# NORTHWESTERN HAWAIIAN ISLANDS PROPOSED NATIONAL MARINE SANCTUARY

## Draft Environmental Impact Statement and Management Plan

## Draft Management Plan Volume II of II

April 2006

Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
National Marine Sanctuary Program

This document was produced by the National Marine Sanctuary Program, under the National Ocean Service, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, to fulfill the requirements of the National Marine Sanctuaries Act (16 U.S.C. 1434 (C)) and Executive Order 13178 (EO 13178).

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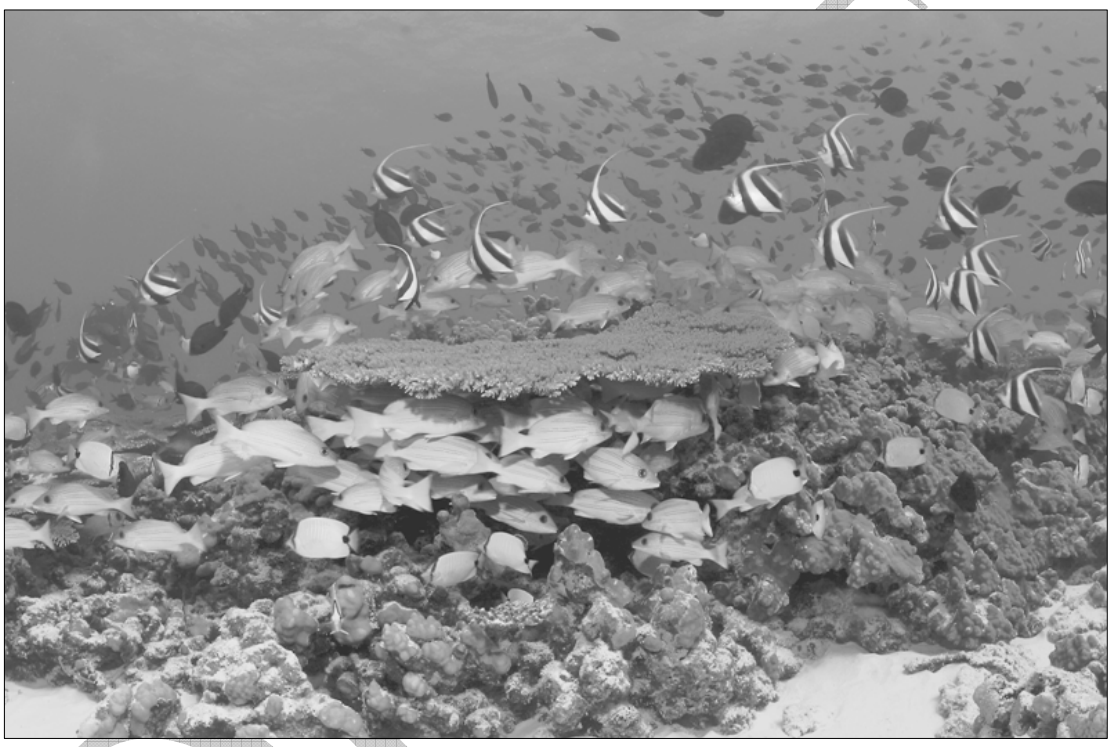
**Cover Photos**
Background: Shoals in the Northwestern Hawaiian Islands. Photo: Monte Costa
Insets: Top: Bluefin trevally over shallow coral at Maro Reef. Top Middle: Hawaiian Monk Seal. Bottom Middle: *Acropora* spp. Table corals and reef fish. Bottom: Galapagos sharks. All inset photos: James Watt

***Vision***

*That the vast coral reefs, ecosystems, and resources of the Northwestern Hawaiian Islands – unique in the world – remain healthy and diverse forever.*[1]



***Mission***

*Carry out coordinated and integrated management to achieve the primary purpose of strong and long-term protection of the marine ecosystems in their natural character, as well as the perpetuation of Native Hawaiian cultural practices and the conservation of heritage resources of the Northwestern Hawaiian Islands.*

[1] From the Goals and Objectives Statement. For the complete text see Section 2.2.

## Acknowledgments

Since the 1990s, the efforts of many individuals, organizations, and government agencies led to the establishment of the NWHI Coral Reef Ecosystem Reserve in 2000. Since then these dedicated individuals, organizations and agencies worked toward the development of goals and objectives, management plan, and environmental impact statement for a proposed national marine sanctuary, providing instrumental input at Advisory Council Meetings, subcommittee meetings, workshops, discussion groups, and other forums throughout the planning process. The contributions of each person who participated in the development of this plan, especially members of the public, are appreciated.

Special thanks go to the members of the Reserve Advisory Council for their formative contributions to the development of the management plan. The Reserve Advisory Council contributions to the development of the management plan have extended over 4 years, beginning with working groups on the Reserve Operations Plan, upon which this management plan was based. The Advisory Council identified management principles as well as goals and objectives, regulatory, and permitting needs and development of action plan strategies. With the leadership of their chair and vice-chair, this council made recommendations to ensure the NWHI would indeed become a sanctuary like no other, setting a precedent for ocean conservation worldwide. Their role was, and continues to be, crucial to planning for a future sanctuary, which builds and improves upon the foundation set by the Reserve.

Cooperating agency agreements made it possible for this document to bear three logos on the cover. The contributions of the State of Hawaii, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, were central to the development of this plan, both through the Advisory Council, and in consultation and review. Dozens of individuals worked diligently in this effort, sacrificing an enormous amount of time and effort to contribute to and move this project forward.

Thank you to those individuals who reviewed and commented on specific portions of the plan for accuracy. Recognition and appreciation goes to all NOAA staff who drafted, edited, and lived this document since its inception, and will continue to usher it through the public comment process from draft to final.

## Executive Summary

The proposed National Marine Sanctuary (Sanctuary) in the Northwestern Hawaiian Islands comprises the largest marine protected area in the world. The designation is identified as a national priority for permanent protection as a Sanctuary for its unique and significant confluence of conservation, ecological, historical, scientific, educational, and Native Hawaiian cultural qualities. The National Oceanic and Atmospheric Administration (NOAA) together with its jurisdictional agency partners, the State of Hawaii Department of Land and Natural Resources (DLNR) and the United States Fish and Wildlife Service (USFWS), are committed to achieving the strong and long-term resource protection afforded through Sanctuary designation.

A vast, remote, and largely uninhabited marine region, the Sanctuary encompasses an area of approximately 139,793 $mi^2$ (362,061 $km^2$) of Pacific Ocean in the northwestern extent of the Hawaiian Archipelago. Covering a distance of 1,200 miles, the 100-mile wide Sanctuary is dotted with small islands, islets, and atolls and a complex array of shallow coral reefs, deepwater slopes, banks, seamounts, and abyssal and pelagic oceanic ecosystems supporting a diversity of marine life, 25 percent of which are endemic to the Hawaiian Archipelago. These region's natural resources, together with a rich Native Hawaiian cultural and maritime heritage, give this Sanctuary a unique position as one of the most significant marine protected areas in the world. The designation proactively advances the U.S. Commission on Ocean Policy (2005) call for a more comprehensive, integrated, ecosystem-based approach to address the current and future management challenges of the oceans, encompassing the largest continuous and uninhabited track of the marine environment under coordinated management in the United States and the world.

The National Marine Sanctuaries Act (NMSA) provides the legal authority to identify and designate areas of the marine environment, which are of special national significance, and to manage these areas as the National Marine Sanctuary System under NOAA's National Marine Sanctuary Program (NMSP). The NMSP serves as the trustee for the nation's system of marine protected areas with the mission to conserve protect, and enhance their biodiversity, ecological integrity and cultural legacy. Sanctuaries of Hawaii and the Pacific are included in the NMSP Pacific Islands Region. The NWHI will be the 14$^{th}$ sanctuary to be included in the National Marine Sanctuary System.

This Sanctuary Management Plan implements the preferred alternative, Alternative 3, detailed in the accompanying Draft Environmental Impact Statement (Volume I). The plan describes a comprehensive management regime to achieve the purposes and policies of the NMSA, the goals and objectives of the Sanctuary, and to address priority management needs over the next five years. The plan was built over a four-year period beginning with public scoping meetings in 2002, with the active involvement of the Reserve Advisory Council, the public, government agencies, Native Hawaiians, scientists, fishermen, and other stakeholders through over 100 meetings.

This management plan is organized into three main sections. The Introduction describes the current status of the NWHI ecosystem based on historical and recent scientific research and monitoring of environmental conditions, anthropogenic stressors, and trends in ecological

conditions. The natural environmental, cultural, and maritime historical significance of the NWHI is described as a basis for inclusion in the system of national marine sanctuaries.

The Management Framework for the Sanctuary includes key elements to move toward an ecosystem-based approach to management. These include a discussion of the sanctuary designation process and mandates, the overarching policy direction and guidance for Sanctuary management described by the vision, mission, management principles and specific goals and objectives, mechanisms for interagency collaboration and working with stakeholders, regulations, zoning and action plans, and concepts, terms and adaptive management process for moving toward an ecosystem management approach.

The bulk of this management plan is presented in the third section, Action Plans to Address Priority Management Needs, which projects implementation costs over the five-year planning horizon. These priority management needs are:

- Understanding and interpreting the NWHI
- Reducing threats to the ecosystem
- Managing human activities
- Facilitating coordination
- Achieving effective operations

Each action plan consists of multiple strategies and activities to address the priority management need and achieve a desired outcome. A results framework consisting of annual, medium-term, and long-term site performance measures is used to evaluate achievement of the desired outcome at the action plan, site and program levels. Finally, Sanctuary regulations are provided in the Appendices along with definitions, references and pertinent legislation.

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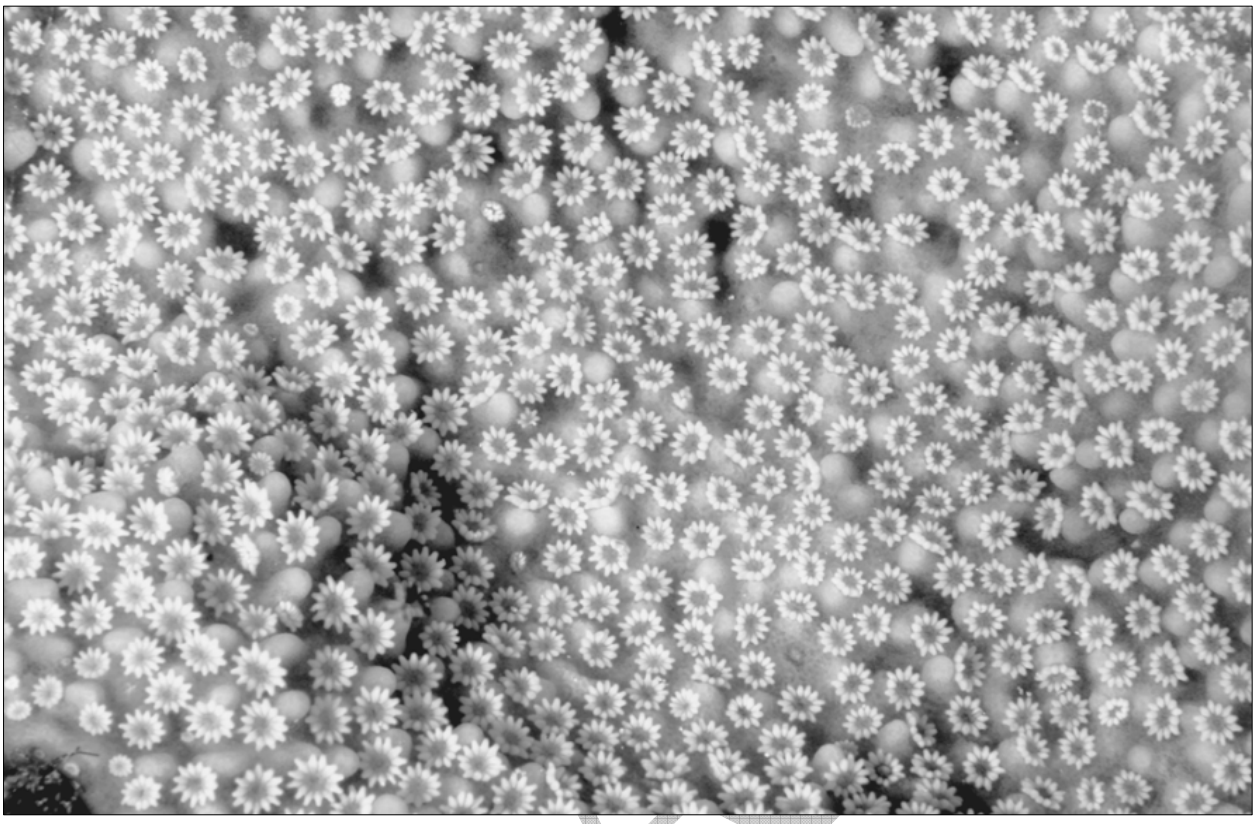
# Acronyms

| | |
|---|---|
| AAUS | American Academy of Underwater Sciences |
| AIS | Automatic Identification Systems |
| AP | Action Plan |
| ARPA | Archeological Resources Protection Act 1979 |
| ASA | Federal Abandoned Shipwreck Act 1987 |
| CCC | Core Coordinating Committee |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CORIS | Coral Reef Information System |
| CRCP | NOAA's Coral Reef Conservation Program |
| CRED | NMFS PIFCS Coral Reef Ecosystem Division |
| CRER | Coral Reef Ecosystem Reserve |
| CRTF | U.S. Coral Reef Task Force |
| CZMA | Coastal Zone Management Act |
| DLNR | State of Hawaii Department of Land and Natural Resources |
| DOCARE | State of Hawaii Division of Conservation and Resources Enforcement |
| DOD | U.S. Department of Defense |
| DOE | State of Hawaii Department of Education |
| DOFAW | State of Hawaii Division of Forestry and Wildlife |
| DOI | Department of the Interior |
| EEZ | Exclusive Economic Zone |
| EMTF | Ecosystem Management Task Force |
| EO | Executive Order |
| ER | Ecological Reserves |
| ESA | Endangered Species Act 1973 |
| FAD | Fish Aggregation Devices |
| FV | Fishing Vessel |
| GIS | Geographic Information Systems |
| GS | Government Services |
| GUI | Graphical User Interface |
| HAZWOPR | Hazardous Waste Operations & Emergency Response |
| HIMB | Hawai'i Institute of Marine Biology |
| HINWR | Hawaiian Islands National Wildlife Refuge |
| HURL | Hawai'i Undersea Research Lab |
| ICC | Interagency Coordinating Committee |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization |
| IMS | Information Management System |
| IUCN | World Conservation Union |
| KAHEA | Hawaiian Environmental Alliance (NGO) |
| KCHS | University of Hawai'i Kamakuokalani Center for Hawaiian Studies |
| MARPOL | International Convention for the Prevention of Pollution from Ships 1973 |
| MBTA | Migratory Bird Treaty Act 1918 |
| MHI | Main Hawaiian Islands |
| MHP | NOAA's Maritime Heritage Program |
| MMPA | Marine Mammal Protection Act 1972 |
| MOA | Memorandum of Agreement |
| MODIS | Moderate Resolution Imaging Spectroradiometer |
| MOU | Memorandum of Understanding |
| MPA | Marine Protected Area |
| MSD | Marine Sanitation Devices |
| MSFCMA | Magnuson-Stevens Fishery Conservation and Management Act |
| NCCOS | National Center for Coastal Ocean Science |
| NCP | National Contingency Plan |
| NDC | NOAA Diving Center |

| | |
|---|---|
| NDP | NOAA Dive Program |
| NEPA | National Environmental Policy Act 1982 |
| NGO | Non Governmental Organizations |
| NHEA | Native Hawaiian Education Association |
| NHLC | Native Hawaiian Legal Corporation |
| NHPA | National Historic Preservation Act |
| NMAO | NOAA Marine and Aviation Operations |
| NMFS | National Marine Fisheries Service |
| NMS | National Marine Sanctuary |
| NMSA | National Marine Sanctuaries Act |
| NMSAA | National Marine Sanctuaries Amendments Act |
| NMSP | National Marine Sanctuary Program |
| NOAA | National Oceanic and Atmospheric Administration |
| NOS | National Ocean Service |
| NOWRAMP | Northwestern Hawaiian Islands Reef Assessment and Monitoring Program |
| NRC | National Research Council |
| NWHI | Northwestern Hawaiian Islands |
| NWHICRER | Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve |
| NWHINMS | Northwestern Hawaiian Islands National Marine Sanctuary |
| OHA | Office of Hawaiian Affairs |
| OLE | NOAA's Office of Law Enforcement |
| OLE PID | NOAA's Office of Law Enforcement, Pacific Island Division |
| ONMS | Office of National Marine Sanctuaries |
| OSPREY | Online Sanctuary Permitting Reporting Education System |
| PCB | Polychlorinated Biphenyls |
| PIFSC | NMFS Pacific Islands Fisheries Science Center |
| PIRO | NMFS Pacific Island Regional Office |
| PISCO | Partnership for Interdisciplinary Studies of Coastal Oceans |
| PMN | Priority Management Need |
| PVS | Polynesian Voyaging Society |
| RAC | Reserve Advisory Council |
| ROP | Reserve Operations Plan |
| RPA | Reserve Preservation Area |
| RRT | Regional Response Team |
| RUST | Resources and Under Sea Threats |
| RV | Research Vessel |
| SAC | Sanctuary Advisory Council |
| SCUBA | Self-Contained Underwater Breathing Apparatus |
| SHIELDS | Sanctuaries Hazardous Incident Emergency Logistics Database System |
| SMCA | Sunken Military Craft Act 2004 |
| SPA | Sanctuary Preservation Areas |
| SPR | Spawning Potential Ratio |
| SPREP | South Pacific Regional Environment Program |
| SRT | Sanctuary Response Team |
| SST | Scientific Support Team |
| SUP | Special Use Permit |
| UAV | Unmanned Aerial Vehicle |
| UDS | Unit Diving Supervisor |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| USCG | United States Coast Guard |
| USFWS | U.S. Fish and Wildlife Service |
| VMS | Vessel Monitoring System |



Detailed photo of coral polyps. 70% of the coral reefs in the United States are located in the NWHI.
Photo: James Watt

*Hānau ka ʻUku koʻakoʻa*
*Hānau kana, he ʻĀkoʻakoʻa, puka*

*Born the coral polyp*
*Born of him came the reef*

*- Kumulipo creation chant*

*Long before the creation of humans, when the world was still dark, Hawaiian genealogies identify the coral polyp as the first living creature to emerge on Earth – the foundation and building block of all other forms of life. Recognized as the eldest organism in a cultural and biological genealogy of evolution, the coral held special rank and status in ancient times. The Sanctuary upholds this Hawaiian tradition by protecting the coral reefs that help to maintain a healthy marine ecosystem.*

# Introduction

# 1.0 Introduction

The Northwestern Hawaiian Islands National Marine Sanctuary (Sanctuary) proposed designation constitutes the largest marine protected area in the world. The designation is proposed in recognition of the region's unique and significant confluence of conservation, ecological, historical, scientific, educational, and Native Hawaiian cultural qualities. The Sanctuary designation process is the result of the long-standing efforts of state and federal agencies, non-governmental organizations, stakeholders, and the public to provide for long-term protection in the marine ecosystems of the Northwestern Hawaiian Islands. The National Oceanic and Atmospheric Administration (NOAA) together with its jurisdictional agency partners, the State of Hawai'i Department of Land and Natural Resources (DLNR) and the United States Fish and Wildlife Service (USFWS), are committed to achieving the primary purpose of Sanctuary designation: strong and long-term resource protection.

**Sanctuary Vision and Mission**

**Vision**

That the vast coral reefs, ecosystems, and resources of the Northwestern Hawaiian Islands (NWHI) – unique in the world – remain healthy and diverse forever.

**Mission**

Carry out coordinated and integrated management to achieve the primary purpose of strong and long-term protection of the marine ecosystems in their natural character, as well as the perpetuation of Native Hawaiian cultural practices and the conservation of heritage resources of the Northwestern Hawaiian Islands.

The Sanctuary is situated in the northwestern portion of the Hawaiian Archipelago, located northwest of the Island of Kaua'i and the other main Hawaiian Islands (Figure 1.1). A vast, remote, and largely uninhabited marine region, the Sanctuary encompasses an area of approximately 139,793 mi2 (362,061 km2) of Pacific Ocean. Jurisdictional authority for this area is shared by NOAA's National Marine Sanctuary Program (NMSP), the State of Hawai'i (State), and the U.S. Fish and Wildlife Service (USFWS). Spanning a distance of approximately 1,200 miles (1,043 nm/1,931 km), the 100-mile (87 nm/161 km) wide Sanctuary is dotted with small islands, islets, and atolls that extend from subtropical latitudes to near the northern limit of coral reef development.

The Sanctuary includes a complex array of shallow coral reefs, deepwater slopes, banks, seamounts, and abyssal and pelagic oceanic ecosystems supporting a diversity of marine life, 25 percent of which are endemic to the Hawaiian Archipelago. The NWHI are intimately connected to Native Hawaiians on genealogical, cultural, and spiritual levels. The region's natural resources, together with a rich Native Hawaiian cultural and maritime heritage, give this Sanctuary a unique stature as one of the most significant marine protected areas in the world. In recognition of this significance, the primary goal of Sanctuary management is to protect, preserve, maintain, and restore the natural biological communities, including habitats, populations, native species, and ecological processes of the Sanctuary as a public trust for current and future generations in collaboration with partners.

Coastal and ocean ecosystems around the world provide a wide range of vital services that are undervalued and at risk. Despite their economic significance in the United States, contributing more than $200 billion in economic activity in 2000, human activities are resulting in unprecedented changes to the marine environment. The U.S. Commission on Ocean Policy (2004) and the Pew Ocean Commission (2003) have both called for a more comprehensive,

integrated, ecosystem-based approach to address the current and future challenges involved in managing our ocean resources. The Sanctuary responds proactively to this call to action, by encompassing the largest continuous and uninhabited track of the marine environment under coordinated management in the nation and the world.

The National Marine Sanctuaries Act (NMSA) provides the legal authority to identify and designate areas of the marine environment, which are of special national significance, and to manage these areas as the National Marine Sanctuary System (Figure 1.2) under the National Oceanic and Atmospheric Administration's (NOAA) National Marine Sanctuary Program (NMSP). The NMSP serves as the trustee for the nation's system of marine protected areas, to conserve, protect, and enhance their biodiversity, ecological integrity and cultural legacy. Sanctuaries of Hawai'i and the Pacific are included in the NMSP Pacific Islands Region. The NWHI will be the 14th Sanctuary to be included in the National Marine Sanctuary System.

As each national marine sanctuary is unique with respect to its location, resources, issues, and threats, site-specific sanctuary management plans establish the framework for achieving long-term resource protection by tailoring management programs to the needs of the particular sanctuary. Common features of management plans, however, include active stakeholder and public involvement in plan development and five-year plan reviews. This Sanctuary management plan describes a comprehensive management regime to achieve the goals and objectives of the Sanctuary and to address priority management needs over the next five years.

This Sanctuary Management Plan implements the preferred alternative, Alternative 3, detailed in the Draft Environmental Impact Statement (Volume I). This plan is organized into four sections including this introduction. The Introduction describes the current status of the NWHI ecosystem based on historical and recent scientific research and monitoring of environmental conditions, anthropogenic stressors, and trends in ecological conditions. The natural environmental, cultural, and maritime historical significance of the Northwestern Hawaiian Islands (NWHI) is described as a basis for inclusion in the system of national marine sanctuaries.

