8 and 404.9) or unless permitted under 50 CFR, Sections 404.10 or 404.11. All U.S. vessels passing through the Monument without interruption are subject to the prohibitions in 50 CFR, Sections 404.5, 404.6, and 404.7 and must provide notification prior to entering and after leaving the Monument (50 CFR, Section 404.4 (b). VMS is required under 50 CFR, Section 404.5 for any vessel that is issued a permit to enter the Monument. Only VMS approved by NOAA's Office of Law Enforcement (OLE) may be used. The USCG may enforce all applicable federal laws within the boundaries of the Monument. The USCG has the authority to enforce Monument regulations and restrictions concerning ship traffic under 14 USC 2 and 14 USC 89. Prohibitions in the Monument regulations do not apply to activities necessary to respond to emergencies threatening life, property, or the environment, or to activities necessary for law enforcement purposes (50 CFR, Section 404.8).

In response to national concern regarding introduction of aquatic nuisance species, the National Invasive Species Act of 1996 was enacted, which reauthorized and amended the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.

On December 22, 2006, the Marine Debris Research, Prevention, and Reduction Act was signed into law. The act makes the Marine Debris Program permanent and directs NOAA to work in

conjunction with federal agencies such as EPA and the USCG to identify the origin, location, and projected movement of marine debris within navigable waters of the United States and within the U.S. exclusive economic zone.

2.5.2.3 Resources Overview

On April 3, 2008, the IMO designated the Monument as a PSSA. As part of the PSSA designation process, the IMO adopted U.S. proposals for associated protective measures consisting of (1) expanding and consolidating the six existing recommendatory Areas to be Avoided (ATBA) in the Monument into four larger areas and enlarging the class of vessels to which they apply; and (2) establishing a ship reporting system for vessels transiting the Monument, which is mandatory for ships 300 gross tons or greater that are entering or departing a U.S. port or place and recommended for other ships. The vessel reporting system requires that ships notify the U.S. shore-based authority (i.e., the USCG; NOAA will be receiving all messages associated with this program on behalf of the USCG) at the time they begin transiting the reporting area and again when they exit. Notification is made by e-mail through the Inmarsat-C system or other satellite communication system. It is estimated that almost all commercial vessel traffic will be able to report via Inmarsat-C. The Armed Forces are not subject to the access restrictions and reporting requirements in the Monument when they are conducting activities and exercises. Sovereign immune vessels also are not subject to the reporting requirement, but all vessels are encouraged to participate.

The PSSA and associated protective measures were adopted to provide additional protection to the exceptional natural, cultural and historic resources in the Monument. Requiring vessels to notify NOAA upon entering the reporting area will help make the operators of these vessels aware that they are traveling through a fragile area with potential navigational hazards such as the extensive coral reefs found in many shallow areas of the Monument. The PSSA is now in effect, and the IMO has provided for an effective date for the associated protective measures of May 1, 2008. These measures have been codified in Federal Law (50 CFR Part 404). Sovereign immune vessels are not subject to the reporting requirement but all vessels are encouraged to participate.

Vessel Activity

With the exception of a few small boats at Midway Atoll and Tern Island, no vessels have home ports in the NWHI. For this reason, almost all marine traffic in the waters surrounding the NWHI is made up of Department of Defense vessels conducting training and testing activities, transiting vessels, research vessels, and fishing vessels, with cruise ships, USCG ships, and recreational boats occasionally visiting. An estimated 50 vessels pass through the EEZ surrounding the NWHI each day (Mathers 2005; Franklin 2006). On average, the range of vessel types include 20- to 60-foot fishing and recreational vessels, 150- to 250-foot research vessels, 500- to 700-foot passenger cruise ships and freighters, 700- to 1,000-foot tankers, and USCG, military, and international ships of all sizes and types.

Research Vessels

Research vessels have been visiting the NWHI in increasing numbers over the past ten years. However, the number of days spent at sea in the Monument has remained fairly constant over the

last four years (Table 2.5-1). Several research vessels regularly visit the NWHI, including ships operated by NOAA, FWS, the University of Hawai‘i, and private charter vessels. Three vessels in the NOAA fleet operate in the NWHI, the *Oscar Elton Sette*, *Hi‘ialakai*, and *Ka‘imimoana*. The NOAA fleet spends more time within the boundaries of the Monument than any other research organization. Table 2.5-1 shows the number of sea days each NOAA vessel spent in the Monument from 2003 to 2007. These vessels are most active in the NWHI from April through November. They average 200 feet in length, weigh 2,300 tons, and carry 50 crew, researchers, and other staff.