**Figure 1.1 Hawaiian Archipelago including the Northwestern Hawaiian Islands (Nihoa Island to Kure Atoll) and main Hawaiian Islands (Hawai‘i to Kaua‘i). Inset shows the Hawaiian Archipelago in the Pacific Ocean.**

**Figure 1.2 National Marine Sanctuary System**


The Management Framework for the Sanctuary includes key elements to move toward an ecosystem-based approach to management. This framework includes the following elements:

- Sanctuary designation process and mandates - Sanctuary designation is founded on the NMSA of 2000 and the Executive Orders which created the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve in 2000
- Goals and Objectives (G&O) Statement - The overarching policy direction and guidance for Sanctuary management described by the vision, mission, management principles and specific goals and objectives for the Sanctuary
- Collaboration and Partnerships - Mechanisms for interagency collaboration and working with stakeholders
- Regulations, Zoning and Action Plans - Components of managing human activities and achieving Sanctuary goals and objectives through focused action
- Ecosystem Approach to Management - Concepts and terms and adaptive management process for moving toward an ecosystem management approach

Part 3 presents action plans to address five priority management needs over the five-year planning horizon. These priority management needs are:

1. Understanding and interpreting the NWHI
2. Reducing threats to the ecosystem
3. Managing human activities
4. Facilitating coordination
5. Achieving effective operations

Each action plan consists of multiple strategies and activities to address the priority management need and achieve a desired outcome. A results framework consisting of annual, medium-term, and long-term site performance measures is used to evaluate achievement of the desired outcome at the action plan, site and program levels. Finally, Sanctuary regulations are provided in the Appendices along with definitions and references.

## 1.1 Sanctuary Setting

The largest in the National Marine Sanctuary System, the Sanctuary covers an area of 139,793 mi$^2$ (362,061 km$^2$) and a distance of approximately 1,200 miles (1,043 nm/1,931 km) by 100 miles (87 nm/161 km), located between approximately 22°N and 30°N latitudes and 161°W and 180°W longitudes, in the Pacific Ocean. Compared in overlay to the continental United States, the Sanctuary would cover a distance equal to that between New York City and Omaha (Figure 1.3).

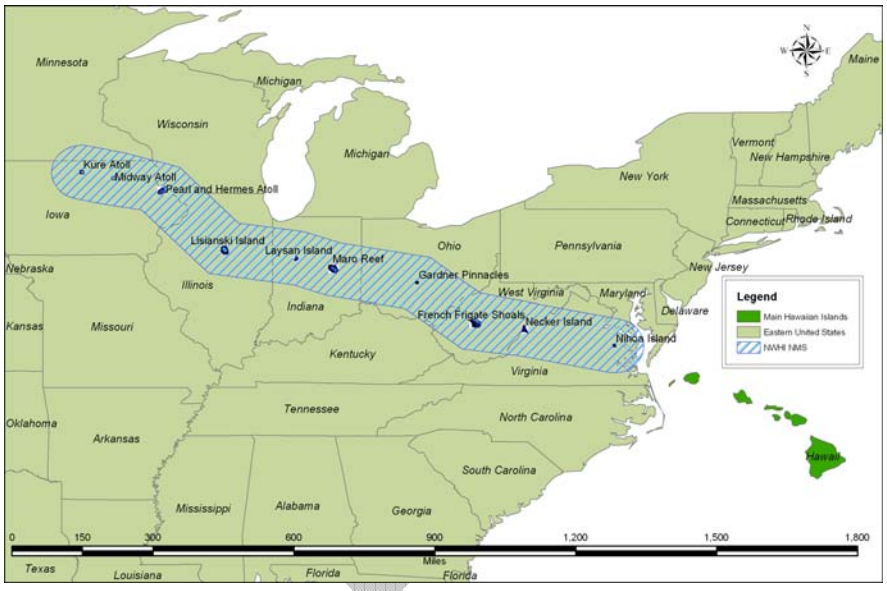
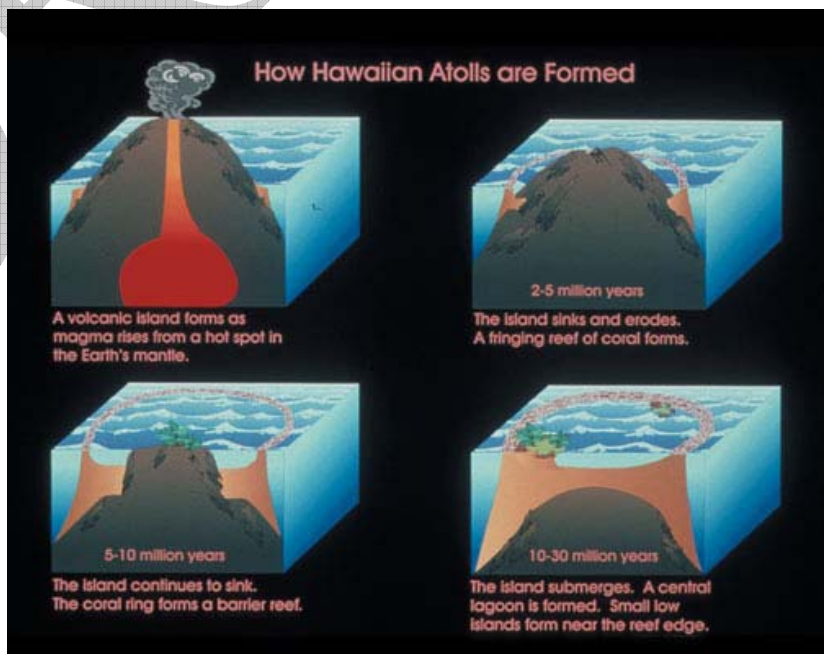



**Figure 1.3 The Sanctuary and Hawaiian Archipelago compared to the continental United States**

The Sanctuary supports a diversity of marine life inhabiting a complex array of reef, slope, bank, seamount, abyssal and pelagic environments. The Sanctuary boundary includes the submerged lands and waters surrounding the NWHI. The Sanctuary includes the nearshore waters under the management of the State of Hawai'i (NWHI State Marine Refuge and Kure Atoll State Wildlife Sanctuary), and the U.S. Fish and Wildlife Service (Hawaiian Islands and Midway Atoll National Wildlife Refuges). Emergent land, including the many small islands, islets and atolls of the NWHI, is not included within the Sanctuary jurisdictional boundary; however, they form an integral part of the overall NWHI ecosystem and are described as part of the Sanctuary setting.




### Physical Features

The NWHI constitute the northern three quarters of one of the world's longest and most isolated island chains. Millions of years ago, a series of undersea volcanoes emerged to form the Hawaiian Archipelago. Most of the NWHI are less than a square mile in landmass. Northwest of Kaua'i and Ni'ihau the rocky islands, atolls and reefs

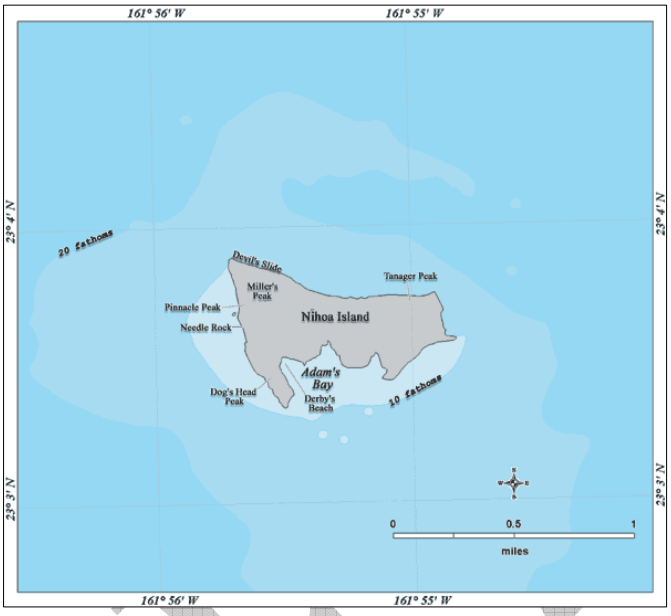
become progressively older and smaller.

For at least 80 million years new islands have formed as the Pacific Plate drifts over a stationary plume of magma rising from a hot spot within the earth's mantle. Millions of years of eruptions have pushed the fluid rock up through the ocean floor creating high volcanic islands. The Pacific Plate creeps northwestward at about 3.4 inches per year, slowly separating the volcanic islands from their source, as a new volcano builds over the hot spot.

Gradually the islands subside and erode. In the NWHI basalt remaining above the surface are at Nihoa, Necker, Gardner and La Perouse Pinnacles. As Hawaiian Islands sink, reef-building corals ring them. When a lagoon is formed between the sinking island and the ring of coral, an atoll is formed. At Kure Atoll, the last landform in the archipelago, coral growth barely keeps pace with the rate of subsidence and erosion. In the cold waters north of Kure, where coral growth rates are slower that the rate at which submerged islands sink, corals begin to die. From here on are seamounts, drowned remnants of the Hawaiian chain which ultimately form the Emperor Seamounts, extending all the way to Japan and Russia.

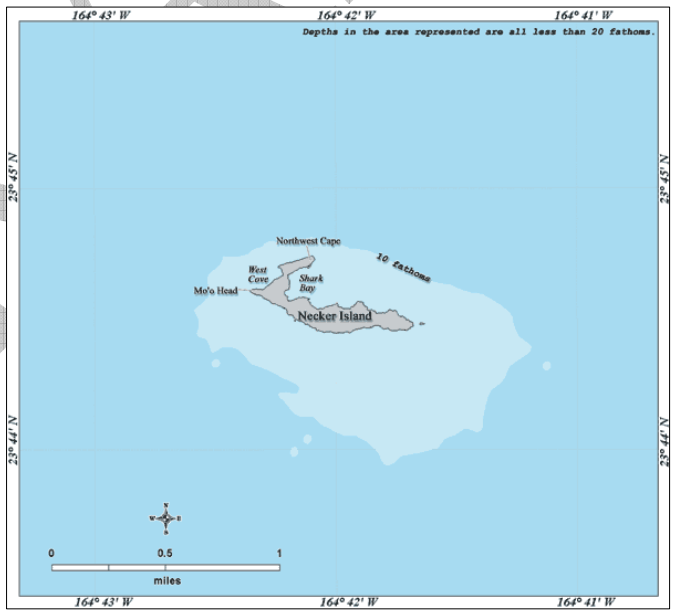
The NWHI are composed of a diverse range of physical features including high islands, atolls, sandy islets, shallow coral reefs, deepwater banks, and seamounts. Each area is distinguished by its geological, ecological, and cultural features. This section provides a brief overview of each of these features along the length of the NWHI from the southeastern end of the Sanctuary at Nihoa Island to the northwestern end at Kure Atoll.

## Nihoa Island[2]




Nihoa Island is located about 155 miles northwest of Kaua‘i in the main Hawaiian Islands. Nihoa, roughly 150 land acres, is the largest emergent volcanic island in the NWHI. The island’s two peaks and steep sea cliffs are clearly visible from a distance. The northern edge is a steep cliff made up of successive layers of lava through which numerous volcanic extrusions (dikes) are visible. Nihoa’s surrounding submerged coral reef habitat totals approximately 142,000 acres. Nihoa’s seabird colony boasts one of the largest populations of Tristam’s storm-petrel, Bulwer’s petrel and blue-grey noddies in the Hawaiian Islands and possibly in the world. Nihoa has a rich cultural heritage with at least 88 known wahi k□puna (ancestral sites) from Hawaiians who inhabited the island for 700 years (until 1700 A.D.). Nihoa and Mokumanamana are both recognized on the National Register of Historic Places.

## Necker Island (Mokumanamana)

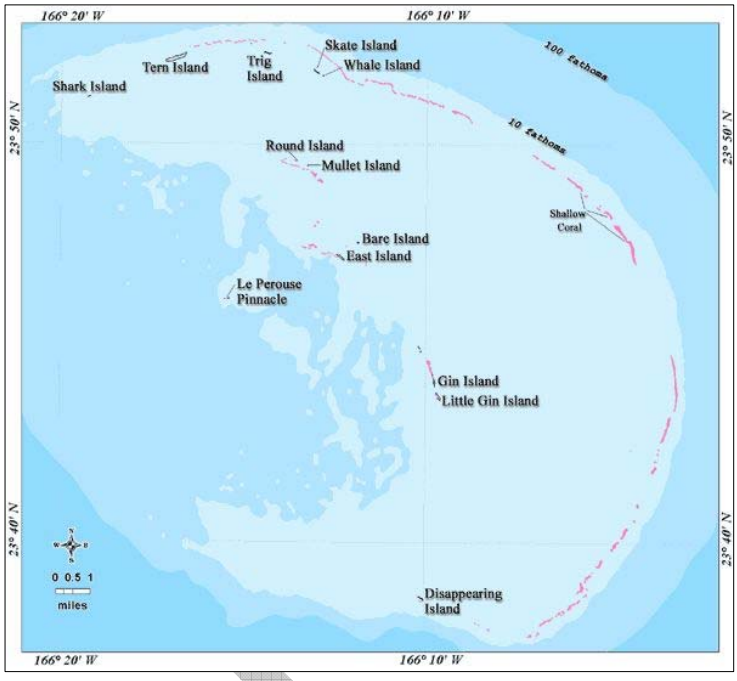



Necker Island is a dry volcanic island shaped like a fishhook and includes about 45 acres of land. Necker is also known by the Hawaiian name Mokumanamana, and is spiritually significant in the Native Hawaiian culture. Geologists believe it was once as large as O‘ahu. Now Mokumanamana’s high point is only 365 feet above the sea. Wave erosion has reduced the rest to a submerged shelf about 40 miles long and 15 miles wide. While this shelf holds more than 380,000 acres of coral reef habitat, severe waves and currents in the exposed areas inhibit coral growth. The 33 heiau (ceremonial sites) that dot the island’s spine suggest that the island was visited by Native Hawaiians for spiritual and possibly navigational purposes.

[2] Places in Hawai‘i are often referred to by multiple names. There is currently a difference of opinions among historians regarding the correct names of the islands and efforts are underway to identify, as accurately as possible, the original names. The names listed here are those that have been recognized by the Hawaiian Lexicon Committee, but several others exist.

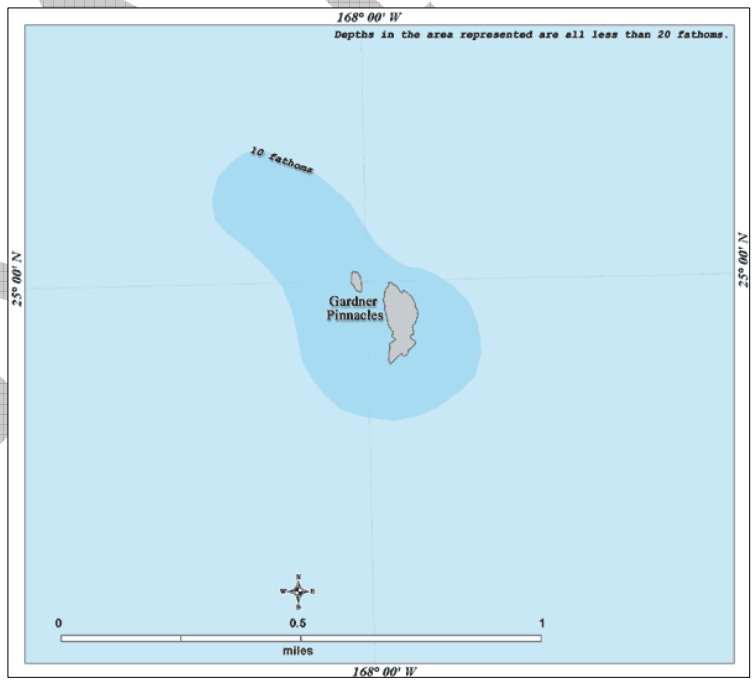
## French Frigate Shoals (Kānemiloha‘i)

French Frigate Shoals, the largest atoll in the chain, forms an 18-mile long crescent-shaped atoll and consists of only 67 acres of total emergent land and approximately 230,000 acres of coral reef habitat. The lagoon contains two exposed volcanic pinnacles and 12 low, sandy islets. French Frigate Shoals is home to the largest breeding colony of the endangered Hawaiian monk seal and supports nesting sites for 90 percent of Hawai‘i’s green sea turtle population. The shoals also have the largest diversity of breeding seabirds (18 species) in the NWHI.

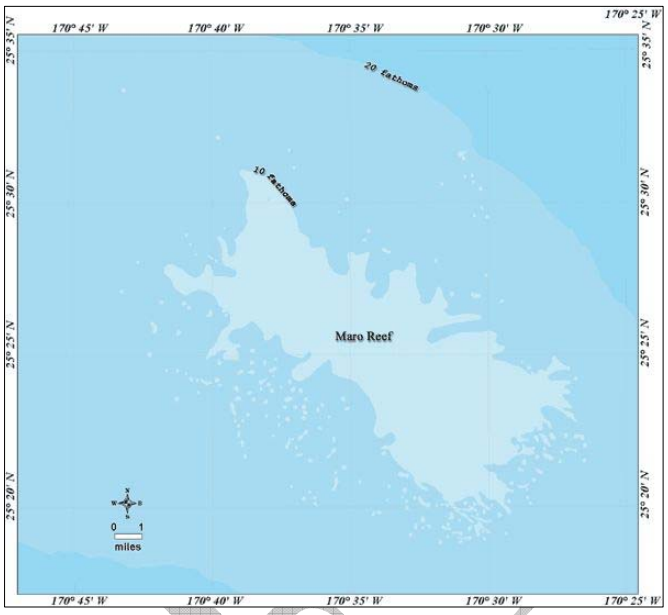



## Gardner Pinnacles (Pūhāhonu)

Gardner Pinnacles consists of two volcanic peaks. Bird guano gives the peaks a frosted appearance and indicates their importance as a roosting site and breeding habitat for 12 species of sub-tropical seabirds. In scale, these pinnacles are small, the larger reaching only 180 feet and about 590 feet in diameter. About 600,000 acres of coral reef habitat, most of which is in waters deeper than 60 feet, surround the pinnacles.

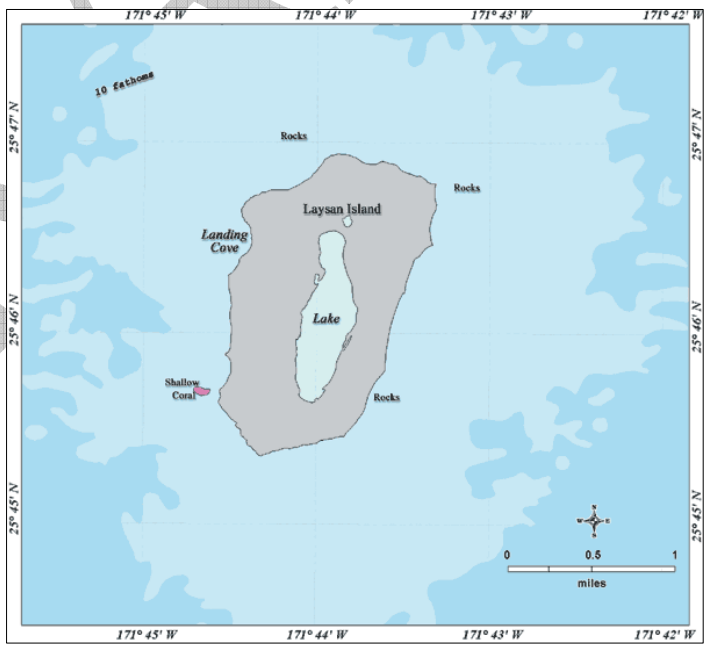


## Maro Reef (Ko‘anako‘a)




Maro Reef is a largely submerged open atoll with less than one acre of emergent land. At very low tide, only a small coral rubble outcrop of a former island is believed to break above the surface. The shallow water reef ecosystem covers nearly half a million acres and is the largest coral reef in the NWHI. It is one of the chain’s most ecologically rich with 95 percent coral cover in some areas, one of the highest observed in the NWHI. Maro has intricate “reticulated” reef crests, patch reefs and surrounding lagoons. Deep-water channels with irregular bottoms cut between shallow reef structures. Maro’s outermost reefs absorb the energy of swells that travel toward the inner lagoon. The innermost area lies within reticulated reefs and aggregated patch reefs and has the characteristics of a true lagoon, with little influence from large ocean swells. Because of Maro’s structural complexity, the shallow reef is poorly charted and it has been largely unexplored.

## Laysan Island (Kauō)



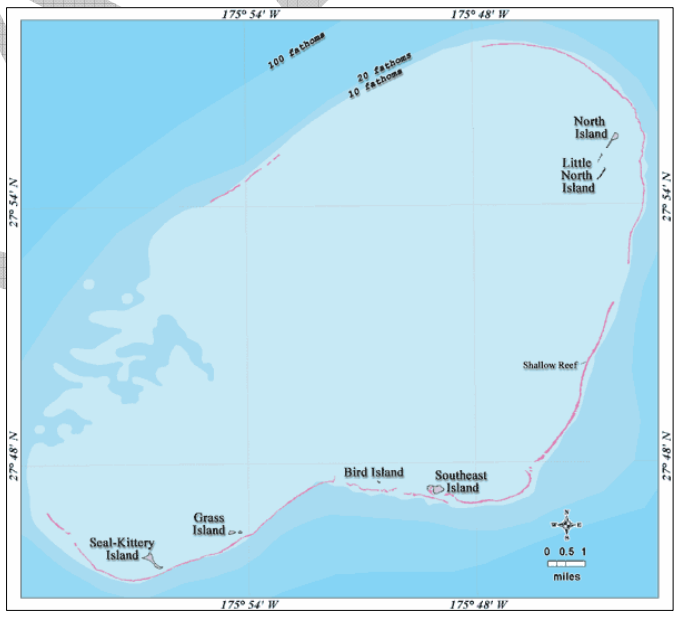

Laysan is the second largest island in the NWHI chain, with about 915 acres of land. It is surrounded by approximately 100,000 acres of coral reef. Most of the reef area at Laysan is in deeper waters with a small, shallow water reef area in a bay off the southwest side of the island. Laysan is well vegetated aside from its sandy dunes and has a 100-acre hypersaline lake (one of only five natural lakes in Hawai‘i). About two million birds nest here – boobies, frigatebirds, terns, shearwaters, noddies, albatrosses, as well as endangered Laysan ducks and finches.

## Lisianski Island (Papa‘āpoho)

Lisianski Island, the second largest NWHI atoll, at over 12 miles across, is a low sand and coral island and includes 400 acres of land. This 20 million-year-old island’s highest point stands at 40 feet. Lisianski is part of a large, open atoll, and lies at the northern end of a large reef bank, Neva Shoal which is estimated to be close to 290,000 acres. The coral cover around the island totals 310,000 acres.

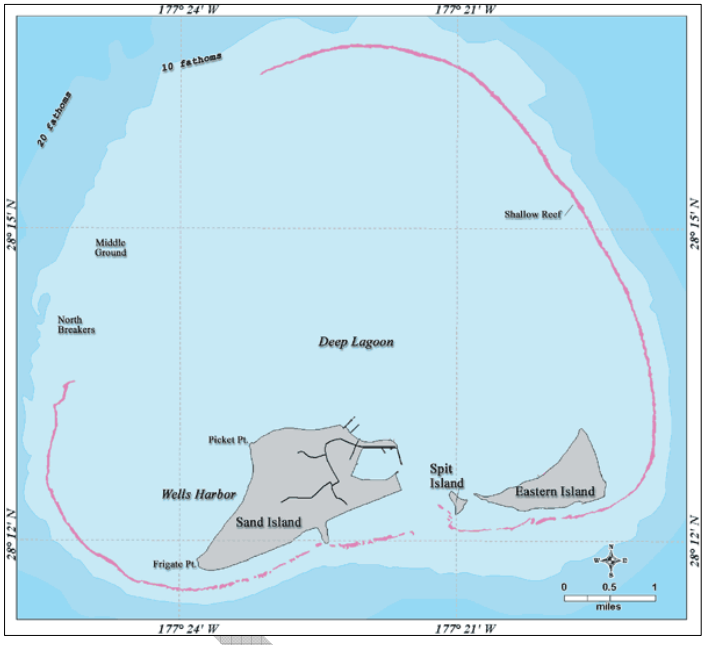

## Pearl and Hermes Atoll (Holoikauaua)

Pearl and Hermes Atoll is a large atoll with several small islets forming about 80 acres of land and almost 300,000 acres of coral reef habitat. The atoll extends over 20 miles across and 12 miles wide. Pearl and Hermes Reef is a true atoll, fringed with shoals, permanent and ephemeral sandy islets. The islets provide important dry land respites for seals, turtles, and birds in need of rest, protection from predators, or nesting grounds. The islets are periodically washed over when winter storms pass through the area.



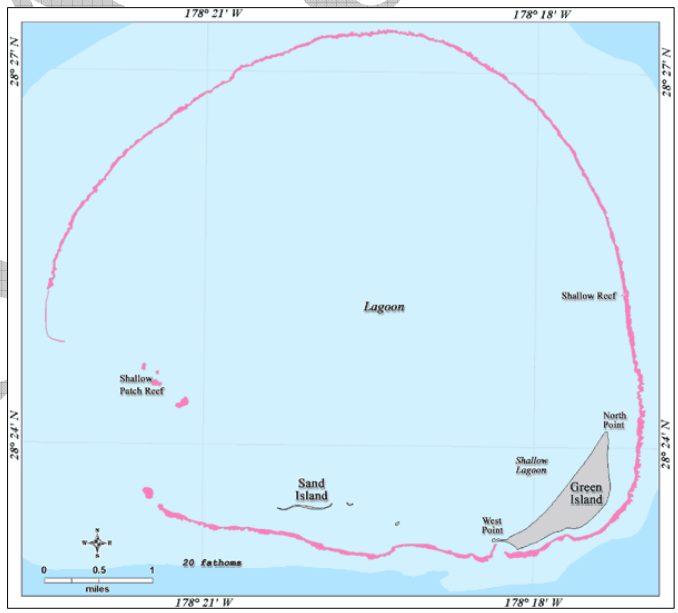
## Midway Atoll (Pihemanu)

Midway Atoll consists of three small, sandy islets totaling 1,540 acres and a large, elliptical barrier reef measuring approximately five miles in diameter. The atoll is surrounded by about 88,500 acres of coral reefs. Numerous patch reefs dot the lagoon. Also known as the "Midway Islands," Midway originated as a volcano approximately 27 million years ago. In 1965, the U.S. Geological Survey took core samples and hit the solid basaltic rock 180 feet beneath Sand Island and 1,240 feet beneath the northern reef. Despite being heavily used by humans, Midway boasts the largest nesting colonies of both Laysan and black-footed albatrosses in the world.



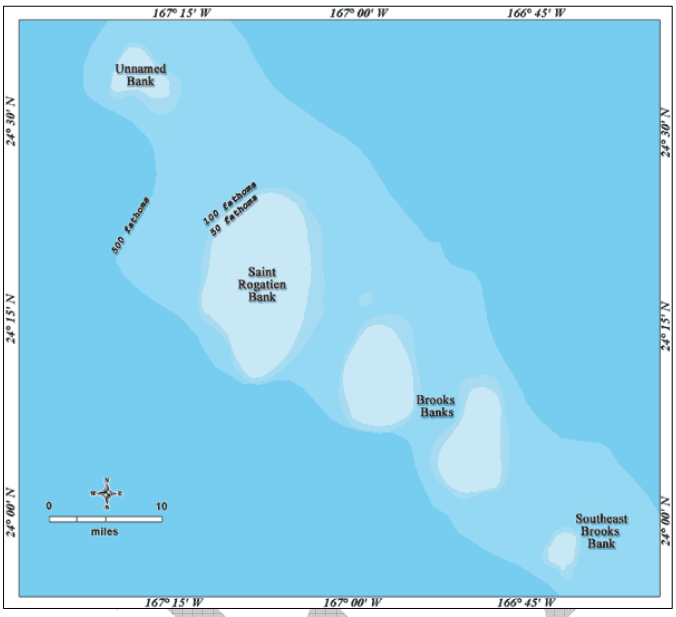

## Kure Atoll (Mokupāpapa)

Kure Atoll is located at the northern extent of coral reef development. The atoll is nearly circular with a six-mile diameter enclosing nearly 200 acres of emergent land. The outer reef nearly forms a circle around the lagoon except for passages to the southwest. The only permanent land in the atoll is crescent-shaped Green Island, located near the fringing reef in the southeastern part of the lagoon. Almost 80,000 acres of coral reef habitat are found there. Kure Atoll is located at the "Darwin Point," theorized by scientists where coral growth occurs at a slower rate than the subsidence of the atoll, resulting in the atoll eventually sinking below the surface. Kure's coral is still growing slightly faster than the island is subsiding. North of Kure, where growth rates are even slower, the drowned Emperor Seamounts foretell the future of Kure and all of the Hawaiian Archipelago. As Kure Atoll continues its slow migration atop the Pacific Plate, it too will eventually slip below the surface.



## Banks and Seamounts

There are approximately 30 submerged banks in the NWHI. Surrounding French Frigate Shoals is a series of submerged banks. An unnamed bank is located just to the east. To the west are South East Brooks Bank, St. Rogatien Bank, and another unnamed bank. Raita Bank is just west of Gardner Pinnacles. The crest or top of Raita Bank is about 60 feet from the ocean surface. Pioneer Bank is only 22 nautical miles from Neva Shoals, and the features combine to form a major coral reef ecosystem rich in biodiversity and with a variety of marine habitats.




Bank areas provide extensive habitat for bottomfish and a few are known to provide foraging habitat for endangered Hawaiian monk seals. Large precious corals, such as gold, pink and black corals, are also found in the deep waters of the banks. Unlike shallow reef corals, which are able to harness sunlight as an energy source due to photosynthesizing symbiotic dinoflagellates in their tissues, deep-water precious corals live in near-total darkness and are completely dependent upon capturing plankton with their tentacles from the water column.

## Oceanographic Features

Ocean currents, waves, temperature, nutrients, and other oceanographic parameters and conditions influence ecosystem composition, structure and function in the NWHI. The NWHI are influenced by a wide range of oceanographic conditions that vary on spatial and temporal scales. Spatial variability in oceanographic conditions range from a localized temperature regime that may affect a small portion of a reef to a temperature regime that influences part or all of the NWHI associated with Pacific and global oceanographic and climatic conditions. Temporal variability in oceanographic conditions may range from hourly and daily changes in nutrient conditions to seasonal, decadal or longer cycles in nutrient inputs to the region related to large-scale oceanographic processes. This section provides an overview of the oceanographic conditions that shape marine ecosystems in the NWHI.

Ocean currents play an important role in the dispersal and recruitment of marine life in the NWHI. Surface currents in the NWHI are highly variable in both speed and direction (Firing et al. 2004) with long-term average surface flow from east to west in response to the prevailing northeast trade wind conditions. The highly variable nature of the surface currents is due in large part to eddies created by local island effects on large-scale circulation. Marine debris accumulation in shallow water areas of the NWHI is also influenced by large- and small-scale ocean circulation patterns.

The distribution of corals and other shallow water organisms is also influenced by exposure to ocean waves. The size and strength of ocean wave events have annual, inter-annual and decadal time scales. Annual extra-tropical storms (storms that originate outside of tropical latitudes) create high waves during the winter. Decadal variability in wave power is possibly related to the Pacific Decadal Oscillation (PDO) events (Mantua et al. 1997). The number of extreme wave events has been recorded during the periods 1985 to 1989 and 1998 to 2002, and anomalously low numbers of extreme wave events occurred during the early 1980s and the period 1990 to 1996.

Tropical storms represent a potential, but infrequent, threat to the shallow coral reef ecosystems of the NWHI. Hurricane Patsy (1959) was the strongest hurricane reported for the NWHI in the past 50 years, with wind speeds exceeding 100 knots as it approached and passed between Midway and Kure Atolls. Only two hurricanes nearing the NWHI since 1979 were classified as Category 2 or weaker. No significant tropical storms have been observed in the NWHI since Hurricane Nele passed near Gardner Pinnacles in 1985.

High wave conditions associated with extra-tropical storms (storms originating outside tropical latitudes) are thought to be a significant and frequent environmental factor influencing coral reef community structure and function in the Hawaiian Archipelago (Dollar 1982; Dollar and Grigg 2004). Most large (5 to 10+ m) wave events approach the NWHI from the west, northwest, north, and northeast, with the highest energy generally occurring from the northwest sector. The southern sides of most of the islands and atolls of the NWHI are exposed to fewer and weaker wave events. Annually, wave energy and wave power (energy transferred across a given area per unit time) are highest (~1.3 W/m) between November and March and lowest (~0.3 W/m) between May and September. Extreme wave events (10+ m waves) impact shallow water coral reef communities to at least an order of magnitude more energy than the typical winter waves.

Sea surface temperature is an important physical factor influencing coral reefs and other marine ecosystems. The northern extent of the NWHI, from Kure to Pearl and Hermes Atoll, is exposed to large seasonal temperature fluctuations including the coldest and sometimes warmest sea surface temperatures in the Hawaiian Archipelago (Brainard et al. 2004). Sea surface temperatures at these northerly atolls range from less than 64° F (18°C) in late winter to highs exceeding 82° F (28°C) in the late summer. During the period between July and September 2002, sea surface temperatures along the entire Hawaiian Archipelago were anomalously warm resulting in widespread mass coral bleaching, particularly in the three northern atolls.

Nutrient conditions in the NWHI may be influenced by local and regional factors. Upwelling may occur in response to localized wind and bathymetric features. Regional factors are largely influenced by the position of the subtropical front and associated high chlorophyll content of waters north of the front. High chlorophyll waters intersect the northern portions of the NWHI during southward winter migrations of the subtropical front. The influx of nutrients to the NWHI from these migrations is considered a significant factor influencing different trophic levels in the NWHI (Polovina et al. 1995).

## 1.2 NWHI Ecosystem Status

Research and monitoring conducted by federal and state agencies, academic institutions, and other organizations over the last 30 years have contributed substantially to our understanding of the factors influencing the NWHI ecosystem. In recent years, increased efforts have focused on documenting coral reef ecosystem health and the effects of priority environmental and anthropogenic stressors identified by the U.S. Coral Reef Task Force (NOAA 2002). This section describes the environmental and anthropogenic stressors in the NWHI and the condition of NWHI ecosystem based to a large extent on the recent biennial report to the U.S. Coral Reef Task Force (Friedlander et al. 2005) and information presented during the NWHI 3rd Science Symposium held in Honolulu in November 2004 as well as other information sources.

## Environmental and Anthropogenic Stressors

Despite its remote location and largely uninhabited condition, the NWHI is subject to a wide range of environmental and anthropogenic stressors. Marine pollution, invasive species, fishing and vessel groundings are some of the factors that have impacted or may cause harm to the resources of the NWHI. An understanding of past and present stressors and potential future threats provides a backdrop for identifying priority management needs and informing an ecosystem-based management approach.

### Marine Pollution

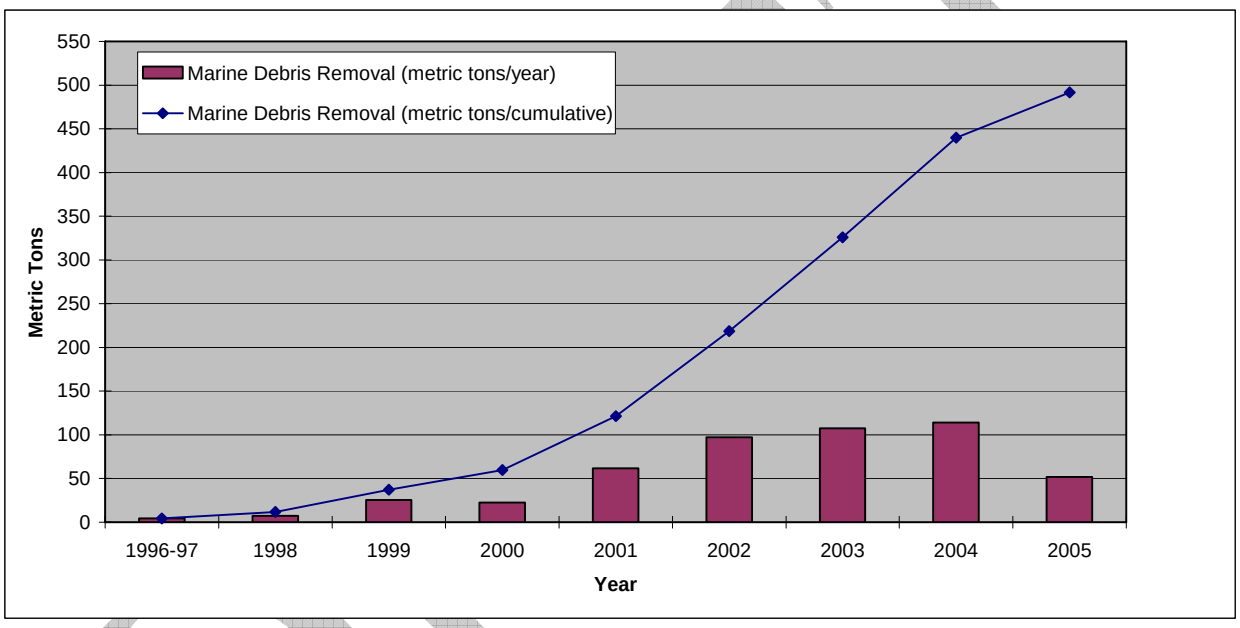
Marine pollution can be defined as the introduction by humans, whether directly or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as hazards to the health of marine life and humans, hindrance of marine activities, and impaired water quality marked by exceeding standards. Marine pollution may originate from land-based or sea-based human activities in the form of point-source discharges or non-point source runoff.

Marine debris is a form of marine pollution that may originate from sea-based activities, such as shipping and fishing or from land-based activities that transport pollutants in surface water runoff. Marine debris, including derelict fishing gear, cargo nets, bottles, military flares, and barrels of hazardous materials, continues to wash ashore on all the islands causing potential localized adverse impacts. Seabirds often ingest smaller debris while foraging, impacting survival rates. A container of the pesticide carbofuran is suspected to have washed ashore at Laysan Island. The area remained a hazard on the island from 1987 until remediated by USFWS in 2002.

Marine debris, in the form of derelict fishing gear from distant fisheries around the Pacific Rim, poses a significant threat to shallow water ecosystems of the NWHI. Fishing and cargo nets lost at sea are carried by currents to shallow water environments of the NWHI causing physical damage to corals and creating entanglement hazards for monk seals and other marine organisms. Since 1997, regular marine debris removal efforts have been conducted through a multi-agency effort led by the NMFS Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division in collaboration with the National Ocean Service, NWHI Coral Reef Ecosystem Reserve, State of Hawai‘i, City and County of Honolulu, U.S. Fish and Wildlife Service, U.S. Coast Guard, U.S. Navy, University of Hawai‘i, Sea Grant, Hawai‘i Metals and Recycling, Honolulu Waste Disposal, and other local agencies, businesses and NGO partners.

Over the last seven years, this effort has resulted in the removal of over 540 tons of derelict fishing gear and other marine debris from the coral reef ecosystems of the NWHI (Figure 1.4). Marine debris survey and collection activities have been conducted at Kure Atoll, Midway Atoll, Pearl and Hermes Atoll, Lisianski Island, Laysan Island and French Frigate Shoals. Removal operations have targeted areas where marine debris has accumulated over the past several decades. It is estimated that long-term average accumulation rates are 40 to 80 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.

**Figure 1.4 Quantity of marine debris removal in the Northwestern Hawaiian Islands. Source: PIFSC-CRED unpublished data.**




Past uses of the NWHI have left a legacy of contamination on many of the atolls. The NWHI has hosted an array of polluting human activities including guano mining, fishing camps, U.S. Coast Guard LORAN stations, U.S. Navy airfields and bases, and various military missions. Contamination at all these sites includes offshore debris such as batteries (lead and mercury), transformers, capacitors, and barrels. Uncharacterized, unlined landfills remain on all these islands. Specific known areas of contamination are the following:

- Kure Atoll and French Frigate Shoals both have point sources of polychlorinated biphenyls (PCBs) due to former U.S. Coast Guard (USCG) LORAN stations. While the USCG has mounted clean-up actions at both sites, contamination remains and is found in island soils and in nearshore sediments and biota.
- French Frigate Shoals and Pearl and Hermes Atoll were used for WWII seaplane refueling operations. This activity is suspected to have been a source of petroleum contamination in soil.

- Midway Atoll was the site of a U.S. Navy airfield. Before transfer to the Department of the Interior in 1996, the naval installation was part of the Base Realignment and Closure that identified and cleaned up numerous contaminated sites throughout the atoll. Contamination identified and remediated included petroleum in the groundwater and nearshore waters, pesticides (e.g., DDT) in the soil, PCBs in soil, groundwater, and nearshore sediments and biota, metals such as lead and arsenic in soil and nearshore waters, and unlined, uncharacterized landfills. While most of the known areas were remediated, several areas warrant continued monitoring for potential releases. Since closure, the Navy has returned on several occasions for further remediation.
- Plutonium from the aboveground nuclear tests in the 1960s at Johnston Atoll has been detected in corals at French Frigate Shoals.

Marine pollution generated by past and present human activities, from sea-based and land-based sources, continues to stress the NWHI ecosystem. Emergency response mechanisms and ongoing clean-up and restoration activities must be maintained and enhanced to address these issues. In the case of marine debris, the NWHI is the recipient, not the source of this type of marine pollution. This provides the Sanctuary with an important opportunity, as well as a challenge, to facilitate global and Pacific regional cooperation to help solve this problem.

## Climate Change and Coral Bleaching

Coral bleaching occurs when zoothanthellae, symbiotic algae that live in coral tissue, leave the coral as a result of thermal and other types of stress. Corals can die or become diseased without their energy producing zoothanthellae and can be subsequently colonized by turf algae and sessile invertebrates.

Central patch reef, Kure Atoll, September 2002. Bleached *Pocillopora meandrina* with initial overgrowth by turf algae. Photo: Jean Kenyon

Sea surface temperature anomalies resulting from regional- and global-scale climatic phenomenon are believed to cause bleaching in the NWHI. Mass coral bleaching in the NWHI occurred during late summer 2002 (Aeby et al. 2003; Kenyon et al., in press). Mass coral bleaching was not recorded or known to exist in the NWHI before this time. Furthermore, the NWHI were believed to be less susceptible to bleaching due to their high latitude location. Bleaching was most severe, however, at the three northernmost atolls (Pearl and Hermes, Midway, and Kure), which experience both higher and lower sea water temperatures than the other reef areas of the NWHI. Bleaching occurred but was less severe at Lisianski and farther south in the NWHI.

## Diseases

The incidence of diseases affecting marine organisms is increasing globally; however, the factors contributing to disease outbreaks are poorly known and hampered due to a lack of information on normal disease levels in the ocean (Harvell et al. 1999). The NWHI provide unique opportunities to document baseline levels of disease in coral reefs in absence of a resident human population.

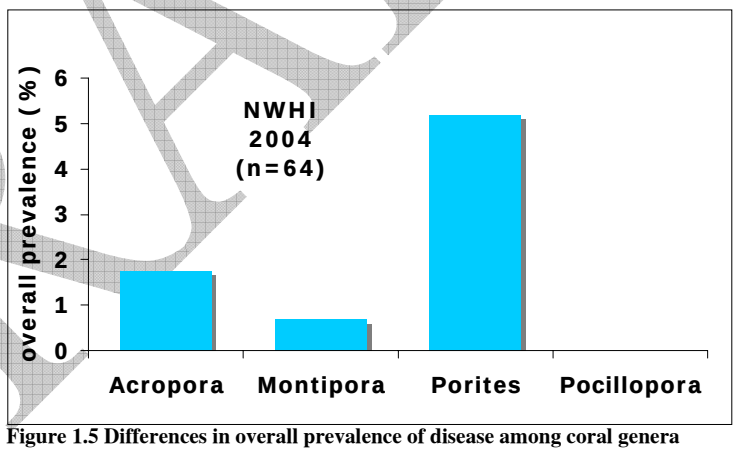



**Figure 1.5 Differences in overall prevalence of disease among coral genera in the NWHI. Source: Aeby, G. unpublished data.**

Recent studies in the NWHI have begun to document baseline levels of coral disease (Work et al. 2004; Aeby in press). Tumors, as well as lesions associated with parasites, ciliates, bacteria and fungi, have been found on a number of coral species. The overall average prevalence of disease (# of diseased colonies/total # colonies) was found to be very low in the NWHI, estimated at 0.5 percent (range 0 to 7.1 percent) (Aeby, in press) compared to the average prevalence of disease of 0.95 percent in the main Hawaiian Islands (Friedlander et al. 2005) The prevalence of disease varies among different genera of coral (Figure 1.6) with the highest prevalence in species of the genera Porites and *Acropora*. A protocol for characterizing coral disease has now been incorporated into regular coral surveys and monitoring of the NWHI.

The endangered Hawaiian green sea turtle is affected by fibropapillomatosis (FP), a disease that causes tumors in turtles. The prevalence of FP in the Hawaiian green turtle population was

estimated at 40 to 60 percent, with the majority of cases found among juvenile turtles (Balazs and Pooley 1991). The herpes virus has been suggested as the possible cause or co-factor of FP (Herbst 1995). The majority of recent turtle strandings are by juvenile turtles with FP (Work et al. 2004). As such, FP may pose a significant threat to the long-term survival of the species (Quackenbush et al. 2001).

## Marine Alien Species

Marine alien species can be defined as aquatic organisms that have been intentionally or unintentionally introduced into new ecosystems resulting in negative ecological, economic, or human health impacts. A total of 12 marine alien invertebrate, fish, and algal species has been recorded in the NWHI (Table 1.1). Alien species may be introduced unintentionally by vessels, marine debris, aquaculture, or intentionally, as in the case of some species of groupers and snappers and algal species.