Table 2.5-1
Number of Days Spent in the Monument from 2003 to 2007

	Number of Days Spent in the Monument				
NOAA Vessel	**FY 2003**	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**
Oscar Elton Sette	80	113	154	177	138
Hi‘ialakai	N/A	18	144	97	120
Charter Vessels	120	120	90	2	2

The University of Hawai‘i has two blue-water research vessels on which it occasionally conducts research in the waters surrounding the NWHI, the R/V *Kilo Moana* and R/V *Kaimikai-O-Kanaloa*. The university conducted research in the Monument twice in 2003 and once in 2004, spending about a month in the Monument on each cruise. There were no cruises to the NWHI planned for University of Hawai‘i ships in 2005 (Winslow 2005).

Fishing Vessels

The only commercial fishery occurring in the Monument is the federal bottomfish fishery. This fishery operates according to the management regime specified in the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region. In the NWHI, the bottomfish fishery is a hook and line fishery that targets a range of snappers, jacks, emperors, and groupers that live on the outer reef slopes, seamounts, and banks at depths of approximately 50 to 400 fathoms.[1] The management regime includes several precautionary measures that minimize potential effects of this fishery. For instance, the bottomfishery participants do not operate in the presence of the Hawaiian monk seals so as to avoid any direct or indirect effects of the fishery on the species.[2] Also, it is known that the vessels operations do not negatively affect habitat.[3] Finally, the annual catch limit in the NWHI is set by regulation at 300,000 lbs of bottomfish and 180,000 lbs of pelagic species (50 CFR Part 404). In practice, bottomfish harvest

[1] For a full list of bottomfish management unit species or BMUS, see DEIS Draft Amendment 14 to the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region, June 27, 2007, Table 5.

[2] 50 CFR Part 665.61(2007) Subpart E – Bottomfish and Seamount Groundfish Fisheries and the Endangered Species Act Consultation on the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region, March 8, 2002.

[3] See the finding of no significant impact for the environmental assessment, “Issuance of a Conservation and Management Permit to the National Marine Fisheries Service Pacific Islands Regional Office for Anchoring in Non-coral Areas by the Northwestern Hawaiian Islands Bottomfish Fishery,” issued July 6, 2007.

is below catch limits and is not thought to affect the status of the bottomfish stocks in the NWHI or throughout the Hawaiian archipelago.

The fishery management plan divides the fishery into two zones, the Mau and Hoʻomalu. Four vessels fish the Mau zone, which includes areas east of the 165º longitude, and four vessels fish the Hoʻomalu zone, which includes areas west of the 165º longitude. All vessels offload their catch in Honolulu. A small number of foreign fishing companies use the open seas to the north and south of the EEZ surrounding the NWHI. These companies often fish the open ocean north or south of the EEZ, then transit through the island chain to fish the open ocean on the other side. Foreign fishing vessels in the open ocean also transit the Monument en route to Honolulu (Franklin 2006).

Eight commercial fishing permits are eligible for use in the Monument. The fishermen average 2 to 10 trips per year per vessel, with duration ranging from 3 to 22 days per trip. For the most part, these vessels bottomfish around the atolls and banks at the 100-fathom depth, and troll in deep water and across banks as they transit between islands. Crew size ranges from one to four people. Presidential Proclamation 8031 allows this fishery to continue operating until June 15, 2011 (50 CFR, Section 404.10 [b][3]), at which time the commercial fishery will cease altogether in the Monument.

Cruise Ships

A small number of cruise ships have visited Sand Island in the Midway Atoll National Wildlife Refuge. The Seven Seas Voyager visited Midway once, and the Pacific Princess visited twice in 2004. In 2005, 2006, and 2007, one cruise ship visited the atoll each year (Maxfield 2007 personal communication). Due to their size and the narrow width of the entrance channel at Midway, as well as port security requirements, cruise ships offload passengers 3 to 4 miles outside the lagoon and transport them ashore in small boats. Cruise ship passengers participate in a guided tour of the historical section of Sand Island led by FWS staff or volunteers. Typically, a cruise ship visit begins in mid-morning, and all passengers have returned to the ship by 4:00 pm. The ship departs the SMA before sunset.

Worldwide, cruise ships constitute a large and growing industry, and like other ships, they present a potential environmental threat to the Monument. Large cruise ships can carry thousands of passengers and crew, producing hundreds of thousands of gallons of wastewater and tons of garbage each day. Monument regulations and permit requirements (which are more restrictive than other open ocean sites) appear to have discouraged cruise ship visits, and none are scheduled for 2008.

Marine Debris Removal Vessels

The USCG provides ship support for marine debris activities and sends a buoy tender once a year. This mission also serves as a law enforcement patrol. In addition, the USCG may send other ships to the area as needed (Havlik 2005). Since 1997, regular marine debris removal efforts have been conducted through a multi-agency effort led by NOAA, in collaboration with FWS, the State of Hawaiʻi, City and County of Honolulu, Honolulu Waste Disposal, USCG, U.S. Navy, University of Hawaiʻi Sea Grant College Fund, Schnitzer Steel Hawaiʻi Corporation (formerly Hawaiʻi Metals Recycling Company), The Ocean Conservancy, and other local agencies, businesses, and nongovernmental partners. Since then, this effort has resulted in the removal of

more than 563 tons (502 metric tons) of derelict fishing gear and other marine debris from the coral reef ecosystems of the NWHI (figure 1.24) and put one ship on the reef. Marine debris survey and collection activities have been conducted at Kure Atoll, Midway Atoll, Pearl and Hermes Atoll, Lisianski Island, Laysan Island, and FFS. Removal operations have targeted areas where marine debris has accumulated over the past several decades. Long-term average accumulation rates are estimated at 45 to 79 tons (40 to 71 metric tons) per year. Until substantial efforts are made to significantly reduce the sources of debris and until debris can be effectively removed at sea, similar amounts are expected to continue accumulating indefinitely in the reef ecosystems of the NWHI.

Native Hawaiian Vessels

Between 2003 and 2007, several trips for Native Hawaiian cultural practices, education, and documentary film and photography projects were conducted on vessels in the Monument. Vessel size varied, as did anchoring and waste discharge practices. Such trips normally include a representative from FWS or NOAA.

Support Vessels

FWS maintains permanent facilities on Tern Island at FFS, Sand Island, and Midway Atoll and a field camp at Laysan Island, while NMFS maintains seasonal camps at Pearl and Hermes Atoll and Lisianski Island. A fuel barge makes a port call at Midway once a year, and supply barges provision Midway and the other refuge islands at least twice each year.

The DLNR maintains permanent facilities on Green Island at Kure Atoll. The DLNR does not operate or charter vessels to transport people or supplies to or from the NWHI; instead, it uses other agency vessels to access the Kure Atoll station (Smith 2005).

There are deteriorating deep-water piers to accommodate between two and four large visiting ships. Midway Atoll annually authorizes two supply barges, one fuel barge, and two visiting large ships (NOAA, USCG, university, or charter). There are also deteriorating small boat finger piers and a boat ramp that are exposed to incoming wind chop.

The deep water cargo pier (Pier 1 on charts) is in functional condition and can handle ships up to 450 feet but will need maintenance in the next 3 to 4 years to remain serviceable for the long term. It can safely handle one ship at a time. The fuel pier is in unsafe condition and is no longer operational. Midway Atoll normally has one barge per year associated with ongoing construction projects that brings supplies for those projects and general materials for island operation. With the new fuel farm capacity, FWS expects to have a fuel barge delivery to Midway every 11-14 months, depending on usage. NOAA ships transiting the Monument typically stop at Midway 3 to 5 times per year. FWS maintains a fleet of 11 small boats for routine operational and research needs. These include several 21 to 23-foot fiberglass skiffs and two aluminum SAFE boats, one 23-foot and one 31-foot with a full cabin. Both SAFE boats have full electronic packages, including RADAR. The existing small boat maintenance facility is in poor condition and needs replacement within the next 5 years.

Vessel Routes

Container ships, bulk carriers, and tankers regularly transit the waters of the Monument. Although it is estimated that 50 vessels transit the EEZ surrounding the Monument each day, most traffic passes to the north of the island chain, following great circle routes to and from ports

on the west coast of North America and East Asia. Occasionally vessels will transit farther south, passing within the Monument. Vessels have been observed using the pass between Pearl and Hermes Atoll and Lisianski Island because it allows vessels to maintain an east-west heading while transiting through the island chain (Franklin 2006). Periodically, accidental loss of cargo overboard causes marine debris or hazardous materials to enter sensitive shallow-water ecosystems.