**Table 1.1 Marine Alien Species in the Northwestern Hawaiian Islands[1]**

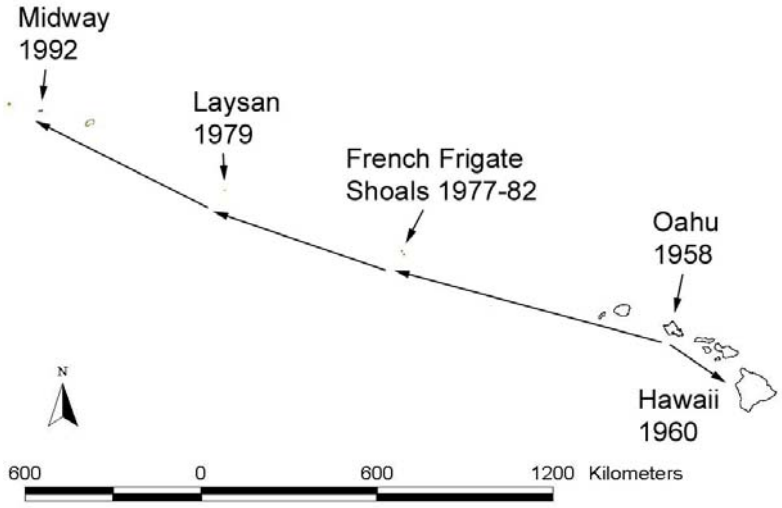
| Species | Taxa | Native Range | Present Status in NWHI[2] | Mechanism of Introduction |
|---|---|---|---|---|
| *Acanthophora spicifera* | Algae | Indo-Pacific | Established (MID) | Fouling on ship hulls (hypothesized) |
| *Hypnea musciformis* | Algae | Unknown; Cosmopolitan | Not Established; in drift only (MAR) | Intentional introduction to Main Hawaiian Islands (documented) |
| *Diadumene lineata* | Anemone | Asia | Unknown; on derelict net only (PHR) | Derelict fishing net debris (documented) |
| *Pennaria disticha* | Hydroid | Unknown; Cosmopolitan | Established (PHR, LAY, LIS, KUR, MID) | Fouling on ship hulls (hypothesized) |
| *Balanus reticulatus* | Barnacle | Atlantic | Established (FFS) | Fouling on ship hulls (hypothesized) |
| *Balanus venustus* | Barnacle | Atlantic and Caribbean | Not Established; on vessel hull only (MID) | Fouling on ship hulls (documented) |
| *Chthamalus proteus* | Barnacle | Caribbean | Established (MID) | Fouling on ship hulls (hypothesized) |
| *Amathia distans* | Bryozoan | Unknown; Cosmopolitan | Established (MID) | Fouling on ship hulls (hypothesized) |
| *Schizoporella errata* | Bryozoan | Unknown; Cosmopolitan | Established (MID) | Fouling on ship hulls (hypothesized) |
| *Lutjanus kasmira* | Fish | Indo-Pacific | Established (NIH, NEC, FFS, MAR, LAY, and MID) | Intentional introduction to Main Hawaiian Islands (documented) |
| *Cephalopholis argus* | Fish | Indo-Pacific | Established (NIH, NEC, FFS) | Intentional introduction to Main Hawaiian Islands (documented) |
| *Lutjanus fulvus* | Fish | Indo-Pacific | Established (NIH and FFS) | Intentional introduction to Main Hawaiian Islands (documented) |

Notes:
1 Zabin et al. 2003, Godwin 2002, DeFelice et al. 2002, Godwin 2000, DeFelice et al. 1998, McDermid (pers. com.)
2 NIH=Nihoa, NEC=Necker, FFS=French Frigate Shoals, MAR=Maro, PHR=Pearl and Hermes, LAY=Laysan Island, LIS=Lisianski Island, MID=Midway, KUR=Kure Atoll

Eleven species of shallow-water snappers (Lutjanidae) and groupers (Serranidae) were purposely introduced to one or more of the main (high) 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 2,400 km (1,491 miles) until it has now been reported as far north as Midway in the NWHI (Figure 1.6). These records suggest a dispersal rate of about 18-70 nautical miles per year. The other two species have only been recorded as far north as French Frigate Shoals and are present in much lower numbers than bluestripe snappers.

**Figure 1.6 Spread of bluestripe snapper throughout the Hawaiian Archipelago after introduction to O'ahu in 1958. Source: Friedlander et al. 2005.**




The magnitude of the problem of aquatic alien species is far greater in the main Hawaiian Islands (MHI) than the NWHI. Efforts to control the accelerated introduction of alien species in the NWHI must focus on transport mechanisms, such as marine debris, ship hulls, and discharge of bilge water from vessels originating from Hawaiian Island and other ports, to effectively reduce new introductions. Monitoring is needed as an early warning system for response actions to be effective. Natural transport mechanisms, such as larval transport in currents, also play a role in the spread of aquatic invasive species.

**Fishing**

Fishing and other resource extractive uses have occurred in varying degrees in the NWHI. Native Hawaiians traveled to these areas as early as 500 A.D. During the western exploration period (1750 to 1920s), explorers and whalers from France, Russia, Japan, Britain, and the United States harvested monk seals, whales, fish, seabirds, and guano from various parts of the NWHI. In more recent history (1920s to 1970s) fishing and other resource extractive uses were punctuated by the overexploitation of the endemic black-lipped pearl oyster (1928 to 1931), the beginning of a Hawaiian fishing fleet (1930s to 1940s), a cessation of commercial uses during WWII, a resumption of commercial fishing (1945 to 1960) during which Tern Island was used as a transshipment point for fresh fish air flown to Honolulu, and a proliferation of foreign fishing vessels from Japan and Russia (1965 to 1977).

The most recent fishing regime was born from the research conducted during the Tripartite Studies (1977 to present) through the development of fishery management plans for precious corals, bottomfish, pelagic fish, crustaceans, and coral reef fisheries. No precious coral or coral reef species fisheries have been permitted under these plans for the NWHI. Commercial pelagic longlining within 50 nm of the NWHI was stopped in 1991 with the designation of the Protected Species Zone due to interactions with endangered and threatened species. The crustacean (lobster-trap) fishery was closed in 2000 to protect overexploited lobster stocks. Only the bottomfish and associated pelagic fishery is currently operating in the NWHI.

**Commercial Bottomfish/Pelagic Fishing**

Federally permitted commercial bottomfish/pelagic fishing occurs in two management zones in the NWHI, the Mau Zone, which extends from Nihoa Island to just south of French Frigate Shoals and the Hoʻomalu Zone, which extends from French Frigate Shoals to Kure Atoll. As of 2003, five bottomfish vessels operate in the Mau Zone and four operate in the Hoʻomalu Zone. These vessels have historically provided between 40 percent and 50 percent of the fresh Hawaiian bottomfish to the local market, averaging 345,000 pounds per year. The fish caught in the NWHI represent approximately one percent of the total pounds of fish landed each year in the State of Hawaiʻi, and a total of two percent of the value of all commercial fish landed in Hawaiian waters.

Evidence of deep slope bottomfishing in the NWHI dates back to the 1700s when Native Hawaiians fished at Necker and Nihoa Islands (WPFMC 2003b). Bottomfishing by Western vessels has occurred since at least the 1930s. At least five commercial vessels targeted bottomfish species in the years following WWII. Efforts increased between the late 1960s and the mid-1980s due to an expanded local market (WPFMC 2003a). The federally permitted NWHI commercial bottomfish fishery has been regulated under the current management regime since 1986. Limited entry (maximum seven permits) for the larger, more distant Hoʻomalu Zone was established in 1989 and for the Mau Zone (maximum ten permits) in 1999 (WPFMC 2004b). The allowable gear and fishing methods minimize habitat impacts but maintain by-catch levels of approximately 25 percent.

The bottomfish fishery targets deepwater (generally > 75-100 fm) snappers and one endemic species of grouper (WPFMC 2004a) The four primary targeted species, pink snapper (*Pristipomoides filamentosus)* or *ʻōpakapaka* (26 percent), the red longtail snapper (*Etelis coruscans)* or *onaga* (20 percent), the endemic Hawaiian grouper, *(Epinephelus quernus)* or *hapuʻupuʻu* (17 percent), and the gray snapper (*Aprion virescens*) or *uku* (15 percent) comprise 78 percent of the total landings (WPFMC 2004a). Two species, the green jobfish and the endemic Hawaiian grouper occur in shallow reef habitats and also contribute to bottomfish landings (WPFMC 2004a).

Multiple indicators that have been used to identify signs of stress in the fishery include: catch-per-unit-effort (CPUE), the amount of fish caught for a standardized amount of fishing effort and spawning potential ratio (SPR), the ratio of the spawning stock biomass per recruit at the current level of fishing to the spawning stock biomass per recruit that would occur in the absence of fishing.

Utilizing these methods the NWHI bottomfish fishery showed signs of stress in 2002 in the Mau zone. Since that time a control rule, based on MSY has been employed to determine the

archipelago-wide status of the stock. Applying the control rule to the 2002 data indicated that the fishing effort in the MHI contributed overwhelmingly to the overfishing status identified in 2002, followed by Mau zone. Within the Mau zone it was found that effort exceeded the level estimated to produce MSY by 19 percent. However, by applying the control rule to 2003 data indicated that the overfishing condition was no longer occurring in the area. At this time, there is no reason to believe that the fishing mortality metrics for either NWHI zones (Mau or Ho‘omalu) will change significantly in 2004.

Current assessment methods for the bottomfish fishery, however, rely heavily on biased fishery-dependent data sets that lack information on important segments of the population, which together leads to uncertainty in stock assessments (Ralston et al. 2004). As such, a Bottomfish Stock Assessment Panel was convened by the WPFMC in January 2004 to develop a plan to improve data collection and assessment methodology. The expert panel evaluated existing biological, oceanographic, and fisheries data, as well as stock assessment systems relating to bottomfish resources of Hawai‘i and other U.S. Pacific island areas, identified weaknesses in current assessment methods and supporting data, reviewed alternative approaches for modeling and stock assessment, and proposed a course of action to improve stock assessment methods and associated data collection.

The panel concluded that available information is fragmented and not being used effectively to manage the resource. Furthermore, the panel recognized the need to collect a great deal of information to build bottomfish management on a strong foundation. Recommendations made by the panel include the following short-, medium- and long-term actions:

- Review, standardize, and improve sampling methodologies and data collection programs.
- Collect biological data for key species, including length, weight, sex, maturity and age, to determine important life history parameters and develop indices of the status of exploitation to highlight “yellow light” situations requiring closer study and management action.
- Manage data in a relational database to link biological data with individual fishing events, locations, and depths.
- Create an inventory of bottomfish habitat containing measures of habitat suitability to form the basis for designing an efficient stratified-random fishery-independent survey in the future.
- Update all basic life history parameters that are of special relevance to management, in particular, growth curves and reproductive rates of key species.
- Implement a tagging program to determine the extent of movements of bottomfish, both within and between banks.
- Initiate a routine fishery-independent survey, with the intention of gathering unbiased relative abundance data that could be used to assess the extent of bias that exists in the fishery-dependent CPUE data.
- Create an operational model of the fishery using existing information (larval movement, habitat distribution, growth, distribution, etc.) to simulate the dynamics of the entire assemblage that could be used to evaluate different potential approaches to stock assessment and management (e.g., marine reserves).
- Assess the meta-population structure of bottomfish stocks, which at the present time is completely unknown.

- Increase knowledge of the spatial structure of population sources and sinks, for example, determining which banks are most critical to population persistence; this information is needed to effectively design spatial management schemes, including marine reserves.
- Develop population models that capture the essential aspects of grouper biology and accurately gauge the effect of fishing on the persistence of grouper stocks, given that known life history characteristics seriously complicate management of these species.

The panel specifically highlighted the importance of determining if spawners in the NWHI generate substantial recruitment to the main Hawaiian Islands given the depleted status of bottomfish stocks in the main Hawaiian Islands.

**Commercial Pelagic Trolling**

A very small number of commercial pelagic trolling fishermen have operated recently or operate currently in the NWHI. These fishermen are not federally permitted, as the fishery management plan for pelagic species does not regulate this small fleet. These fishermen operate under a State of Hawai'i commercial marine license that enables them to sell their catch legally. Commercial pelagic trolling is divided into three distinct types of fishermen: *aku* (pole and line) boats, handline (*ika shibi* and *palu ahi*) boats, and pelagic trolling boats. Of these, pelagic trolling is the most popular statewide, with 90 percent of the participants and 50 percent of the landings (WPFMC 2003a). Over the years, a few vessels have occasionally ventured into the southern portion of the NWHI. The State of Hawai'i Department of Land and Natural Resources, Division of Aquatic Resources (DLNR/DAR) has records for nine commercial pelagic trolling vessels fishing in the NWHI between 1991 and 2000 around Nihoa, Necker, Gardner Pinnacles and French Frigate Shoals, with most of the catch focused around the National Weather Service's Buoy 1 near Nihoa. These vessels reported landing slightly less than 140,000 pounds over this period, which corresponds to less than 0.5 percent of total statewide landings (Ehler 2004). Anecdotal information suggests that only a few of these fishermen, if any, still commercially fish for pelagic species in the southern portion of the NWHI. Commercial pelagic longlining was prohibited within 50 nm of the NWHI in 1991 due to interactions with endangered and threatened species by the designation of the Protected Species Zone.

**Commercial Lobster Fishery**

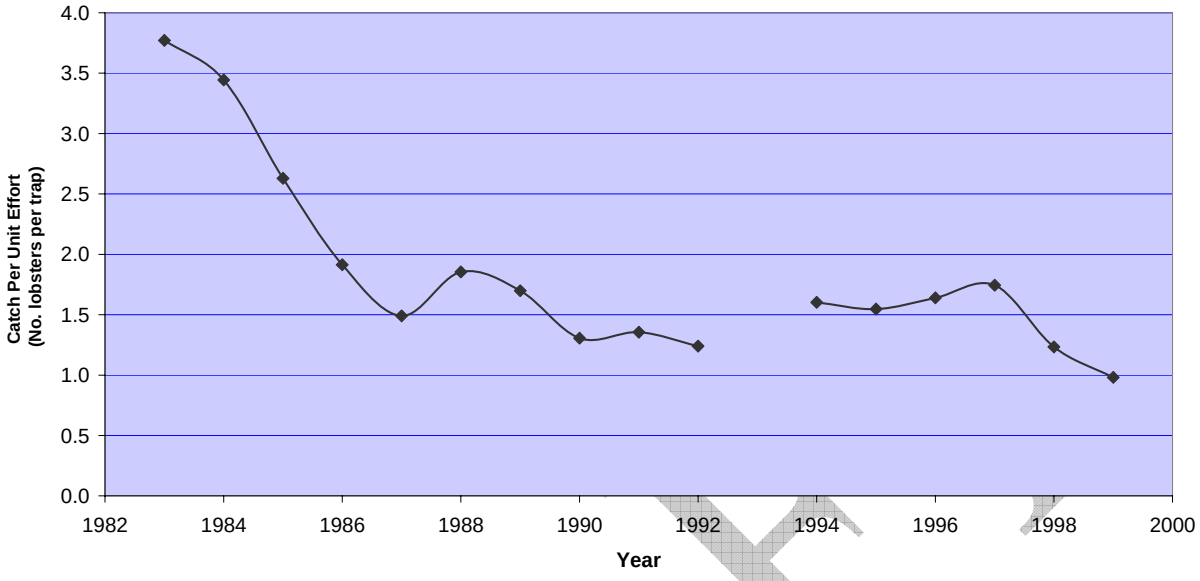
The now-closed, commercial lobster fishery began in 1976 to target the endemic Hawaiian spiny lobster (*Panulirus marginatus)* then shifted to the non-endemic slipper lobster (*Scyllarides squammosus*) in 1998. Advances in trap design and processing techniques led to huge increases in total landings. New trap designs, introduced in 1984, tripled trap hauls in a single year (Kawamoto and Pooley 2000). Moving from a live lobster fishery to a frozen tail fishery allowed fishermen to remain at sea longer and return with much more products.

The commercial crustacean fishery experienced a classic "boom and bust" scenario (Table 1.2) characterized by a six-fold decrease in landings, an eleven-fold decrease in value, a five-fold decrease in effort and a doubling of regulatory discards. A precipitous drop in catchability foreshadowed the bust by five years. This decline occurred across all lobster grounds, including the primary banks of Necker Island, Maro Reef, and Gardner Pinnacles (Figure 1.7).

## Table 1.2 Changes in Commercial Crustacean Fishery in the NWHI[1]

| Parameter | Boom Years (1984-1990) | Bust Years (1991-1999) |
|---|---|---|
| Lobsters landed (average per year) | 1,275,000 | 211,000 |
| Value of fishery (inflation-adjusted) | $11,000,000 (1985) | $1,000,000 (1999) |
| Participation (average boats per year) | 14 | 6 |
| Effort in trap-hauls per year (average per year) | 1,037,000 | 213,000 |
| Discard rate (percent of juveniles and berried) females in catch)[2] | 28% (1982) | 62% (1995) |
| Notes: 1 - Based on data from Dinardo and Marshall 2001; 2 - Changed to a "retain-all" fishery in 1996 | | |

**Figure 1.7 Commercial Crustacean Catch Per Unit Effort (all species) in the NWHI. Based on data from Dinardo and Marshall 2001.**




Federal fishery management began in 1983 with the adoption of the Fishery Management Plan for Crustaceans of the Western Pacific. Between 1984 and 1988, landings exceeded the maximum sustainable yield (MSY) of 300,000 lobsters (WPFMC 1982) by an average of 445 percent. In 1989, the MSY was increased to 1,000,000 lobsters (SRG 2004), adjusted to include slipper lobsters in the catch. A "laissez-faire management strategy" of allowing the free-market to address overcapacity problems, with a minimum of biological regulation, was employed through 1988 (Clarke et al. 1992). This strategy was unsuccessful, propelling development of a limited-entry program in 1991 and catch quotas in 1992 (Kawamoto and Pooley 2000).

These management tools were being applied at the same time that NMFS began a series of emergency actions for the lobster fishery. An emergency action was taken on May 13, 1991 to close the fishery from May 8 through August 12 in response to indications of NWHI lobster stocks approaching an overfished condition (56 FR 21961). The closure was extended until November 12, 1991 through another emergency action on July 30 (56 FR 36912). The fishery was reopened in 1992 under new harvest guidelines. The fishery was closed for the entire 1993 season and a second emergency closure was issued eight weeks into the 1994 season (59 FR 44341). The fishery was open to a single vessel in 1995 under an experimental fishing permit to assess stock conditions.

A 20-year time series of fishery-independent data has not shown improved recruitment to this population (Dinardo and Marshall 2001). Key factors considered to be responsible for the decline in lobster stocks include: overfishing resulting from exceeding MSYs, decreased recruitment resulting from inability of fishermen to return juvenile and berried female lobsters to the sea alive (Dinardo 2004), combined with decreased productivity of the entire island chain (Polovina and Mitchum 1992) associated with a decadal oscillation in oceanographic conditions

and ecological factors, including competition over suitable habitat (Parrish and Polovina 1994) and meta-population[3] dynamics.

The NWHI commercial lobster fishery was closed in 2000 by both federal court order, and by NMFS to protect lobster stocks because of (1) shortcomings in understanding the dynamics of the NWHI lobster populations, (2) the increasing uncertainty in population model parameter estimates, and (3) the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI (65 FR 39314). The closure has continued through 2004 (69 FR 12303) and 2005 (70 FR 8544). In compliance with an order of the U.S. District Court for the District of Hawai'i, the crustacean fisheries must remain closed until an environmental impact statement and biological opinion have been prepared. NMFS has continued its fishery research during this closure, including tagging studies and population assessments, and has developed a spatially structured population model to replace the archipelago-wide harvest guideline (Botsford et al. 2002). The fishery closure is also consistent with Executive Orders 13178 and 13196, issued in December 2000 and January 2001, respectively, that established the NWHI Coral Reef Ecosystem Reserve (70 FR 8544).

**Recreational and Sport Fishing Activities**

Recreational catch and keep fishing (as separate from charter fishing) is virtually non-existent in most parts of the NWHI. Some recreational fishing takes place at Weather Buoy 1, and the banks in the vicinity of Nihoa Island, based on reports of pelagic spearfishing and recreational trolling by fishermen from the main Hawaiian Islands. This type of recreational fishing activity differs from sustenance fishing and recreational catch and release fishing (largely by charter boats) as catch is kept and generally not consumed on site but kept for later consumption. Catch and effort data is unavailable for this fishing activity.

From 1996 to 2001, sport fishing operations at Midway Atoll consisted of a charter catch and release season occurring roughly between April and November, with an estimated 375 angler-trips per year (WPFMC 2001). Targeted species included tuna, billfish, and large jacks, with a smaller inshore fishery targeting *ulua* (giant trevally) and other reef fish (HFAC 2004). Although they were mandatory, vessels did not regularly complete trip data logs for fishing activities, which inhibits accurately determining total fishing days and hours, fishing location, or numbers of target species kept, tagged, or released (SRG 2004a).

**Trade in Coral and Reef Species**

The harvest of live rock and live coral is currently prohibited throughout the Hawaiian Archipelago by both state and federal regulations (WPFMC 2001, Hawai'i Administrative Rules 13-95). The harvest of other coral reef species has been prohibited in federal waters of the NWHI since the establishment of the Reserve in 2000 by EO; however, commercial exploitation of nearshore coral reef resources began in the 1800s, when Western sailing ships exploited the area for seals, whales, reef fish, turtles, sharks, birds, pearl oysters, and sea cucumbers (WPFMC 2003b). Japanese vessels harvested bird skins and feathers until 1909, when the area was designated the Hawaiian Island Bird Reservation by President Theodore Roosevelt.

Between 1910 and the 1940s, six known vessels and three to four sampans fished for turtles, lobsters, pearl oysters, and a wide variety of fish species. Two of these vessels were lost at sea.

[3] A population of geographically separated populations linked through limited recruitment.

In the 1920s, a fishing station was established at Pearl and Hermes Atoll. Between 1946 and 1959, nine large commercial vessels fished the NWHI, split equally between shoal and deep-sea vessels and inshore vessels. Two fishing stations at Tern Island in French Frigate Shoals supported the inshore vessels, using a DC-3 cargo aircraft to fly *akule* and other species to Honolulu. These were unmanaged fisheries with no regulations limiting or accurately documenting their activities. The black-lipped pearl oyster fishery decimated the population shortly after their discovery, leading to a 1929 act prohibiting their harvest. After 75 years of protection, this species is beginning to recover, with 200 to 300 counted during a recent survey of the lagoon at Pearl and Hermes Atoll, the site of the original fishery (Maragos and Gulko 2002). The large *akule* schools kept the FFS fishing station active for a few years, but disappeared and were not spotted by fishermen for ten years after the original harvest (Agard 2000).

**Other Fishing Activities**

A short-lived commercial fishing operation involving a single vessel using bottom longlines to catch reef sharks was conducted at FFS and nearby banks in the year 2000. During one 21-day fishing trip, this vessel caught 990 sharks in the NWHI consisting mainly of sand-bar sharks (*Carcharhinus plumbeus*) at 69 percent, Galapagos sharks (*Carcharhinus galapagensis*) at 18 percent, and tiger sharks (*Galeocerdo cuvier*) at ten percent (Vatter 2003). There has never been a precious coral fishery in the NWHI (the fishery in the MHI has been inoperative since 2001). No other commercial fishing or resource extractive activities are occurring within the Sanctuary.

Recreational fishing and Native Hawaiian subsistence fishing are both limited. Sustenance fishing, defined as fishing for on-site consumption conducted as incidental to another permitted, non-fishing activity, includes fishing for pelagic reef and bottomfish species using trolling, handline, and pole and line fishing techniques. Sustenance fishing is known to take place aboard research, Coast Guard, and military vessels. This type of fishing is also believed to occur from transiting vessels, including sailboats, although no data exists to confirm this assumption. Fishing effort and landings are currently undocumented and unknown. These data are now being collected by the Sanctuary.

**Vessel Hazards and Groundings**

Hazards to shipping and other forms of maritime traffic are inherent in the NWHI's 1,200 miles of islands and islets as well as shallow submerged reefs and shoals. The region is exposed to open ocean weather and sea conditions year round punctuated by winter severe storm and wave events. Vessel groundings and the release of fuel, cargo and other items pose real threats to the NWHI.

Twelve of the 60 ship losses known to have occurred in the region have been located, including whaling vessels, navy frigates, tankers and modern fishing boats. Additionally, there are 67 known plane losses in the region, mainly naval aircraft (many from World War II), though only two have been located. Some of these ship and aircraft wreck sites fall into the category of war graves associated with major historic events.

Unexploded ordnance, debris and modern shipwrecks, such as the fishing vessels *Houei Maru #5* and *Paradise Queen II* at Kure Atoll, or the tanker *Mission San Miguel* lost at Maro Reef, are not protected as heritage resources and represent a more immediate concern as threats to reef ecosystems. Mechanical damage from the initial grounding, subsequent redeposition of wreck

material by storm surge, fishing gear damage to reef and species, and release of fuel or hazardous substances are all issues to be considered in protecting the integrity of the environment. In some cases it may be more detrimental to remove the grounded vessel than to leave it where it is, and these concerns must be weighed when deciding how to respond to these threats.

In 1998, the *Paradise Queen II* ran aground at Kure Atoll, spilling 11,000 gallons of diesel fuel and 500 gallons of hydraulic fluids and oil. The vessel also lost 3,000 pounds of frozen lobster tails, 4,000 pounds of bait, 11 miles of lobster pot mainline, and 1,040 lead-weighted plastic lobster traps. Traps rolling around in the surf broke coral and coralline algal structures. Two years later, researchers found broken coral, 600 lobster traps, and the bodies of two monk seals among piles of nets surrounding the decaying wheelhouse (USFWS 2000).

When the 85-foot longliner *Swordman I,* carrying more than 6,000 gallons of diesel fuel and hydraulic oil, ran aground at Pearl and Hermes Reef in 2000, VMS technology allowed agents to track the disaster and quickly send out equipment for a clean-up that cost upward of $300,000, costs for which the government had to sue to recover.

By comparison, the grounded chartered marine debris cleanup vessel *Casitas* caused less environmental damage. Following the removal of 33,000 gallons of fuel and oil, the 145-foot motor vessel *Casitas* was successfully extracted from the reef at Pearl and Hermes Atoll and entombed northwest of the atoll in approximately 7,200 feet of water. The ship was conducting marine debris clean-up operations under a NOAA charter when it ran aground on July 2, 2005. Unified Command representatives from the U.S. Coast Guard, State of Hawai‘i, and Northwind Inc. (owner of the *Casitas*), in cooperation with the federal trustees USFWS and NOAA, oversaw the operation to prevent further damage to the coral reef ecosystem.

Emergency response and natural resource damage assessment and restoration protocols must be reviewed and updated to address these threats in a coordinated and strategic manner taking into account the remote location of the NWHI. Ongoing mapping efforts and the development of the bathymetric atlas for the NWHI will provide detailed and highly accurate maps of submerged features that until recently were represented by bathymetric data from surveys conducted before World War II (Miller et al. 2004).

**Tourism and Recreation**

Due to the NWHI's isolation from human population, tourism and recreational activities have historically been extremely limited. Midway Atoll has served as a base for an ecotourism operation conducted under the auspices of the USFWS from 1996 to 2002. Ecological and historic preservation service projects, guided tours, diving and snorkeling trips, as well as sport fishing operations were conducted at Midway and neighboring Kure and Pearl and Hermes Atolls by private companies and nongovernmental organizations. In addition, Midway Atoll has been a destination for a limited number of cruise ships.

**Coastal Development**

Historically, coastal development in the NWHI consisted of guano mining at Laysan Island a century ago, naval base construction at Midway and French Frigate Shoals (FFS) during the first half of the 20th century, and U.S. Coast Guard (USCG) LORAN station construction and operations at Kure and FFS for several decades following World War II. The Midway Naval Air Station supported several hundred to several thousand soldiers and dependents during the pre- to post-WW II era before the atoll was transferred to the U.S. Fish and Wildlife Service in 1996. Navigation channels for the naval bases at Midway and FFS were dredged during the middle of the 20th century. These types of coastal development activities alter current flow, shoreline configuration and, as a result, may significantly alter coastal erosion patterns. Operation of housing and other facilities contribute to point and non-point sources of pollution to the marine environment.

Since the closure of Navy and USCG facilities, coastal development activities have been limited to small-scale conversion of abandoned USCG buildings on Tern Island at FFS and Green Island at Kure to wildlife research stations. The only recent coastal construction has been the repair of the seawall protecting Tern Island's small runway and buildings and construction of a small boat ramp at FFS in 2004. This construction was needed to eliminate the risk of injury and death to endangered monk seals, threatened green sea turtles and migratory seabirds previously trapped in derelict sheet piling now removed from the island.

Current human population levels are limited to a few researchers, volunteers, and maintenance contractors at wildlife stations operated at Laysan, FFS, and Midway year round and at Kure, Lisianski, and Pearl and Hermes Atoll, seasonally.

## Condition of Marine Ecosystem

The NWHI can be characterized as a large marine ecosystem exposed to a wide range of oceanographic conditions and environmental and anthropogenic stressors. Submerged geomorphologic features, including reef, slope, bank, and seamount habitats, support a diverse range of shallow and deepwater marine life. Small islands and islets provide critical breeding grounds and nesting sites for endangered, threatened, and rare species that forage throughout the coral reef, deepwater, and pelagic marine ecosystems encompassing the NWHI.

**Coral Reefs**

The shallow water coral habitat, at depths less than 30 m, covers an area of 3,687 square km (Miller et al. 2003). A total of 57 stony coral species are known in the shallow waters of the NWHI, of which 17 endemic species account for 37 to 53 percent of the relative abundance of stony corals surveyed on each reef in the NWHI (Friedlander et al. 2005). Three genera, *Montipora*, *Porites*, and *Pocillopora*, account for 15 of the 17 endemic species and most of the endemic abundance. Seven species of *Acropora* have been documented in the central NWHI despite their near absence from the main Hawaiian Islands. Coral cover varies significantly across the NWHI. Most regions have low coral cover with the exception of Maro Reef and Lisianski Island having comparatively high coral cover (Figure 1.8). Despite their high latitudes, more species of coral have been reported for the NWHI (52) than the main Hawaiian Islands (MHI) (48) (Friedlander et al. 2005).

Shallow water coral reef habitat harbors a diversity of macro algae. Currently, a total of 355 algal species have been recorded from coral reef habitats of the NWHI. The NWHI contain a large number of Indo-Pacific algal species not found in the main Hawaiian Islands, such as the green calcareous alga (*Halimeda velasquezii*). Unlike the MHI where alien species and invasive algae have overgrown many coral reefs, the reefs of the NWHI are largely free of alien algae and the high natural herbivory results in a natural algal assemblage.

Coral reefs in the NWHI are among the few remaining large-scale, intact, predator-dominated reef ecosystems left in the world (Friedlander et al. 2005). Areas with the highest apex predator biomass include Pearl and Hermes Atoll, followed by Lisianski and Laysan Islands (Figure 1.9). Apex predator biomass in the NWHI is about 55 percent of the total fish biomass, whereas this trophic level accounts for less than three percent of the fish biomass in the MHI (Friedlander et al. 2005). Apex predator biomass on fore-reef habitats in the NWHI is 1.3 metric tons per hectare compared to less than 0.05 metric tons per hectare in the main Hawaiian Islands (Figure 1.11). Overall, reef fish standing stock is more than 260 percent greater than the main Hawaiian Islands across similar habitats.

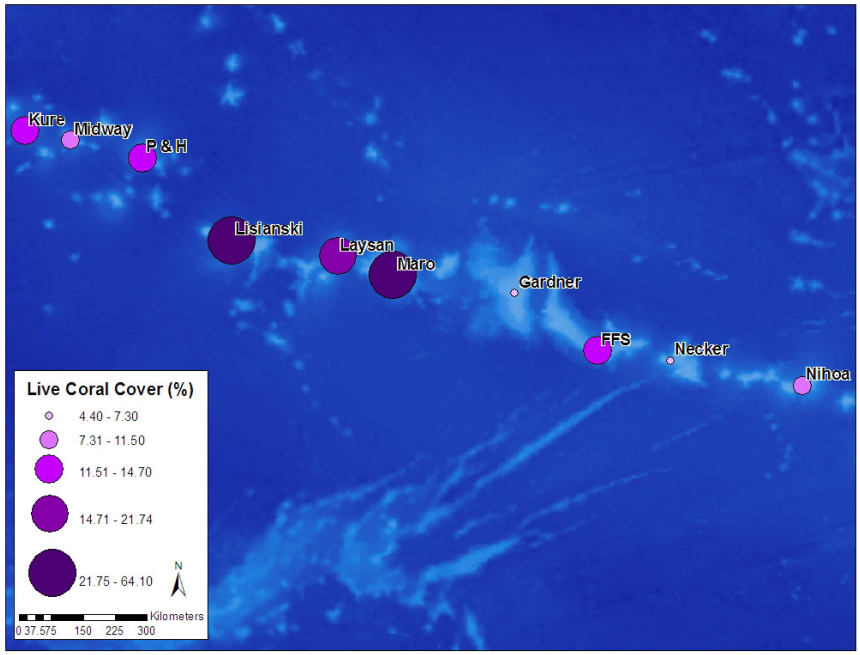



**Figure 1.8 Differences in coral cover among regions within the NWHI. REA surveys were conducted at 173 sites in 2002. Coral cover was calculated from size frequency data of colony counts within transects. Data are mean and standard error. Based on unpublished data from PIFSC-CRED. Map by Friedlander and Wedding of the NCCOS/CCMA/Biogeography Team.**

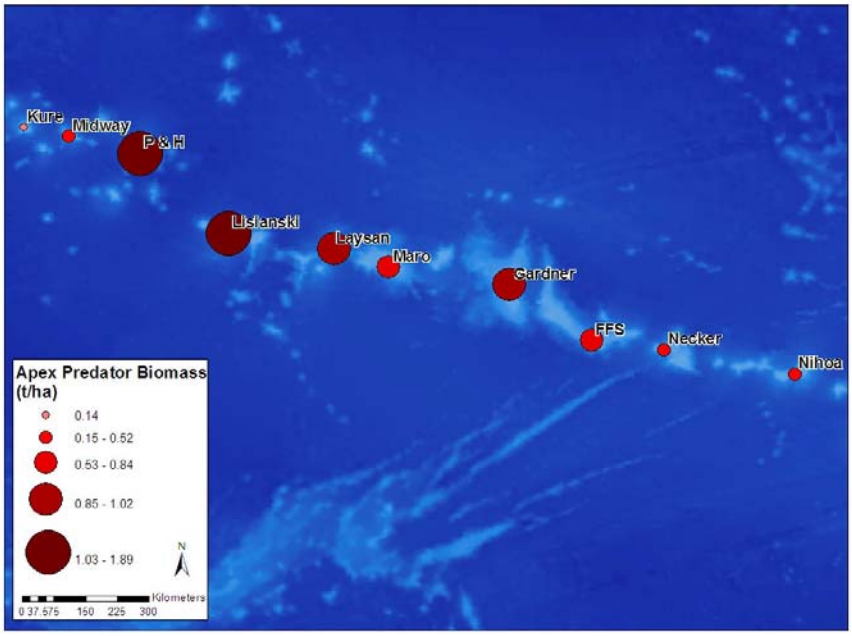



**Figure 1.9 Geographic pattern of apex predator biomass density (t/ha) at the 10 emergent Northwestern Hawaiian Islands (NWHI) reefs surveyed during September/October 2000, 2001 and 2002. Based on data from DeMartini and Friedlander 2004. Map by Friedlander and Wedding of the NCCOS/CCMA/Biogeography Team.**

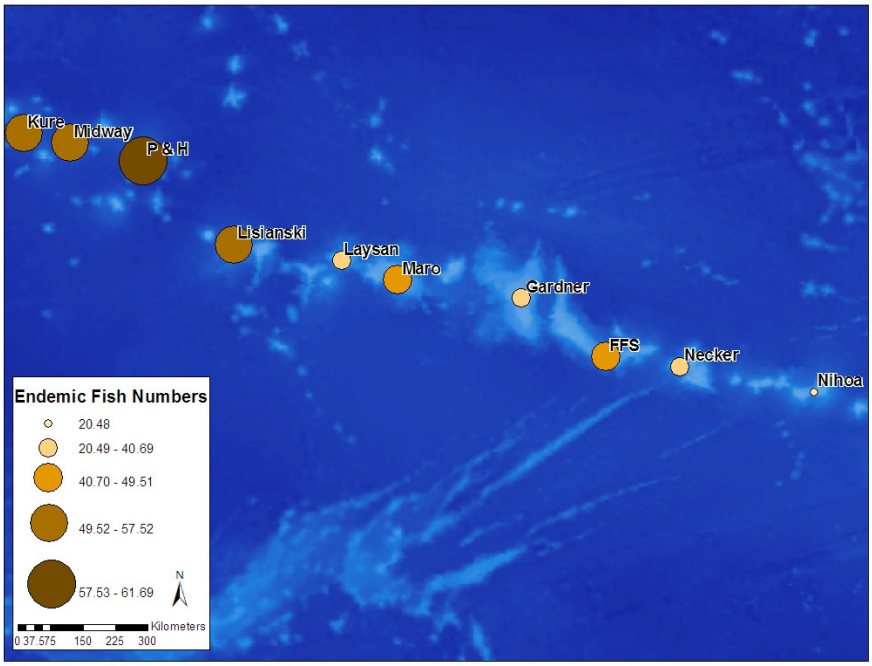



**Figure 1.10 Percent endemism (based on numerical densities) at each of 10 emergent Northwestern Hawaiian Islands (NWHI) reefs, surveyed during September/October 2000, 2001 and 2002. Note patterns of endemism with latitude. Based on data from DeMartini and Friedlander 2004. Map by Friedlander and Wedding of the NCCOS/CCMA/Biogeography Team.**

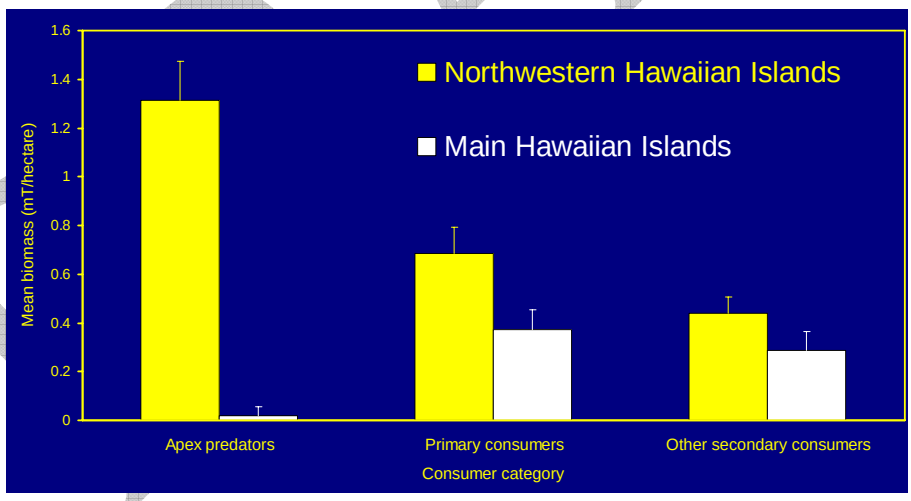



**Figure 1.11 Comparison of biomass in major trophic guilds between the Northwestern Hawaiian Islands and the main Hawaiian Islands. Source: Friedlander and DeMartini 2002.**

Hawai‘i has one of the most unique fish fauna on earth (DeMartini and Friedlander 2004). Because of the decline in global marine biodiversity, endemic “hot spots” like Hawai‘i are important areas for global biodiversity conservation. Overall fish endemism is higher in the NWHI compared to the MHI (Friedlander et al. 2003; DeMartini and Friedlander 2004). Within

the NWHI, endemism increases up the chain and is highest at the three most northern atolls and Lisianski (Figure 1.10).

**Deepwater Banks and Seamounts**

Deepwater banks and seamounts are the least studied environment of the NWHI. Recent use of shipboard mapping technologies, submersibles and remotely operated vehicles, however, are providing valuable information and data to characterize the physical and biological components of these ecosystems.

Deepwater marine plants have been characterized as a mixture of tropical species, species with cold-temperate 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 that the distribution and abundance of bottomfish are patchy and appear to be associated with high relief topographic features including crevices and caves (Kelly et al. 2004). Submersible surveys conducted at depths of 200 to 350 meters on Raita and West St. Rogatien, and Brooks Banks found little evidence of physical disturbances by bottomfishing from anchors and fishing gear (Kelly and Moffitt 2004).

Multi-beam mapping expeditions have revealed dramatic geologic features including knife-edge rift zones, seafloor calderas, sea level terraces, submarine canyons, underwater landslide scars and debris fields, and previously unmapped seamounts (Smith et al. 2004a). Submersible surveys on South Pioneer Ridge (Pioneer Bank) and two unnamed seamounts, one east of Laysan Island and the other east of Necker Island have been characterized by various substrate types, including volcanic rock (basalt lava), fossil reef, and layered lagoonal sediments that were deposited when these geologic features were at sea level (Smith et al. 2004b). In some areas, dense communities of corals (ahermatypic) and sponges at depths approaching 1,800 m obscured the underlying substratum.

**Endangered, Threatened, and Rare Species**

Twenty-three species of plants and animals known to occur in the NWHI are listed under the Endangered Species Act (Tables 1.3). Of those listed species that occur in the marine ecosystem, the Hawaiian monk seal, green sea turtle, and nesting seabirds are discussed further.

| **Table 1.3 Species observed in the NWHI listed as threatened or endangered under the Endangered Species Act**[4] | | |
|---|---|---|
| **Marine Mammals** | | |
| Hawaiian monk seal | *Monachus schauinslandi* | E |
| Humpback whale | *Megaptera novaeangliae* | E |
| Sperm whale | *Physeter macrocephalus* | E |
| Blue whale | *Balaenoptera musculus* | E |
| Fin whale | *B. physalus* | E |
| Sei whale | *B. borealis* | E |
| North Pacific right whale | *Eubalaena japonica* | E |
| **Marine Turtles** | | |
| Olive ridley turtle | *Lepidochelys olivacea* | E |
| Leatherback turtle | *Dermochelys coriacea* | E |
| Loggerhead turtle | *Caretta caretta* | E |
| Hawksbill turtle | *Eretmochelys imbricata* | E |
| Green turtle | *Chelonia mydas* | T |
| **Terrestrial Birds** | | |
| Laysan duck | *Anas platyrhynchos laysanensis* | E |
| Laysan finch | *Telespyza cantans* | E |
| Nihoa millerbird | *Acrocephalus familiarus* | E |
| Nihoa finch | *Telespyza ultima* | E |
| **Seabirds** | | |
| Short-tailed albatross | *Phoebastria* | E |
| **Plants** | | |
| No common name | *Amaranthus brownii* | E |
| Kamanmano | *Cenchrus agrimoniodes var laysanensis* | E |
| No common name | *Mariscus pennatiformis ssp bryanii* | E |
| Loulu | *Pritchardia remota* | E |
| No common name | *Schiedea verticillata* | E |
| ‘Ohai | *Sesbania tomentosa* | E |

[4] Under the Endangered Species Act of 1972, endangered species are those in danger of extinction. Threatened species are those likely to become an endangered species within the foreseeable future. E = endangered; T = threatened.

**Hawaiian Monk Seal (*Monachus schauinslandi*)**

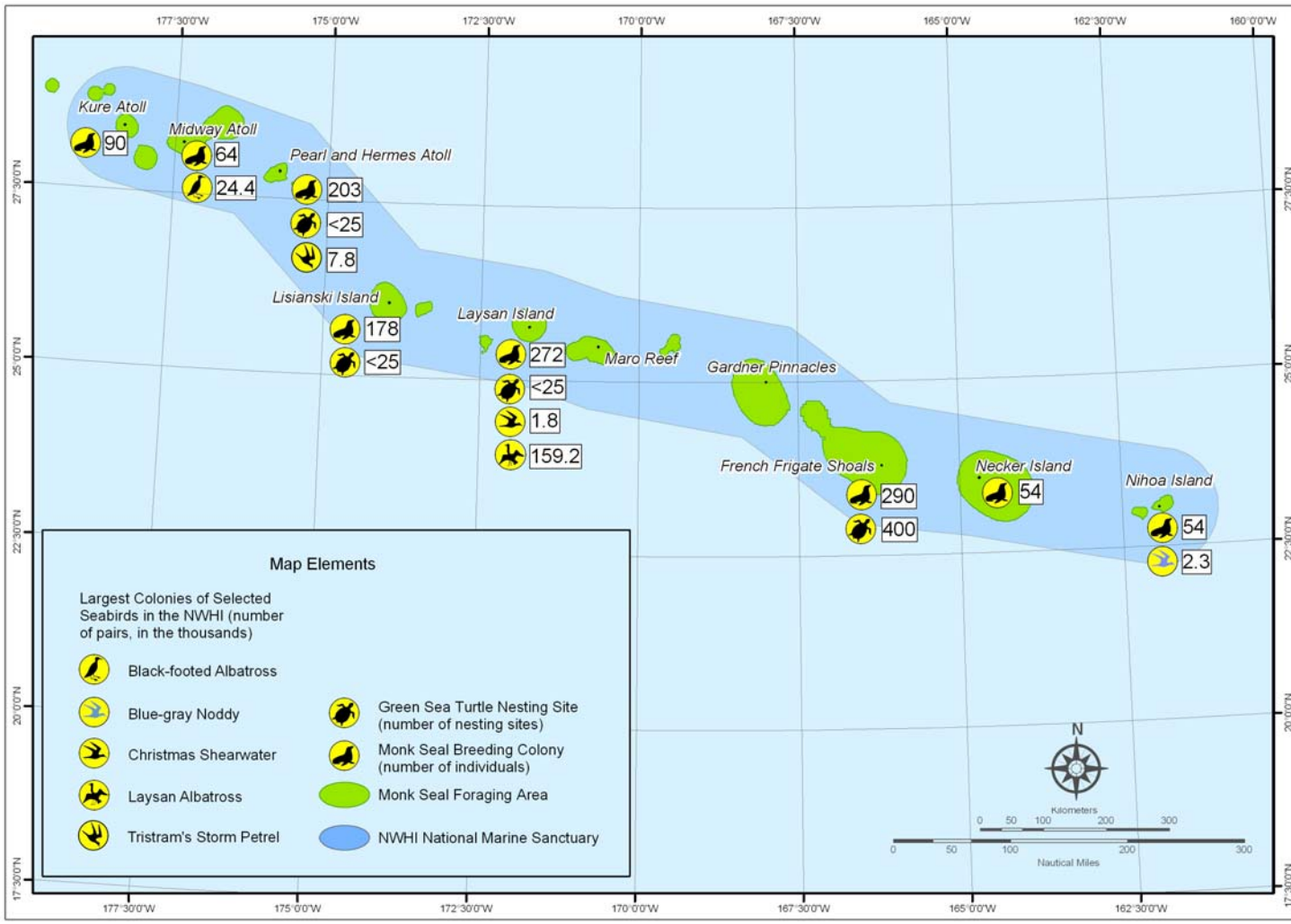
The Hawaiian monk seal was listed as an endangered species under the U.S. Endangered Species Act in 1976 (FR 51612) and remains listed as endangered. The current population size is estimated between 1,200 and 1,300 individuals (Antonelis et al., in press; NMFS 2003; NMFS 2004a). The Hawaiian monk seal depends almost entirely on the islands of the NWHI for breeding and the surrounding reefs for sustenance (Antonelis et al., in press). Reproductive success has declined, with a total of mean non-pup beach counts at the main reproductive NWHI subpopulations in 2001 approximately 60 percent lower than in 1958 (NMFS 2003). French Frigate Shoals has the largest monk seal breeding colony followed by Laysan Island, Pearl and Hermes Atoll, and Lisianski Island (Figure 1.12).