A preliminary analysis of vessel traffic patterns in the NWHI was performed using positional information collected by the Volunteer Observing Ship program (VOS) from March 2004 to November 2005 (Franklin 2006). The VOS program has collected geo-referenced data from a set of selected non-research vessels that make frequent and regular crossings of all major ocean basins and has provided access to these data through the International Comprehensive Ocean-Atmosphere Data Set (ICOADS; NOAA 2006). The vessel names and call signs collected from ICOADS were then used to search for vessel attributes such as service type, length, and tonnage through the USCG Maritime Information Exchange (USCG 2006). During the 21-month study period, there were 132 vessels that reported from within the Monument. The 132 vessels comprised 104 freighters, 8 tankers, 4 research vessels, 2 passenger vessels, 2 school vessels, 1 recreational vessel, 1 towing vessel (with a 666-foot vessel in tow), and 10 vessels with service unidentified. The mean vessel length was 651 feet, and mean gross tonnage was 43,452 tons. The vessels hailed from 23 countries, with Liberia, Panama, and Germany flying the most common foreign flags. There were 17 U.S.-flagged vessels. The study was limited to vessels participating in the VOS program; therefore, these results do not describe the total vessel traffic through the Monument but rather suggest a limited level of vessel activity over a given time period.

Aircraft Activity

A relatively small number of flights are conducted in the Monument. The MMB agencies charter an average of 27 flights to FFS. Henderson Airfield on Sand Island handles approximately 45 chartered flights to Midway Atoll annually. Aircraft transport goods, materials, and passengers. The USCG conducts regular enforcement overflights, often landing at Midway Atoll for refueling. A few research and management activities associated with remote sensing, mapping, wildlife survey, and marine debris detection may be conducted by aircraft each year.

Henderson Field Airport (PMDY), a 7,900-foot runway, is on Sand Island at Midway Atoll. A contractor maintains the infrastructure associated with the airfield under a base operations service contract with FWS. The airport operator and FWS, as the airport owner, jointly hold and maintain the FAA-issued Part 139 Airport Operating Certificate for PMDY (14 CFR Section 139.3337). The airport provides logistical support for the refuge and is an emergency landing strip for commercial extended twin-engine operation jets that traverse the Pacific. Congress provides partial funding for the operation and maintenance of the airfield because of its function as an emergency landing strip. The USCG also uses the airfield to refuel during fisheries enforcement missions and to evacuate injured crew members from fishing and cargo vessels traveling in the north Pacific. In a 1996 environmental assessment, completed before the FWS took over its management, the airport and its operations were found to have no effects (U.S. Fish and Wildlife Service 1996). As part of continued maintenance of the airport, a new airport building was constructed during 2007 and 2008, and new runway lighting and runway painting

are planned for 2008-2009. Midway's 7,900-foot runway is capable of handling almost any type of aircraft. A new FAA operations center was constructed southwest of the existing hangar in 2007. At least three flights per month bring personnel and supplies to the refuge. The plane seats 19 passengers. A separate charter cargo aircraft is used to bring up to 25,000 lbs of cargo three times per year.

At Pearl and Hermes Atoll, visiting NOAA, USCG, or contract ships are used for cargo and personnel delivery from either Honolulu or Midway. The timing is subject to cruise schedule and berth availability. Ship and field camp small boats are used to shuttle supplies. The field camp has two small boats. The weight of present cargo drop off is 13,000 lbs (12 boat loads); pickup is 5,000 lbs.

FFS accepts eight flights per year for personnel transfers. There is an existing runway and seaplane ramp. The area permits three visiting large ships per year for cargo supplies and personnel transfers. Visiting ships may also deliver limited cargo and personnel depending on schedule and berth availability. Small boats are used to shuttle supplies to the island. The field camp has between two and three small boats.

At Nihoa, Laysan Island, and Lisianski Island, visiting NOAA, USCG, or contract ships are used for cargo and personnel delivery from Honolulu or Midway Atoll. The timing is subject to cruise schedule and berth availability. Small boats are used to shuttle supplies to the island. The weight of present cargo drop-off is 3,000 lbs (3 boat loads); pickup is 3,000 lbs.

Communication Infrastructure

Minimum communication infrastructure exists in the Monument. Before satellite communication, ocean cables were used to transmit data across the Pacific Ocean. In July 1903, the first trans-Pacific cable was completed. It was routed along the NWHI, coming ashore at Midway Atoll. The only actively used cable, the Trans-Pacific Cable No. 1, was installed in 1964 and linked Hawai‘i to Guam. The cable runs the length of the island chain from O‘ahu to Midway, where it comes ashore. From Midway it continues to Wake Island before terminating in Guam. The cable continues to be used for scientific purposes (ICPC 2004).