The foraging biogeography of the Hawaiian monk seal has been described in a number of recent reports (Stewart 2004a, b, and c; Stewart and Yochem 2004a, b, and c) and is illustrated in Figure 1.12. Between 1996 and 2002, the movements and diving patterns of 147 Hawaiian monk seals in the NWHI were monitored with satellite-linked depth recorders (41 adult males, 35 adult females, 29 juvenile males, 15 juvenile females, 12 weaned male pups, 15 weaned female pups). Overall findings of these studies include:

- Monk seal foraging range covers an area of approximately 18,593 square miles (48,156 square km), or almost 14 percent of the total area of the Sanctuary.
- Seals foraged extensively at or near their colony sites (95 percent within 20 miles of the colonies), except at French Frigate Shoals where foraging distances were demonstrated to be greater.
- The highest concentration of monk seal activity in the NWHI is focused on French Frigate Shoals and surrounding banks.
- Seals moved along specific corridors to transit between colonies and extra-colony sites. These corridors were closely associated with the NWHI submarine ridge. Seals likely forage along these corridors around subsurface features like reefs, banks, and seamounts.

Several banks located northwest of Kure Atoll represent the northern extent of the monk seal foraging range (Stewart 2004a). These areas have also been identified as important precious coral habitat as a result of recent submersible work conducted by NOAA's Office of Ocean Exploration (NOAA 2003c). Past and present impacts to the monk seal population in the NWHI include hunting in the 1880s, disturbance from military uses of the area, entanglement in marine debris (Hendersen 2001; 1990; 1984a; 1984b), direct fishery interaction including recreational fishing (Kure Atoll) and commercial fishing prior to the establishment of the 50 mile Protected Species Zone around the NWHI in 1991 (NMFS 2003), predation by sharks (Nolan 1981), aggression by adult male monk seals, and reduction of habitat and prey due to environmental change (Antonelis et al., in press).

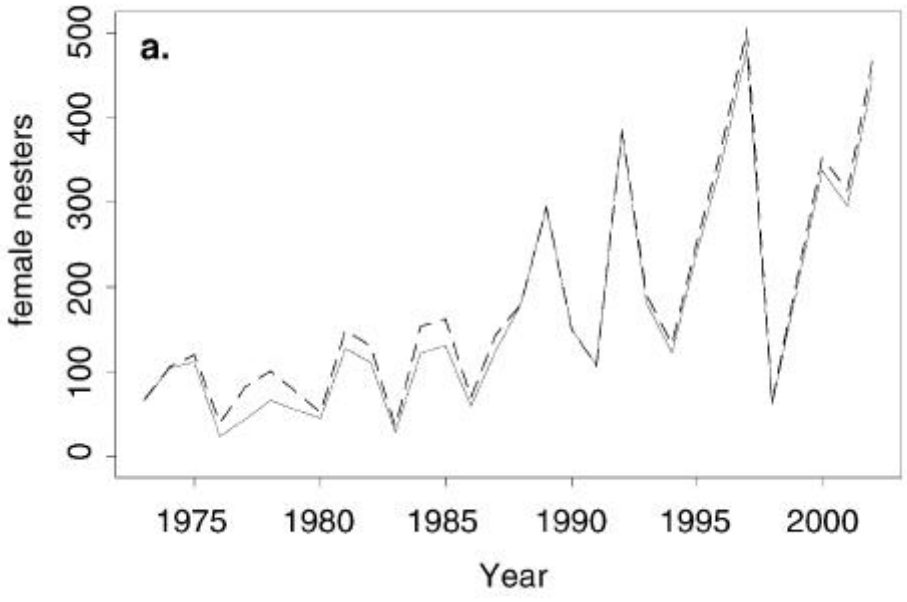
**Figure 1.12 Hawaiian monk seal breeding colony size and foraging area (Stewart 2004a); green turtle nesting sites (Balazs and Ellis 2000); and largest nesting sites for seabird species of highest concern for the Pacific Island Region (Kushlan et al. 2002) in the Northwestern Hawaiian Islands (NOAA 2001 for seabird colony size).**



**Hawaiian Green Turtle *(Chelonia mydas)***

Green sea turtles have been protected under the Endangered Species Act since 1978. Over 90 percent of all sub-adult and adult green turtles found throughout Hawai'i come from the NWHI. The Hawaiian green sea turtle stock is clearly recovering after more than 25 years of protecting their nesting and foraging habitats in the Hawaiian Archipelago (Figure 1.13) (Balazs and Chaloupka 2003). Green turtle nesting sites occur at Pearl and Hermes Atoll, Lisianski Island, Maro Reef, and French Frigate Shoals (Figure 1.12). French Frigate Shoals is the primary nesting site for green turtles throughout the Hawaiian Archipelago, accounting for 400 nesting sites or 90 percent of all nesting within the Hawaiian Archipelago.

**Figure 1.13 Long-term trend in the abundance of nesting Hawaiian green sea turtles (dash lines represent Bayesian 95 percent credible region. Source: Balazs and Chaloupka 2003.**




**Seabirds**

The importance of seabirds in the NWHI was recognized in 1909 with the establishment of the Hawaiian Islands National Wildlife Refuge. Early protection and active management have resulted in large, diverse, and relatively intact seabird populations. Seabird colonies in the NWHI constitute one of the largest and most important assemblages of seabirds in the world, with approximately 14 million birds representing 20 breeding species (Naughton and Flint 2004). Birds that live at sea and migratory birds are also part of the ecosystem. The NWHI contain over 95 percent of the world's black-footed and Laysan albatrosses.

The conservation status of Hawaiian seabirds was assessed as part of the North American Waterbird Conservation Plan (Kushlan et al. 2002). Eight of the 20 species that breed in the Northwestern Hawaiian Islands were classified as highly imperiled or of high conservation concern at the broad scale of the plan (eastern North Pacific, western North Atlantic and Caribbean). At the regional scale (Pacific Islands) five of the breeding species were included in these highest concern categories: Laysan and Black-footed albatrosses, Christmas shearwater, Tristram's storm-petrel, and Blue noddy (Table 1.4).

**Table 1.4 Breeding seabirds in the Northwestern Hawaiian Islands. Source: NOAA 2001; Kushlan et al. 2002; Flint 2006 pers. com.**

| Common Name | Taxonomic Name |
|---|---|
| Black noddy | *Anous minutus* |
| Black-footed albatross | *Phoebastria nigripes* |
| Blue noddy | *Procelsterna cerulea* |
| Bonin petrel | *Pterodroma hypoleuca* |
| Brown booby | *Sula leucogaster* |
| Brown Noddy | *Anous stolidus* |
| Bulwer's petrel | *Bulweria bulwerii* |
| Christmas shearwater | *Puffinus nativitatis* |
| Gray-backed tern | *Sterna lunata* |
| Great frigatebird | *Fregata minor* |
| Laysan albatross | *Phoebastria immutabilis* |
| Little tern | *Sterna albifrons* |
| Masked booby | *Sula dactylatra* |
| Red-footed booby | *Sula sula* |
| Red-tailed tropicbird | *Phaethon rubricauda* |
| Sooty tern | *Sterna fuscata* |
| Tristram's storm-petrel | *Oceanodroma tristrami* |
| Wedge-tailed shearwater | *Puffinus pacificus* |
| White tern | *Gygis alba* |
| White-tailed tropicbird | *Phaethon lepturus* |

The greatest threats to seabirds in the NWHI are introduced mammals and other invasive species, fishery interactions, contaminants, oil pollution, and climate change. Over the past 20 years, active management in the National Wildlife Refuges and State Seabird Sanctuary has included eradication of black rats (*Rattus rattus)* at Midway Atoll and Polynesian rats (*R. exulans)* at Kure Atoll; eradication or control of invasive plants; cleanup of contaminants and hazards at former military sites; and coordination with NMFS, and the Regional Fishery Management Councils, as well as industry, and conservation organizations to reduce fishing impacts.

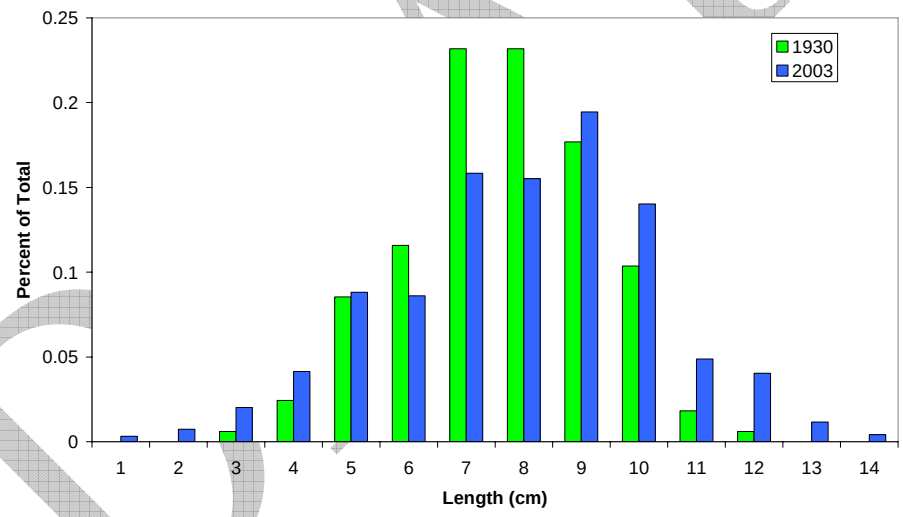
**Spinner Dolphin (*Stenella longirostris)***

Hawaiian spinner dolphins are distributed through most of the Hawaiian Archipelago. Populations of spinner dolphins in the NWHI have been observed at Kure Atoll and French Frigate Shoals. The NWHI spinner dolphins are considered genetically distinct from populations from the main Hawaiian Islands. Genetic isolation, together with an apparent low genetic diversity, suggests that spinner dolphins could be highly vulnerable to anthropogenic and environmental stressors (Andrews et al. 2004).

**Pearl Oysters *(Pinctada margaritifera)***

The black-lipped pearl oyster was discovered in 1927 and heavily harvested at Pearl and Hermes Atoll until prohibited by law in 1929. An estimated 150,000 oysters were harvested before a 1930 expedition estimated the remaining population at 100,000 oysters. More recent surveys in 1969, 1996, and 2000 found only a few oysters indicating that the population had not recovered since the last harvest. Recent surveys conducted in 2003 at Pearl and Hermes Atoll mapped and measured over 1,000 individuals (Keenan et al. 2004). The average size of pearl oysters in the 2003 surveys was larger than the 1930 surveys (Figure 1.14). It is unclear whether the number and size structure reflect a potential recovery of the species 70 years later or a more thorough sampling effort relative to previous survey.

**Figure 1.14 Size frequency distribution of pearl oyster population at Pearl and Hermes Atoll in 1930 and 2003. Source: Keenan et al. 2004.**




**Information Needs for Ecosystem Science and Management**

A wealth of information and data on the geological, biological, and oceanographic processes in the NWHI has been gathered, beginning with the earliest Polynesian explorers and Native Hawaiians and continuing today by scientists and resource managers using a wide array of advanced technologies both above and below the sea. In order to understand past, present, and future environmental and anthropogenic stressors and their impacts on the condition of the NWHI, research and monitoring must continue to provide insights on how to achieve lasting protection of this large, significant marine ecosystem. Information needed to advance ecosystem science and management in the NWHI was identified during a workshop convened by the NMSP and the NWHICRER (Gittings et al. 2004). Workshop groups addressed information and data needs for the following topics:

- **Oceanographic Regime:** Understanding the characteristics and qualities of the ocean and atmosphere that influence the region's resources
- **Habitat Delineation:** Determining the location and extent of biotic and abiotic components of the region's habitats and relationships between habitat and living resources
- **Living Marine Resources:** Determining the dynamics of structure and function through assessments of status and trends in distribution, abundance, community composition, and relationships among living resources and their environment
- **Threatened, Endangered, and Terrestrial Resources:** Determining distribution, abundance, community composition, and fitness of individuals and populations, and understanding the environmental influences on these parameters
- **Cultural Heritage:** Preserve and perpetuate Native Hawaiian ancestral relationships and associated practices
- **Stresses on Living Resources:** Understanding and tracking fitness and factors affecting the fitness of individuals, populations, and communities
- **Commercial and Recreational Uses:** Determining impacts, intended and unintended, of natural resource extraction and use; identifying the effects of limiting or eliminating extraction, and the information necessary to select appropriate locations and sizes of areas established for such purposes; and characterizing and quantifying the economic contributions of commercial and recreational activities in the region
- **Resource Injury Assessment, Response and Restoration:** Understanding and responding to the physical, chemical, and biological impacts of human activities, such as vessel groundings, shipwrecks, spills, military activities, marine debris, entanglement and stranding, and using the most appropriate means to minimize damage, clean, restore, or enhance recovery in degraded environments
- **History and Archaeology:** Understanding the history and material culture of human populations and activities, including economies, trade, and living conditions

The Sanctuary provides an important opportunity to develop a strategic research agenda, to further collaborative research and monitoring programs, and to build on the growing information and database that will be needed to manage this unique region for future generations.

## 1.3 Sanctuary Designation Standards

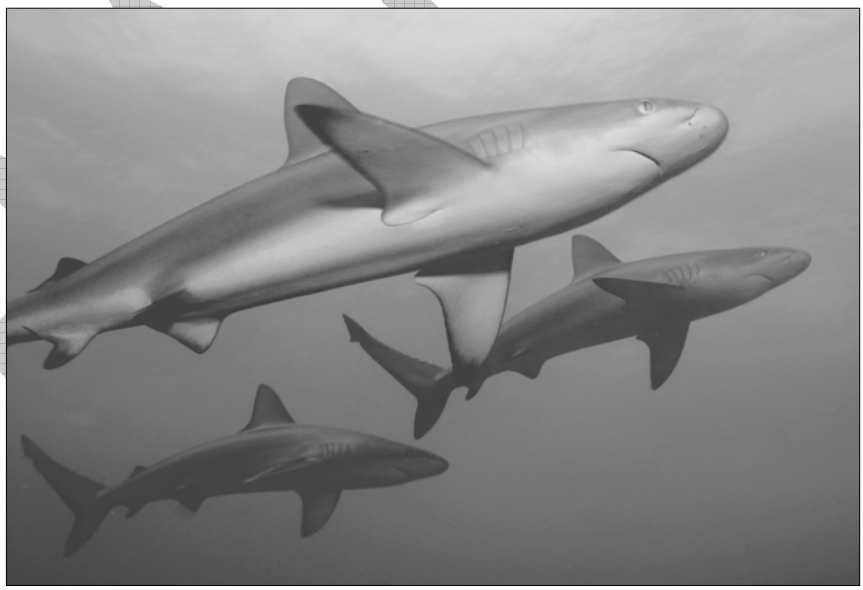
Under the NMSA, the Secretary of Commerce may designate any discrete areas of the marine environment as a national marine sanctuary meeting specific standards and considering other factors described in Section 303 of the NMSA. The sanctuary designation process is described in Section 304 of the NMSA and includes the preparation of an environmental impact statement (EIS) that meets the requirements of the National Environmental Policy Act (NEPA). This section describes the standards used to designate a National Marine Sanctuary in the Northwestern Hawaiian Islands.

**Designation Standards**

The national marine sanctuary system is composed of discrete areas of the marine environment that possess conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological, or esthetic qualities which give them special national and, in some instances, international significance. The size and nature of these areas must permit comprehensive and coordinated conservation and management. The designation of such an area must also improve or supplement coordinated and comprehensive conservation and management of the area. The Sanctuary was proposed for its unique combination of natural environmental, and Native Hawaiian cultural and maritime heritage resources. A complete analysis of designation standards under the NMSA can be found in Appendix 6.

**Natural Environmental Significance**

*The NWHI represent one of the few remaining, intact, large-scale, apex predator-dominated marine ecosystems in the world.*



Galapagos sharks are common on most reefs throughout the NWHI, one of the few coral reef ecosystems remaining on the planet still dominated by apex predators. Photo: James Watt

Shallow water coral reefs are the foundation of an ecosystem that hosts more than 7,000 species, including marine mammals, fishes, sea turtles, birds, invertebrates, and marine algae. Many are rare, threatened, or endangered. At least one quarter are found nowhere else on Earth. Many more remain unidentified. Largely unexplored, deepwater banks and seamounts harbor a diversity of fish, corals, and other invertebrates, providing opportunities for new scientific discoveries for decades. Even the shallow coral reef habitats hold species new to science. This is especially true for invertebrates and algae (Friedlander et al. 2005).

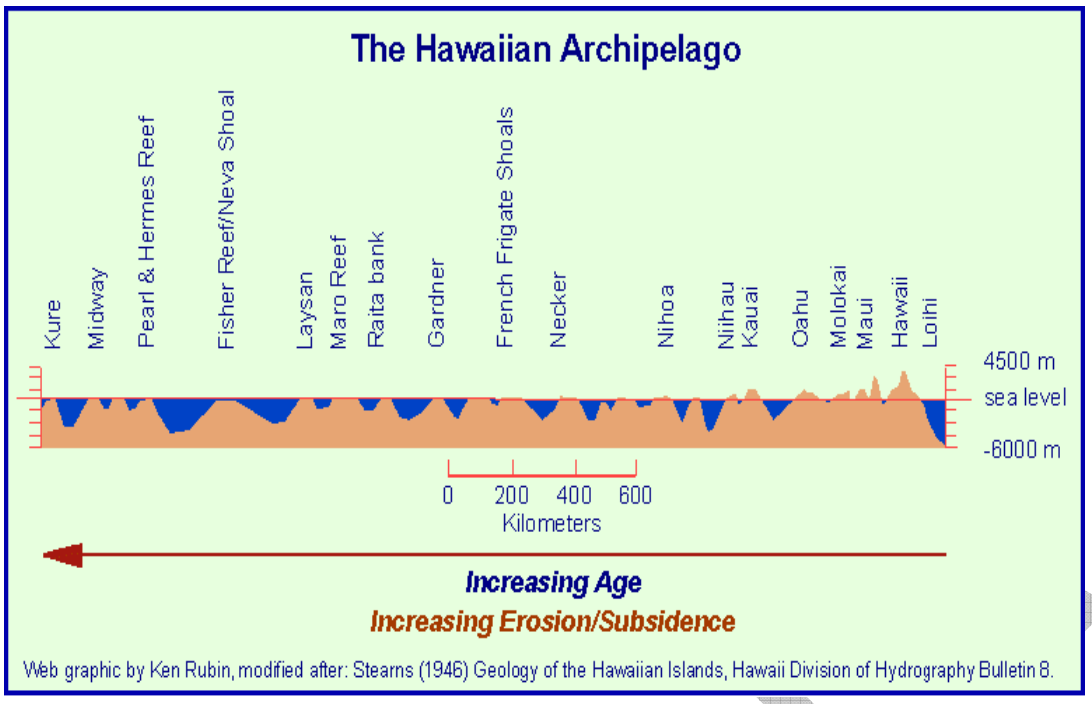



**Figure 1.15 Geologic progression of the Hawaiian Islands as they erode and subside into the sea over millions of years**

Stretching for more than 1,200 miles, the NWHI provide a vast geologic record of the physical, chemical, and biological forces that shaped their geomorphologic sequence from volcanic islands to sandy islands and islets, coral atolls, submerged banks, and seamounts. Due to their active volcanism, isolation, and linear progression, the NWHI, together with the main Hawaiian Islands, represent a nearly perfect "textbook" example of the evolution of islands and reefs (Figure 1.15).

Remote, uninhabited, and relatively pristine in comparison to the main Hawaiian Islands and other marine ecosystems in the world, the NWHI serve as one of the few modern sentinels for monitoring and deciphering short-term and long-term responses to local, regional, and global environmental and anthropogenic stressors.

## Native Hawaiian Significance

Cultural site on Nihoa Island. Photo: David Boynton

*Kū pākū ka pali o Nihoa i ka makani*
*The cliff of Nihoa stands as resistance against the wind*

*~ Said of one who bravely stands in the face of misfortune* (Pukui 1983: 206)

The first discoverers of the Hawaiian Archipelago, Native Hawaiians have continued to inhabit these islands for thousands of years prior to Western contact. During this time, Native Hawaiians developed complex resource management systems and a specialized set of skills to survive on these remote islands with limited resources. Native Hawaiians continue to maintain their strong cultural ties to the land and sea and continue to understand the importance of managing the islands and waters as inextricably connected to one another (Beckwith 1951; Lili‘uokalani 1978). More specifically the ocean played an important role to Native Hawaiians as it was used for resources and physical and spiritual sustenance in their everyday lives. Poetically referred to as *ke kai pōpolohua mea a* Kāne (the deep dark ocean of Kāne), the ocean was divided into numerous smaller divisions and categories beginning from the nearshore to the deeper pelagic waters (Malo 1951). Likewise, channels between islands were also given names and served as connections between islands, as well as a reminder to their larger oceanic history and identity.

In Hawaiian traditions, the Northwestern Hawaiian Islands are considered a sacred place, a region of primordial darkness from which life springs and spirits return after death (Kikiloi In prep). Much of the information about the NWHI has been passed down in oral and written histories, genealogies, songs, dance, and archaeological resources. Through these sources, Native Hawaiians are able to recount the travels of seafaring ancestors between the Northwestern Hawaiian Islands and the main Hawaiian Islands. Hawaiian language archival resources have played an important role in providing this documentation, through a large body of information published over a hundred years ago in local newspapers (e.g., Kaunamano 1862 in *Hōkū o ka Pakipika*; Manu 1899 in *Ka Loea Kālai‘āina*; Wise 1924 in *Nūpepa Kūoko‘a*). More recent ethnological studies (Maly 2003) highlight the continuity of Native Hawaiian traditional practices and histories in the Northwestern Hawaiian Islands. Only a fraction of these have been recorded, and many more exist in the memories and life histories of *kūpuna*.

Nihoa and Mokumanamana Islands are recognized as culturally and historically significant and are listed on the National and State Register of Historic Places and protected by the U.S. Fish and Wildlife Service in accordance with the National Wildlife Refuge System Administration Act 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 Island, where there is significant soil development, hosts no less than 88 cultural sites, including ceremonial, residential, and agricultural features. On Mokumanamana, there are 52 recorded cultural sites, including ceremonial and temporary habitation features. Several archaeological surveys have collected cultural artifacts from both of these islands and are now stored in the Bernice Pauahi Bishop Museum and the University of Hawai‘i Archaeological Laboratory. The range in types of cultural artifacts stored in these collections is testimony to the various uses these islands and the surrounding oceans served for Native Hawaiians.

The Kingdom of Hawai‘i exhibited strong interest in the Northwestern Hawaiian Islands. Title to the islands and waters of the Northwestern Hawaiian Islands was vested in the Kingdom of Hawai‘i throughout the 1800s (Mackenzie and Kaiama 2003). In 1822 Queen Ka‘ahumanu organized and participated in an expedition to locate and claim Nihoa Island under the Kamehameha Monarchy. In 1856, Nihoa was reaffirmed as part of the existing territory of Hawai‘i by authority of Alexander Liholiho, Kamehameha IV (March 16, 1856 Circular of the Kingdom of Hawai‘i). The following year, King Kamehameha IV voyaged to Nihoa and then returned to Honolulu. He instructed Captain John Paty on the *Manuokawai* to explore the rest of the northwestern region to annex any lands discovered during the expedition. Paty traveled to Nihoa, Necker, Gardner, Laysan, Lisianski, and Pearl and Hermes. Later in 1857, the islands of Laysan and Lisianski were declared new lands to be included into the domain of the Kingdom (Kingdom of Hawai‘i 1857).

In 1885, the most famous visit by Hawaiian royalty was made by then princess Lydia Lili‘uokalani and her two-hundred person party who 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 (Harbottel-Boyd 1886). In 1893, Queen Lydia Lili‘uokalani was illegally overthrown by the self-proclaimed provisional government, with the assistance of U.S. Minister John L. Stevens. In 1898, the archipelago, inclusive of the Northwestern Hawaiian Islands, was collectively ceded to the United States through a domestic resolution, called the “New Lands Resolution”.

The sovereignty, life (*ea*), and responsibility (*kuleana*) for the entire Hawaiian Archipelago continues to exist in the hearts and minds of many Native Hawaiians. This position was recognized by the “Apology Bill” (U.S. Public Law 103-150), a joint resolution of Congress signed by the President in 1993. The Apology Bill acknowledges the wrongful role of United States’ officers in the overthrow of the Kingdom of Hawai‘i and “apologizes to Native Hawaiians on behalf of the people of the United States” for the unlawful overthrow and the “deprivation of the rights of Native Hawaiians to self-determination.” It also recognizes that “the health and well-being of the Native Hawaiian people is intrinsically tied to their deep feelings and attachment to the land.”

Today, Native Hawaiians remain deeply connected to the Northwestern Hawaiian Islands on genealogical, cultural, and spiritual levels. Kaua‘i and Ni‘ihau families voyaged to these islands indicating that they played a role in a larger network for subsistence practices into the 20th century (Tava and Keale 1989; Maly 2003). In recent years, Native Hawaiian cultural practitioners voyaged to the Northwestern Hawaiian Islands to honor their ancestors and

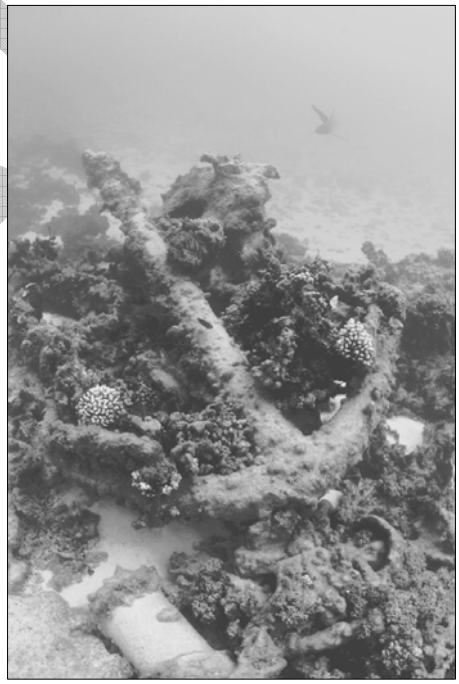
perpetuate traditional practices. In 1997, Hui Mālama i Nā Kūpuna o Hawai'i Nei repatriated sets of human remains to Nihoa and Mokumanana that were collected by archaeologists in the 1924-25 Bishop Museum Tanager Expeditions (Ayau and Tengan 2002). In 2003, a cultural protocol group, Nā Kup'eu Paemoku, traveled to Nihoa on the voyaging canoe *Hōkūle'a* to conduct traditional ceremonies. In 2004, *Hōkūle'a* sailed over 1,200 miles 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.

## Maritime Heritage Significance

*"I had just put my hand upon my coat when the ship struck with a fearful crash...I sprang upon deck… to find ourselves surrounded with breakers apparently mountain high, and our ship careening over upon her broadside..."*

*Thomas Nickerson, Loss of the ship* Two Brothers *at French Frigates Shoals, 1823 (Nantucket Historical Association MS 106 folder 3.5)*

In addition to the rich Native Hawaiian cultural setting, maritime activities following Western contact with the Hawaiian Islands have left behind the historical and archaeological traces of a unique past. Currently, there are over 60 known ship losses and/or confirmed sites among the NWHI, the earliest loss dating back to 1818. This, combined with 67 known aircraft crashes, gives a total of over 120 potential maritime heritage resource sites. Many of these resources reflect the distinct phases of historical activities in the remote atolls (Van Tilberg 2002).



Anchor from unidentified 19th century whaling ship at Kure Atoll. Photo James Watt

As American and British whalers first made passage from Hawai'i to the seas near Japan in 1820, they encountered the low and uncharted atolls of the NWHI. At times the treacherous nature of navigation in the region gave rise to the Western names of the islands and atolls as we know them today. Pearl and Hermes Atoll is named for the twin wrecks of the British whalers *Pearl* and *Hermes* lost in 1822. Midway was originally sighted by Captain Daggett of the New Bedford whaler *Oscar* in 1839. Laysan was reportedly discovered by the American whaleship *Lyra* prior to 1828. Gardner Pinnacles was named by Captain Allen on the Nantucket whaler *Maro* in 1820, the same year the ship came across Maro Reef. The history of American whaling is a significant part of our national maritime heritage and is a topic that encompasses historic voyages and seafaring traditions set on a global stage as these voyages had political, economic, and cultural impacts. As a nation we were intimately involved in the whaling industry in important and complex ways. There are 10 known whaling shipwrecks in the NWHI. Three of these have been located (American whaler *Parker* and British whalers *Pearl* and *Hermes*) and

their archaeological assessment is underway (Van Tilberg and Gleason, in prep). Whaling vessel wreck sites from the early 19th century are quite rare, and the study and preservation of heritage resources is an important concern. The NWHI provide a unique glimpse into our maritime past.

Despite being slowly integrated into navigational charts, the NWHI remained an area of low and inconspicuous reefs and atolls for many years, frequented by shipwrecks and castaways. Crews were often stranded for many months while they constructed smaller vessels from salvaged timbers and set out for rescue. Some vessels were lost with all hands. Russian and French ships of discovery transited the NWHI, and sometimes found themselves upon the sharp coral reefs. Nineteenth century Japanese junks of the Tokugawa Shogunate period, drifting away from their home islands and into the Pacific, were reportedly washed onto the sands of the atolls. Hawaiian schooners and local fishing sampans voyaged into the archipelago, many not to return. Marine salvage expeditions based out of the main Hawaiian Islands profited from the area, although existing records of their cruising activities are scarce. These types of sites have the potential to tell us about early historic period voyages in the Pacific and about the seafaring traditions of many cultures.

The strategic geographical location of the NWHI proved early on to be a valuable "commodity." The opening of China and Japan to commerce in the mid-19$^{th}$ century and the transition to steam propulsion brought with it the need for Pacific coaling stations. In August 1867 Captain William Reynolds of the USS *Lackawanna* took formal possession of Midway Atoll for the United States. Soon after, the USS *Saginaw,* a Civil War-era side wheel gunboat, was assigned to support improvement efforts at Midway. However, work to open a channel into the lagoon remained incomplete and the *Saginaw,* on a return voyage from Midway with the contracting party, wrecked on the reef at nearby Kure Atoll on October 29, 1870. The wreck site was discovered in 2003, allowing research into the early technology of the "Old Steam Navy" (Van Tilberg 2003a).

From this inauspicious beginning the strategic location of Midway and the NWHI continued to grow in importance for commercial and military planners. The Spanish-American War in 1898 led to the American colonization of Guam and the Philippines, as well as annexation of the Hawaiian Islands. This greatly expanded American colonial presence made transpacific communication a priority. By 1903, the first transpacific cable and station were in operation and employees of the Commercial Pacific Cable Company settled at Midway. Tons of imported soil and numerous introduced plants significantly altered the landscape. In the 1930s, Pan American Airways' flying "clippers" (seaplanes) were crossing the ocean, arriving at Midway from Honolulu on their five-day transpacific passage (Cohen 1985). In 1939 the U.S. Navy expanded its interest in Midway and millions of dollars were awarded to the Pacific Naval Air Base Consortium. Construction of the naval air facility at Midway was begun the following year.

Naval activities increased during World War II. French Frigate Shoals was the temporary staging site for Japanese seaplanes, as well as a U.S. naval air facility at a later time. The Navy built an important submarine advance base at Midway Atoll, dredging the reef to form a channel and harbor for submarine refit and repair. The wreck of the USS *Macaw*, a navy submarine salvage vessel lost in 1944 during the rescue of the submarine *Flier,* testifies to the dangerous nature of Pacific operations at Midway (Van Tilberg 2003a; Van Tilberg 2003b). Eastern Island possessed the main airfield in the early days of the war, while submarine and seaplane support operations were concentrated on Sand Island. Together, these areas constituted a vital center for undersea, surface fleet, and naval aviation operations. In fact, the Hawaiian Sea Frontier forces

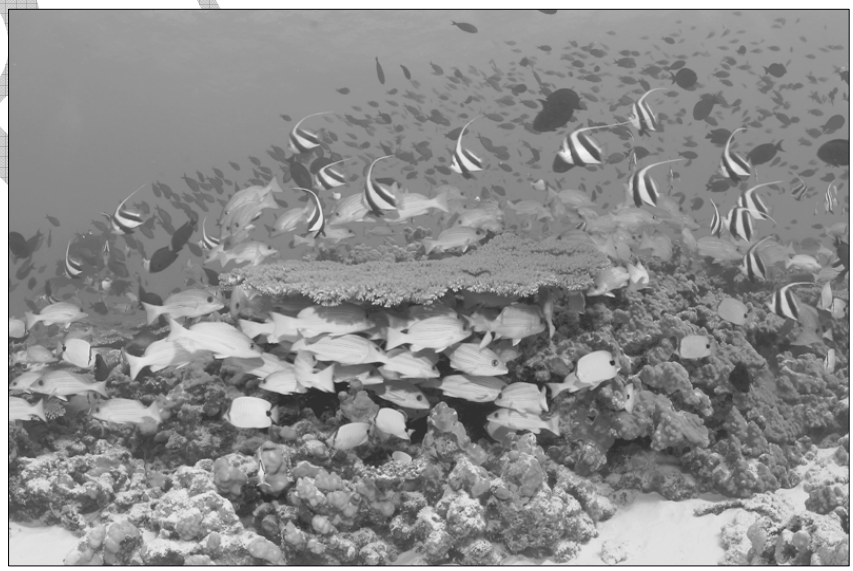
stationed patrol vessels at most of the islands and atolls. Tern Island, in French Frigate Shoals, was initially developed as a naval air facility for staging aircraft from the main Hawaiian Islands.

In June 1942, the Battle of Midway took place in seas north of Midway Atoll. Four Japanese aircraft carriers and one American carrier were sunk, and the Japanese military was forced to withdraw from a planned invasion. Although most of the battle took place 100 to 200 miles to the north, an intense air fight was waged directly over and around the atoll. Training exercises before and after the battle also took their toll. At least 30 naval aircraft, both American and Japanese, crashed or were ditched into the nearshore waters of Midway and Kure Atolls, many of them combat losses for both American and Japanese navies. Many of these crash sites are war graves. This battle proved to be the most decisive U.S. victory and was the turning point of World War II in the Pacific (Prange 1982). Today Midway Atoll is designated as a National Memorial to the Battle of Midway, ensuring that those who fought and died in this battle will always be remembered and appreciated for their sacrifices. Nine defensive structures related to the Battle of Midway were designated a National Historic Landmark in 1986. Many others are eligible for placement on the National Register of Historic Places (Speulda et al. 1999).

All of these maritime activities have left a scattered material legacy around and on the islands: whaling ships, Japanese junks, navy steamers, Hawaiian fishing sampans, Pacific colliers, salvage vessels, and navy aircraft (Rauzon 2001). Many of these sites, as defined by state and federal preservation laws (National Historic Preservation Act NHPA; Archaeological Resources Protection Act ARPA; Abandoned Shipwreck Act ASA), are of historical and national significance. Programmatic mandates have been established to ensure their preservation and protection. NOAA's Maritime Heritage Program focuses on the discovery and investigation of these heritage resources for the benefit of present and future generations. These sites are the physical record of past activities in the NWHI, and embody unique aspects of island and Pacific maritime history.

**International Significance**

The NWHI region is also important globally, as it is one of the world's most significant coral reef and marine ecosystems and the world's largest protected marine conservation area. The NWHI region serves as an example of ongoing geological processes, biological evolution, and the effects humans have had on the natural environment. Habitat for species of marine animals and plants with outstanding scientific, conservation, and aesthetic universal value, the relatively pristine NWHI contrast sharply with most marine ecosystems that are more heavily impacted by human activities and populations around the world. At the same time, the millions of pounds of marine debris that have accumulated in the NWHI illustrate the impact people have



*Acropora* spp. Table corals are rare in the main Hawaiian Islands, but abundant in the NWHI. Photo: James Watt

on far-away uninhabited ecosystems at an international scale. This recognition has led the State of Hawai'i to work with the National Park Service to nominate the NWHI as a UNESCO World Heritage Site for their natural and cultural values and as part of the world heritage of mankind. The NWHI share values with the World Heritage Site criteria (UNESCO 2005), stated here:

- Is an outstanding example representing a major stage of the earth's evolutionary history
- Is an outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment
- Contains unique rare and superlative natural formations and features and areas of exceptional natural beauty
- Provides habitats where populations of rare and endangered species of plants and animals still survive

Protecting the Northwestern Hawaiian Islands contributes to international community efforts to protecting biodiversity and ecosystem integrity around the world. These organizations include the World Conservation Union (IUCN) the world's largest environmental knowledge network; the Convention on Biological Diversity (CBD); the South Pacific Regional Environment Program (SPREP); and the United Nations Educational, Scientific, and Cultural Organization (UNESCO). Conservation and management of NWHI ecosystem contributes to the reduction in the current rate of loss of biological diversity at the global, national, and regional level to the benefit of all life on earth.

Remote, uninhabited, and relatively pristine in comparison to other marine ecosystems in the world, the NWHI serve as one of the few modern sentinels for monitoring and deciphering short-term and long-term responses to local, regional, and global environmental and anthropogenic stressors. The NWHI are one of the few marine regions on earth where monitoring and research activities can be conducted in virtual absence of local human habitation. In comparison, most reef systems in the coastal regions of the world are adjacent to human population centers, where vessel traffic, over harvesting, sedimentation, habitat destruction, and other human actions have altered the marine environment. Ongoing research and monitoring marine ecosystems in the NWHI will continue to provide significant insights that will benefit management interventions not only for the NWHI but for marine ecosystems around the world.

Manu-o-Kū, white tern (*Gygis alba rothschildi*) at Midway Atoll.
Photo: James Watt

*In double-hulled canoes, Hawai‘i’s first settlers used celestial bodies, winds, wave currents, and other natural elements to navigate their way across the ocean. Today, the practice of traditional non-instrument navigation has been revived in Hawai‘i and throughout the Pacific. With an estimated range of about 120 miles, diurnal seabirds like the manu-o-Kū confirm to a navigator that he is approaching land.*

*Today, manu-o-Kū are found in the Northwestern Hawaiian Islands and on only one of the main Hawaiian Islands – O‘ahu.*

# Management Framework

# 2.0 MANAGEMENT FRAMEWORK

The Sanctuary provides an opportunity to move toward an ecosystem-based approach, one that emphasizes interconnectivity and protection of ecosystem structure, function, and key processes. Consistent with NOAA's mission goal to protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management, the Sanctuary seeks to maintain ecosystem integrity and incorporate and integrate best practices, available science, traditional knowledge, and innovative management techniques in order to address both the ecological and social environment.

Key elements of the ecosystem-based management framework for the proposed Sanctuary include: (1) statutory authority of the National Marine Sanctuaries Act, (2) a statement of overall policy direction expressed as a Goals and Objectives Statement, (3) mechanisms to promote and enhance collaboration with jurisdictional partner agencies and other stakeholders, (4) regulations and zoning, (5) action plans with strategies designed to address management needs, (6) integration of ecosystem science and traditional knowledge, and (7) an adaptive management process. Together these elements provide a comprehensive approach to management with an application unique to the needs of the Northwestern Hawaiian Islands marine ecosystems.

## 2.1 Designation Process

**Building a legal and policy basis for Sanctuary designation**

The legal and policy basis for designation of the NWHI as a National Marine Sanctuary builds on a number of directives beginning in 1995 with the establishment of the Interagency Ecosystem Management Task Force (Table 2.1). This momentum for cooperative ecosystem-based management was furthered with the establishment of the U.S. Coral Reef Task Force and programs to preserve and protect coral reef ecosystems, including the NWHI.

The National Marine Sanctuaries Amendments Act of 2000 (NMSAA) and Executive Order 13178 provide specific directives for the designation of the Reserve and initiation of the Sanctuary designation process in consultation with federal agencies, the Governor of the State of Hawai'i, and with the advice of the NWHI Coral Reef Ecosystem Reserve Advisory Council.

The NMSA and Executive Orders 13178 and 13196 (EO) provided the overarching policy framework to guide designation and management of the Sanctuary through the purposes and policies of the Act and the purpose and management principles of the Reserve (Table 2.2). In providing for the long-term comprehensive protection and conservation of the marine resources of the NWHI, the Sanctuary supplements and complements the NWHI Coral Reef Ecosystem Reserve (Reserve). The EO further required that, where the Reserve overlay the Hawaiian Islands National Wildlife Refuge (HINWR), it be managed to supplement and complement the HINWR to ensure coordinated conservation and management. Furthermore, Sanctuary management must build on and expand the management regime defined in the Reserve Operations Plan (ROP) developed through extensive consultation with the Reserve Advisory Council. The ROP had two public comment periods, one for the draft and one for the draft final. For the draft final public comment period in March 2004, 29,400 comments were received. The Final ROP was published in March 2005 (NOAA 2005a).

**Reserve operations**

Funded by NOAA's Coral Reef Conservation Program, implementation of the Executive Orders began in 2001. In January, the Reserve was declared an active candidate for Sanctuary designation (5509 FR 66), and selection of an Advisory Council and establishment of an Interagency Committee began (NOAA 2006). On March 18, 2002, the NMSP initiated a series of ten public scoping meetings hosted in Hawai'i and Washington, D.C. Over 13,000 comments were received between March and August 2002. Public scoping, together with science workshops (Gittings et al. 2004), focus group discussions with stakeholder groups (SRG 2004b), and meetings of the RAC and associated subcommittees and interagency partners, provided input and direction for the development of this management plan. The State of the Reserve Report (NOAA 2006) provides a comprehensive summary of five years of Reserve operations.

**Designation process**

As part of the designation process, and as directed under section 304(a)(5) of the National Marine Sanctuaries Act (NMSA) the regional Fishery Management Council was given the opportunity to draft fishing regulations consistent with the goals and objectives of the proposed sanctuary. The NMSP provided the Western Pacific Fishery Management Council (WPFMC) with this opportunity on September 20, 2004 when the goals and objectives of the proposed sanctuary were delivered along with advice and recommendations on how to develop fishing regulations that would be most consistent with NMSA requirements (NOAA 2004b). Following the receipt of the draft fishing regulations from WPFMC on April 14, 2005, NOAA found that they did not fulfill the goals and objectives of the proposed sanctuary. As a result, the 304(a)(5) consultation process with the Regional Fishery Management Council concluded and NOAA is moving forward to develop these draft regulations as part of an entire suite of regulations for the proposed Sanctuary (*Appendix 1: Regulations*).

The designation proposal, consisting of a draft environmental impact statement, management plan, and regulations, is the result of years of synergistic and cumulative efforts to provide long-term protections for the NWHI marine ecosystems. The NMSA requires that a draft environmental impact statement be prepared for all new sanctuary proposals in accordance with the National Environmental Policy Act of 1969 (NEPA). The draft EIS considers a range of alternatives for sanctuary designation, while the management plan describes the implementation of the preferred alternative. The draft EIS describes the purpose and need for sanctuary designation, the alternatives being considered, the affected environment, and potential environmental consequences of each alternative.

Together, the draft EIS and management plan provide a designation proposal for review during a 60-day public comment period. During this time, a series of public meetings will be held in Hawai'i and Washington, D.C. A final EIS and management plan will be developed and released to the public, with a record of decision concluding the designation process.

**Table 2.1 Building a Legal and Policy Basis for Sanctuary Designation**

**Interagency Ecosystem Management Task Force (Memorandum of Understanding, 1995)**

- Establishes Interagency Ecosystem Management Task Force to provide leadership in, and cooperate with, activities that foster the ecosystem approach to natural resource management

**Coral Reef Protection (Executive Order 13089 of 1998)**

- Establishes U.S. Coral Reef Task Force and programs to preserve and protect coral reef ecosystems including the NWHI

**Marine Protected Areas (Executive Order 13158 of 2000)**

- Requires establishment and management of marine protected areas
- Directs Secretaries of Commerce and the Interior to work cooperatively with the State of Hawai‘i, in consultation with the WPFMC, to develop a coordinated management regime to increase the protection of the NWHI coral reef ecosystem, while providing for sustainable uses in the region

**Coral Reef Conservation Act of 2000**

- Provides financial resources for projects to preserve, sustain, and restore coral reef ecosystems and promote wise management, scientific study, and community involvement through the Coral Reef Conservation Program

**National Marine Sanctuaries Amendments Act of 2000 Section 6(g)**

- Allows the President, after consultation with federal government agencies and the Governor of the State of Hawai‘i, to designate the NWHI as a coral reef ecosystem reserve to be managed by the Secretary of Commerce consistent with the purpose and polices of the NMSA
- Allows the Secretary of Commerce to initiate the designation of the reserve as a National Marine Sanctuary under the NMSA

**Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (Executive Order 13178 of December 4, 2000 as amended by Executive Order 13196 January 18, 2001)**

- Establishes the Coral Reef Ecosystem Reserve
- Orders Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary pursuant to sections 303 and 304 of the National Marine Sanctuaries Act

## Table 2.2 Policy Framework Guiding Sanctuary Designation

| National Marine Sanctuary Act[1]: Purposes and Policies | Executive Order 13178: Purpose and Management Principles of the NWHI Coral Reef Ecosystem Reserve |
|---|---|
| (1) to identify and designate as National Marine Sanctuaries areas of the marine environment which are of special national significance and to manage these areas as the National Marine Sanctuary System<br><br>(3) to maintain the natural biological communities in the National Marine Sanctuaries, and to protect and, where appropriate, restore and enhance natural habitats, populations, and ecological processes<br><br>(9) to cooperate with global programs encouraging conservation of marine resources | (a) Principal purpose of the Reserve is the long-term conservation and protection of the coral reef ecosystem and related marine resources and species of the NWHI in their natural character<br><br>(b) The Reserve shall be managed using available science and applying a precautionary approach with resource protection favored when there is a lack of information regarding any given activity, to the extent not contrary to law<br><br>(g) The Reserve shall be managed to further restoration and remediation of degraded or injured Reserve resources |
| (2) to provide authority for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities<br><br>(7) to develop and implement coordinated plans for the protection and management of these areas with appropriate federal agencies, state and local governments, Native American tribes and organizations, international organizations, and other public and private interests concerned with the continuing health and resilience of these marine areas | (h) The Reserve shall be managed to facilitate coordinated management among federal and state agencies and other entities, as appropriate, to provide comprehensive (looking beyond jurisdictional boundaries) conservation of the coral reef ecosystem and related marine resources and species throughout the Northwestern Hawaiian Islands, consistent with applicable authorities and the Management Principles of this section |
| (4) to enhance public awareness, understanding, appreciation, and wise and sustainable use of the marine environment, and the natural, historical, cultural, and archeological resources of the National Marine Sanctuary System | (f) To the extent consistent with the primary purpose of the Reserve, the Reserve shall be managed to enhance public awareness, understanding, and appreciation of Reserve resources, and the impacts or threats thereto from human and other activities<br><br>(c) Culturally significant, noncommercial subsistence, cultural, and religious uses by Native Hawaiians should be allowed within the Reserve, consistent with applicable law and long-term conservation and protection of Reserve resources |
| (5) to support, promote, and coordinate scientific research on, and long-term monitoring of, the resources of these marine areas | (e) To the extent consistent with the primary purpose of the Reserve, the Reserve shall be managed to support, promote, and coordinate appropriate scientific research and assessment, and long-term monitoring of Reserve resources, and the impacts or threats thereto from human and other activities, to help better understand, protect, and conserve these resources and species for future generations |
| (6) to facilitate to the extent compatible with the primary objective of resource protection, all public and private uses of the resources of these marine areas not prohibited pursuant to other authorities<br><br>(8) to create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques | (d) The Reserve shall be managed using, when appropriate, geographical zoning and innovative management techniques to ensure that the Reserve resources are protected from degradation or harm |
| 1 - Section 301(c) National Marine Sanctuaries Act as amended by the National Marine Sanctuaries Amendment Act of 2000 | |

## 2.2 Goals and Objectives Statement

Based on the NMSA and the EO establishing the NWHI Coral Reef Ecosystem Reserve, the G&O Statement was developed with inputs and advice of the NWHI Coral Reef Ecosystem Reserve Advisory Council and subcommittees, the Interagency Partners, and the public through a series of meetings beginning in July of 2003. The language reflects the purposes and policies of the NMSA, the management principles of the EO, and multiple documents including scoping comments, the draft Interagency Memorandum of Understanding (MOU), and the Constitution of the State of Hawai'i.