A new fiber optic distribution system was constructed during 2006/2007 in the core area of Sand Island, Midway Atoll. The satellite antenna was relocated and refurbished in October 2007. Satellite service was upgraded to T-1, and work to install a new VOIP phone system was completed in March 2008. These upgrades will markedly improve telecommunications for the current island population but do not add capacity for a large population increase.

Terrestrial Transportation

The Midway Atoll interim visitor services plan designates areas that are both open and closed to the public. Closed areas ensure public safety and maximum protection for wildlife. Most roads are open to the public. Trails are listed as closed, open by guided tour only, or open. Trails generally follow existing paths, roads, or the edges of aircraft runways. Visitors are free to walk on paved and gravel roads, walkways, and marked trails, but areas such as the fuel farm and pier,

power plant/utility building complex, construction and rehabilitation sites, and aircraft runways and service areas are off limits to visitors. Bikes and golf carts are also used.

At other islands in the Monument, transportation is almost exclusively on foot.

2.5.3 Utilities

2.5.3.1 Introduction/Region of Influence

This section addresses issues related to the Proposed Action alternative that are associated with utilities. The ROI is the utilities and infrastructure systems on the islands within the Monument.

2.5.3.2 Resources Overview

The ROI for the utilities and infrastructure systems in the NWHI are limited to Midway Atoll (Sand Island). Field stations located on FFS, Kure Atoll, and Laysan Island rely on satellite communications and field camp utilities such as solar power and desalinated and imported water. All trash generated is shipped off-island. The following section describes the existing utilities and infrastructure at these field camp-style locations and on Midway Atoll.

Potable Water Supply and Fire Protection

The drinking water source on Midway Atoll consists of a rainwater collection and distribution system. Rainwater is collected in a pond then pumped to storage tanks following a significant rainfall event. The storage volume is approximately 12,000,000 gallons. A new drinking water treatment system and distribution main were constructed and became operational in October 2005. The design daily use rate for the new system is 100 gallons per day/person, or 20,000 gallons per day total for a design capability of 200 people. This new water distribution pipeline was connected to existing lateral pipes at selected buildings through the core area of town but need to be extended to serve newly constructed or remodeled facilities located outside of the new water main.

The old system was left in place to provide water for fire-fighting activities and to serve the Inner Harbor and Cargo Pier areas. This water is not treated to drinking water standards. The storage tanks in the R-1 area provide water for both the new and old systems, but the old system leaks approximately 10,000 gallons per day, which reduces the stored volume of water.

Drinking and other fresh water at Tern Island, FFS, and Laysan Island is produced by desalination and rain catchment systems. Tern Island has the capacity to hold up to 58,000 gallons of rain catchment water and up to 14,500 gallons of desalination treated water. Rain water is collected from an abandoned tennis court and from the roofs of two large buildings on the island. Drinking water is drawn from a brackish water well for desalination. Laysan has holding tanks for 1,000 gallons of rain catchment water, which is collected from the roofs of the living and working tents, and 110 gallons of desalination treated water, which is drawn from a well. Desalination at both locations is conducted using reverse osmosis equipment.

Sanitary Wastewater Management

The existing sanitary wastewater system at Midway Atoll is composed of central septic tanks and drainfields. Stormwater intrusion and suspected groundwater infiltration has overloaded the current system. Work has been performed to eliminate stormwater intrusion, and a new sewer system and treatment and disposal system have been designed for certain facilities located in the core area of town. The estimated construction cost for a new wastewater treatment system is approximately $2,000,000. A dispersed septic design is preferred over the existing central septic in sensitive habitat areas and bird nesting sites.

Tern Island has two septic tanks to collect the sewage and wastewater from the barracks. These tanks together hold approximately 3,200 gallons of sewage.

Stormwater System

The Navy designed the existing stormwater system on Sand Island to work in conjunction with the sewage disposal system that simply discharged raw sewage into the ocean. The existing septic/leach field system was installed in 1998 and it connected to the old Navy system. The stormwater component floods the leach field during heavy rainfall events which reduces the long term viability of the system by moving solids into the drainfield. The stormwater system collects runoff from streets and the many buildings on Sand Island that were designed with direct downspout discharge into the drains throughout the island. To minimize the stormwater influx into the leach field, the FWS has been disconnecting building downspouts from the system and reducing the hard surface areas that collect rainfall, allowing for more groundwater percolation.

Energy

Electrical power at Midway Atoll is supplied by a diesel generator power plant. Two generators that operate in automatic duplex mode were installed and began operating in 2005. In most cases, only one generator is needed to meet the island's demand. If one generator exceeds capacity, the second generator automatically comes online and automatically shuts off when electrical demand reduces. The current system for generating electricity is sufficient for the existing population. Midway has two electrical distribution grids. A new electrical distribution grid was constructed and placed into service in 2006. This system serves most of Sand Island. The old grid still provides power to the old airport hangar, the old fuel farm, and the finger pier area. Materials and equipment of the old grid are aging and need replacing. Constructing new developments or renovating existing facilities would require the new grid to be extended.

Tern Island and Laysan Island electrical power systems are primarily supported by photovoltaic systems, and generator power is used in emergencies and to supplement low-sun days, as needed. These systems have been in place for several years and are being upgraded and replaced as funding becomes available.

Communication System

Telecommunication is provided by satellite service. A new fiber optic distribution system was constructed during 2006/2007 in the core area of Sand Island, Midway Atoll. The satellite

antenna was relocated and refurbished in October 2007. Satellite service was upgraded to T-1, and work to install a new VOIP telephone system was completed in March 2008. These upgrades will markedly improve telecommunications for the existing island population but will not add capacity for a large population increase.

Primary communications on Tern Island and Laysan are provided by satellite telephone and associated e-mail service. Single-side band radio is used as a secondary means of communicating with the Honolulu office from these field camps. Currently, Tern Island has high speed internet access through a satellite link provided by NMFS.

Solid Waste Management

Solid waste disposal practices in Midway Atoll include the temporary storage of waste in open plastic containers with periodic collection via stake bed truck. The solid waste is then burned in an oil-fired incinerator, dependent on the availability of waste fuel, or burned in an unlined open-aired pit and ashes are disposed of in the existing landfill/dump. The existing incinerator has been modified to burn waste oil, but the island does not generate enough waste oil to operate the incinerator on a daily basis. Alternatively, daily waste is burned in an open pit. Aluminum cans are collected, compacted and sent to a recycling facility in Hawai‘i. Glass is collected, crushed, and buried in the landfill/dump. The existing landfill used for solid waste disposal is limited in its capacity and the types of waste it can safely handle. The landfill, which is only used when an item cannot be incinerated, contains general household/food waste or wood materials.

Because of concerns specific to asbestos and lead in many buildings on Sand Island, any major renovations or remodeling must take worker safety and hazmat disposal into consideration in accordance with appropriate OSHA guidelines.

The Bulky Waste Landfill, located on the south shore of Sand Island, is an uncharacterized landfill that was created by the disposal of scrap metal, used equipment, and unconsolidated waste. This landfill is no longer utilized for waste disposal, but continued monitoring and further remediation may be required. Wastes known to have been deposited in the landfill are metals, gasoline, battery acid, batteries, mercury, lead-based paint, solvents, waste oil, PCBs, dioxins, furans, transmission and brake fluids, vehicles, equipment, tires, and miscellaneous debris (BRAC SI 1996 Volume 1). The landfill is eroding, and soil placed on top is sifting through the debris, causing large holes to open up around the edge and in the center of the landfill. Additionally, burrowing birds are bringing up buried soil and nesting below the cover.

Both Tern and Laysan Islands burn all food and paper waste produced on island. Ashes, plastics, glass, metals, and other non-burnable waste is shipped off island to be disposed of or recycled in Honolulu.

Fueling Facilities

A new fuel tank farm was constructed in 2007 with a capacity of 450,000 gallons. The tank farm stores a sufficient amount of fuel to operate electrical generators, vehicles, and aircraft for a year. Of this total capacity, 100,000 gallons were purchased by the USCG for their use in search and

rescue or law enforcement flights. The USCG and FWS have an interagency agreement that covers this cooperative effort and outlines shared costs.

While Laysan Island has very little need for fuel storage or use (up to 40 gallons per year), Tern Island requires storage of several hundred gallons of gasoline, diesel fuel, and aviation gasoline. All fuel is transported to Tern Island in 55-gallon drums and stored in spill containment lockers. This provides spill containment, shelter from the elements, and minimizes fuel handling by allowing fuel storage and shipment in the same containers. Both FWS and NMFS conduct small boat operations at FFS, which requires separate fuel reserves for each agency.

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