The G&O Statement for the Sanctuary (Table 2.3) establishes the overarching policy direction and guidance for Sanctuary management. The G&O Statement serves as the basis for making decisions about human use of the Sanctuary and emphasizes an ecosystem approach to management through protecting and restoring marine ecosystems and all their services, above economic or social goals for single services.


**GOALS AND OBJECTIVES STATEMENT**

The G&O Statement is organized into vision, mission, management principles, and specific goals and objectives. The vision describes the long-term management goal of the Sanctuary to maintain the health and diversity of the NWHI ecosystem in perpetuity.

The mission establishes the primary purpose of the Sanctuary as strong and long-term protection of marine ecosystems in their natural character, perpetuation of Native Hawaiian cultural practices and conservation of heritage resources. Integrated and coordinated management is highlighted as the mechanism to achieve this primary purpose of protecting ecosystem integrity.

The nine management principles embodied in the G&O Statement provide the foundation for making informed decisions consistent with the vision and mission for the Sanctuary. These principles provide for the management of the NWHI as a public resource protection policy with resources held as a public trust. Decisions on present and future activities in the Sanctuary may not violate these principles.

Specific goals and objectives define an ecosystem approach to Sanctuary management and are linked to action plans and strategies. This approach can be described as driven by explicit goals, implemented through policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function (Christensen et al. 1996). Sanctuary goals and objectives emphasize an ecosystem-based management approach by requiring:

- A comprehensive set of management measures, including regulations, permits, zoning, and action plans to achieve the primary purpose of resource protection in the Sanctuary

- An adaptive management process that incorporates best practices, available science and traditional knowledge through a continuous learning process and that reduces risks by erring on the side of caution in order to reduce management errors related to uncertainty in a data- and information-poor environment (Kaufman et al. 2004)
- Collaboration and partnerships at local, national, and international levels to achieve effective management and to enhance public participation

As a whole, the G&O Statement establishes the long-term vision and serves as daily policy guidance for management of the Sanctuary. The G&O Statement also supports NOAA, NOS, and NMSP goals, programs, and priorities. NOAA's strategic plan (2004a), and NOAA's National Ocean Service Strategic Plan (2003a) outline four mission goals and six cross-cutting priorities. The NMSP Strategic Plan (NOAA 2005b) provides seven goals to meet the mandates of the National Marine Sanctuaries Act. The NMSP and the Sanctuary fall under NOAA's Ecosystem Mission Goal:

> ***Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management.***

The Sanctuary G&O Statement also clearly supports five of the six cross-cutting priorities for NOAA:

- Integrated global environmental observation and data management system
- Environmental literacy, outreach and education
- Sound, reliable, state-of-the-art research
- International cooperation and collaboration
- Organizational excellence

**Table 2.3 Goals and Objectives Statement for the Sanctuary**

| Vision and Mission |
|---|
| That the vast coral reefs, ecosystems, and resources of the Northwestern Hawaiian Islands (NWHI) – unique in the world – remain healthy and diverse forever.<br><br>Carry out coordinated and integrated management to achieve the primary purpose of strong and long-term protection of the marine ecosystems in their natural character, as well as the perpetuation of Native Hawaiian cultural practices and the conservation of heritage resources of the Northwestern Hawaiian Islands. |
| **Management Principles** |
| The Sanctuary shall be managed in a manner that:<br>1. Is consistent with the Vision and Mission.<br>2. Recognizes that the resources of the Northwestern Hawaiian Islands are held as a public trust.<br>3. Incorporates and integrates best practices, available science, traditional knowledge, and innovative management techniques in order to have a comprehensive approach to both the ecological and social environment.<br>4. Honors the significance of the region for Native Hawaiians.<br>5. Enhances public awareness and appreciation of the unique character and marine environments of the NWHI.<br>6. Errs on the side of resource protection when there is uncertainty in available information on the impacts of an activity.<br>7. Authorizes only uses consistent with the primary purpose of resource protection and applicable law.<br>8. Coordinates with Federal, state, and local governments, Native Hawaiians, and appropriate organizations.<br>9. Carries out appropriate and effective enforcement and surveillance and associated public outreach. |
| **Goals and Objectives** |
| Goal 1: Protect, preserve, maintain and, where appropriate, restore the natural biological communities, including habitats, populations, native species, and ecological processes, of the Sanctuary as a public trust for current and future generations. |
| **Objectives:**<br>1a. Develop and implement a comprehensive management plan that integrates best practices, available science, traditional knowledge, and innovative management techniques, and addresses both short-term and long-term resource protection needs.<br>1b. When there is uncertainty in available information regarding the potential impacts of any activity, err on the side of resource protection.<br>1c. Develop and implement the necessary prohibitions, rules, regulations, and penalty schedules to achieve the primary purpose of resource protection and address the needs of the Sanctuary.<br>1d. Develop and implement a surveillance and enforcement program needed to ensure compliance with regulations.<br>1e. Cooperate with regional and global programs encouraging conservation of marine resources. |
| Goal 2: Provide for comprehensive and coordinated conservation and management that recognizes and complements existing jurisdictional boundaries and management regimes and involves stakeholder communities. |
| **Objectives:**<br>2a. Develop and implement regional and global approaches, interagency agreements, and processes with partners to address key cross-jurisdictional activities, such as education, research and monitoring, enforcement and surveillance, and access.<br>2b. Create a permit, notification, and tracking system for access and use that is compatible and coordinated with partner agencies.<br>2c. Coordinate all activities to minimize impacts to ecosystems, avoid redundant or duplicative efforts, and achieve efficient use of agency resources.<br>2d. Engage representative stakeholder communities and the public in seeking advice for effective management. |

## Goals and Objectives (*continued*)

**Goal 3:** Manage, minimize, or prevent negative human impacts by allowing access only for those activities that do not threaten the natural character or biological integrity of any ecosystem of the region.

**Objectives:**

3a. Allow access only for activities consistent with long-term ecosystem protection.
3b. The management system shall continue to allow Native Hawaiian cultural, religious, and subsistence uses.
3c. Develop a marine zoning system that prescribes further limits on use to enhance ecosystem protection and ease of management and enforcement.
3d. Develop a permitting and tracking system to identify, evaluate, and monitor activities, access, and uses in order to ensure consistency with long-term ecosystem protection.
3e. Develop other measures as may be necessary to ensure long-term ecosystem protection.
3f. Work with the appropriate domestic and international agencies to adopt a notification requirement for transiting non-military vessels and the designation of special maritime zones on nautical charts.

**Goal 4:** Enhance public awareness, understanding, and appreciation of the marine environment and cultural and maritime heritage resources.

**Objectives:**

4a. Develop public outreach and education programs with partners to raise public awareness of NWHI marine ecosystems and the need to protect them and to effectively communicate access and use restrictions.
4b. To minimize the use of, and impact to, the region, plan and establish programs that emphasize the concept of bringing the place to the people, rather than people to the place.
4c. Increase the awareness of marine conservation in the NWHI by emphasizing the global nature of threats to the ecosystems and the importance of the region to the state, the nation and the world.
4d. Enhance the effectiveness of education programs and public outreach by incorporating Native Hawaiian culturally based themes and traditional approaches to learning, multiple perspectives, histories, and stories of the region.

**Goal 5:** Support Native Hawaiian cultural, religious, and subsistence practices which are consistent with the long-term conservation and protection of the region.

**Objectives:**

5a. Build capacity within the Sanctuary program to develop a working relationship with Native Hawaiians to facilitate their participation in the management of the Sanctuary.
5b. Develop a plan for Native Hawaiian access and use in the NWHI collaboratively with Native Hawaiians and regional partners.
5c. Increase understanding of Native Hawaiian histories and cultural practices in the NWHI through research and oral traditions.
5d. Integrate Native Hawaiian traditional knowledge, values, and perspectives into management and education programs.

**Goal 6:** Support, promote, and coordinate research and long-term monitoring that improves management decision making and is consistent with the conservation and protection of the region.

**Objectives:**

6a. Identify, assess, prioritize, and authorize ecological, historic, cultural, and socioeconomic research and monitoring necessary for effective management of the region.
6b. Coordinate with regional and national agencies to make vessels and other resources available for conservation and research activities.
6c. Compile existing research and avoid duplication by collaborating and coordinating with jurisdictional partner agencies and universities.
6d. Develop the ability to quickly assess and respond to unexpected, rapid ecological changes that have occurred as a result of storm events, dramatic climate and temperature shifts, and other occurrences.
6e. Establish criteria for cultural research activities through consultation with the Native Hawaiians.
6f. Work with partners and researchers to make NWHI research available and accessible to the public in a timely manner.

| ***Goals and Objectives* (continued)** |
|---|
| **Goal 7:** Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region. |
| **Objectives:** As appropriate to maintain the natural character or biological integrity of any ecosystem of the region:<br>7a. Prohibit non-subsistence crustacean fishing.<br>7b. Prohibit commercial precious coral fishing.<br>7c. Prohibit harvest of all coral species, live rock, all aquaria species and live fish trade species, and algae, sponges, and other invertebrates.<br>7d. Allow recreational fishing for pelagic species except within sensitive habitats.<br>7e. Allow bottomfish fishing to continue except within sensitive habitats.<br>7f. Allow commercial pelagic fishing using handline, pole and line and trolling gear except within sensitive habitats.<br>7g. Prohibit subsistence use within the Sanctuary except for Native Hawaiian subsistence use.<br>7h. Allow sustenance fishing for pelagic and bottomfish species using pole and line, trolling and handline methods with the Sanctuary except within sensitive habitats.<br>7i. Allow spearfishing without the use of SCUBA for pelagic species except within sensitive habitats.<br>7j. All fishing not specifically allowed shall be prohibited.<br>7k. When there is uncertainty in available information regarding the potential impacts of any fishing activity, err on the side of resource protection. |

## 2.3 Collaboration and Partnerships

Comprehensive, coordinated conservation and management of a National Marine Sanctuary is a fundamental purpose of the NMSA and an essential aspect of ecosystem-based management. Collaboration between jurisdictional agencies and stakeholders is essential for establishing cross-jurisdictional management goals and developing and evaluating ecosystem-level plans. Effective management of the Sanctuary is dependent on building and enhancing effective working relationships with a broad range of stakeholders involved in the NWHI, including jurisdictional partners, the Sanctuary Advisory Council (SAC), and Native Hawaiians. The need for comprehensive, coordinated conservation and management is emphasized throughout the G&O Statement. This section describes jurisdictional authorities and other stakeholders involved in managing the NWHI and mechanisms to enhance collaboration and partnerships for effective management.

Several partner agencies have been working in the NWHI for many years. The Sanctuary will continue to work with these partners in a manner that respects their ongoing efforts and jurisdictional responsibilities. In this way, the operation of the Sanctuary adds value to ongoing conservation efforts. This approach is summed up in the term "unified ocean governance." It is consistent with the goals of coordinated management of the NWHI, expressly contained within the EO, and the NMSA of 2000. Cooperative efforts, including the establishment of an Interagency Committee, conducting collaborative research projects, and sharing human and financial resources, will enhance the capacity of all to manage the NWHI as a public trust for future generations.

**Jurisdictional Authorities**

The area subject to this coordinated management comprises the lands and waters of the NWHI out to 50 miles (43.5 nm/80.5 km) and includes all islands, atolls, reefs, shoals, banks and seamounts from 50 miles east of Nihoa Island in the southeast, to beyond Kure Atoll in the northwest. The marine waters and submerged lands of the NWHI encompass an area extending approximately 1,200 miles (1,043 nm/1,931 km) long and include the federal waters designated as the Sanctuary, State of Hawai'i waters and submerged lands, the State Wildlife Refuge at Kure Atoll, the Hawaiian Islands National Wildlife Refuge, Midway Atoll National Wildlife Refuge, and the Battle of Midway National Memorial. Jurisdictional authorities for the area include the following:

- NOAA National Ocean Service (NOS) National Marine Sanctuary Program (NMSP), Department of Commerce
- State of Hawai'i
- U.S. Fish and Wildlife Service (USFWS), Department of the Interior
- NOAA National Marine Fisheries Service (NMFS), Department of Commerce
- United States Coast Guard, Department of Homeland Security
- City and County of Honolulu

*NOAA National Ocean Service (NOS) National Marine Sanctuary Program (NMSP), Department of Commerce*

The National Marine Sanctuaries Act (NMSA) of 1972 (16 U.S.C 1431 et. seq.) is the legislative mandate that governs the National Marine Sanctuary Program (NMSP). The NMSA provides the

Secretary of Commerce the authority to designate as national marine sanctuaries areas of the marine environment with special national significance. Additionally, the NMSA established the NMSP as the federal program charged with managing national marine sanctuaries. Violations of marine sanctuary regulations are prosecuted by NOAA General Counsel and adjudicated by an administrative law judge. The NWHI Coral Reef Ecosystem Reserve established by EO in 2000 has been managed by NMSP and funded through NOAA's Coral Reef Conservation Program.

*State of Hawai'i*

In accordance with the Hawai'i Organic Act of April 30, 1900, c 339, 31 Stat 141 Section 2, and the Hawai'i Admission Act of March 18, 1959, Pub L 86-3, 73 Stat 4 Section 2, the islands of the Hawaiian Archipelago, together with their appurtenant reefs and territorial waters, with the exception of Midway Atoll, were part of the Territory of Hawai'i and are now part of the State of Hawai'i, including all emergent, submerged and marine resources. The State of Hawai'i Department of Land and Natural Resources 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 Northwestern Hawaiian Islands under Title 12, Chapter 171.3 Hawai'i Revised Statutes.

DLNR's Division of Forestry and Wildlife (DOFAW) manages the emergent lands at Kure Atoll as a State Wildlife Sanctuary. The State Historic Preservation Division and the State Historic Preservation Officer (SHPO) oversee cultural, historical, and resources statewide. 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 State of Hawai'i, Department of Land and Natural Resources (DLNR), Division of Aquatic Resources, established the Northwestern Hawaiian Islands Marine State Marine Refuge (0-3 nm around all emergent lands, except Midway Atoll) through Hawai'i Administrative Rule, 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, innocent passage, interstate commerce, and activities related to national defense or enforcement, foreign affairs and in response to emergencies. The State currently holds the submerged and ceded lands of the NWHI in trust. This trust is overseen by the Office of Hawaiian Affairs (OHA) which was established in 1978 as a public trust by an amendment to the Constitution of the State of Hawai'i, Article XII, section 5. The amendment further stated that OHA "…shall hold title to all the real and personal property now or hereafter set aside or conveyed to it which shall be held in trust for Native Hawaiians and Hawaiians."

*U.S. Fish and Wildlife Service (USFWS), Department of the Interior*

In 1909, President Theodore Roosevelt designated by Executive Order 1019 all emergent lands, islands and reefs from Nihoa Island to Kure Atoll, except Midway Atoll, as a preserve and breeding ground for the native birds and seabirds. Originally administered by the Department of Agriculture as the Hawaiian Islands Reservation, the area was later transferred to the U.S. Fish and Wildlife Service (USFWS) of the Department of the Interior. The USFWS manages and administers the submerged lands and waters around all islands to ten fathoms, except at Midway Atoll and Necker Island. Necker Island is administered to 20 fathoms. Midway Atoll National Wildlife Refuge was established in 1988 but Executive Order 13022 transferred jurisdiction in 1966 from the Navy to Interior, which manages and administers the three islands and nearly 600,000 acres of surrounding waters. There is not a consensus among the parties as to the seaward extent of the U.S. Fish and Wildlife Service jurisdiction in the Northwestern Hawaiian

Islands. The parties agree this issue need not be resolved at this time to implement any of the proposed alternatives in the DEIS (Volume I). Under Executive Order 10413, issued by President Truman in 1952, the emergent lands at Kure Atoll were transferred to the Territory of Hawai‘i and are also managed as a State Wildlife Sanctuary. All Refuge lands and waters are administered in accordance with the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd-668ee).

*NOAA National Marine Fisheries Service (NMFS), Department of Commerce*
The Magnuson-Stevens Fishery Conservation and Management Act of 1976, 16 U.S.C se. 1361 et seq., established U.S. jurisdiction over fisheries in federal waters of the Exclusive Economic Zone (EEZ) (generally 3-200 miles offshore), and tasked the Secretary of Commerce in coordination with the Western Pacific Fishery Management Council (WPFMC) with stewardship over fishery resources in the EEZ surrounding the NWHI. The WPFMC has developed fishery management plans for bottomfish, crustaceans, pelagic fisheries, and precious corals in the NWHI whose amendments are in different stages of preparation and approval. Some of these fisheries are currently closed or are not currently active. In 1996, the Sustainable Fisheries Act, Pub. L. 104-297, amended the Magnuson-Stevens Act and made NMFS in affiliation with the WPFMC also responsible for protecting essential fish habitat. NMFS also oversees monitoring and restoration of protected species in the EEZ surrounding the NWHI under authority granted by the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). NOAA Office for Law Enforcement is part of the National Marine Fisheries Service.

*U.S. Coast Guard, U.S. Department of Homeland Security*
The Coast Guard may enforce all applicable federal laws within the boundaries of national marine sanctuaries (U.S. Coast Guard 2003). The Coast Guard has authority to enforce Sanctuary regulations and NMSA prohibitions and restrictions under 14 U.S.C. 2 and 14 U.S. C. 89 of the NMSA. Section 1437 (h) of the NMSA specifically states that nothing shall be considered to limit the Coast Guard’s authority to enforce the NMSA or any other federal law. NOAA General Counsel prosecutes violations of Sanctuary regulations.

*City and County of Honolulu*
The City and County of Honolulu shares jurisdiction with the state on emergent lands; however, they are not currently engaged in management of the NWHI.

## Mechanisms for Collaboration and Partnership

Effective management of the Sanctuary is dependent on building and enhancing working relationships with a broad range of stakeholders involved in the NWHI. Mechanisms to enhance collaboration and partnerships include a Sanctuary Advisory Council, an Interagency Management Committee, NOAA coordination, and research, educational, Native Hawaiian and international partnerships (Figure 2.1). These mechanisms, along with an Ecosystem Management Task Force, are described below:

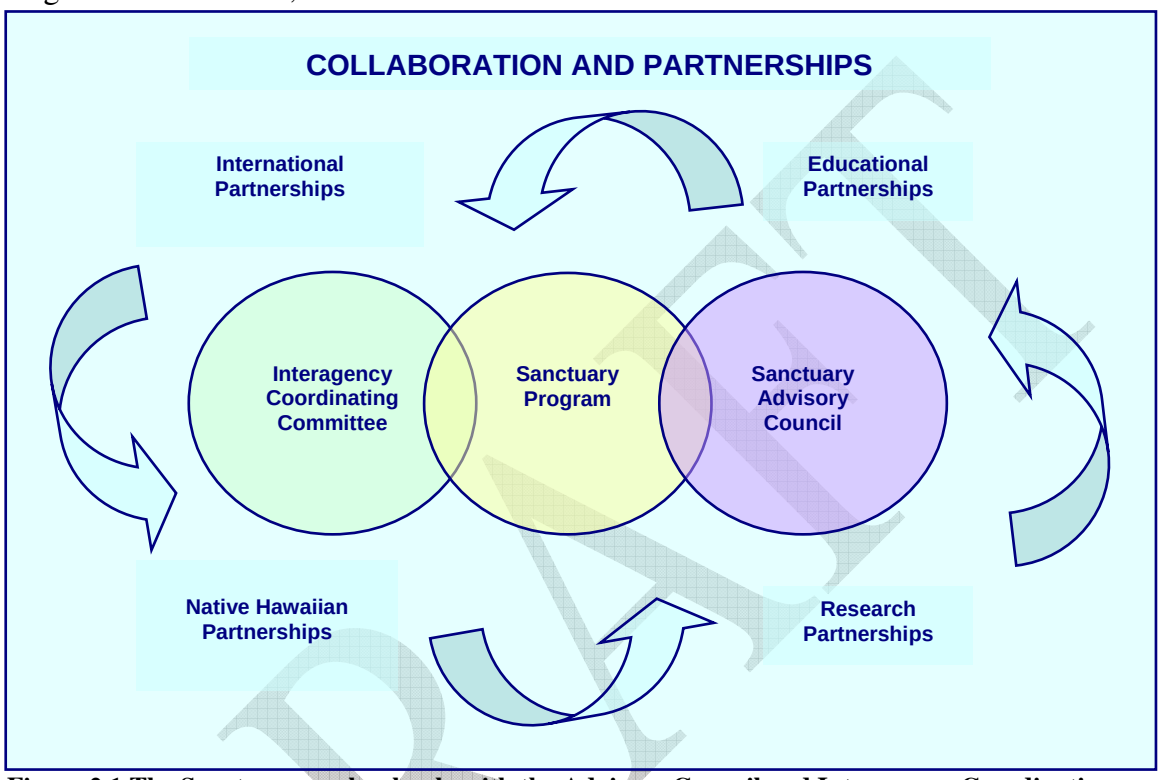



**Figure 2.1 The Sanctuary works closely with the Advisory Council and Interagency Coordinating Committee. Partnerships enhance and expand agency capacities**

### Sanctuary Advisory Council

The Sanctuary Advisory Council (SAC) provides a public forum for consultation on resource management issues affecting the waters surrounding the Northwestern Hawaiian Islands. The role of the SAC is to provide advice and recommendations to the Sanctuary Manager on the management and protection of the Sanctuary. The SAC is a multi-sectoral body composed of representatives from various constituencies, as well as the public at large. The SAC representation is designed to be balanced in terms of points of view represented, geographic diversity, and advisory functions the SAC performs. SAC representatives are selected by NMSP through a competitive application process. Members serve voluntary terms of three years. The council meets approximately four times per year in open public sessions.

The Council includes three Native Hawaiian representatives, including one elder, three representatives from the non-federal science community, three representatives from non-governmental conservation organizations, and one representative each from the commercial fishing industry, recreational fishing, ocean-related tourism industry, non-federal education and outreach, citizen at large, and the State of Hawai‘i representative appointed by the Governor.

Nearly all of these volunteer positions require direct experience in the NWHI. There are non-voting representatives from the Department of Interior, U.S. Coast Guard, Department of Defense, Department of State, National Marine Fisheries Service, Hawaiian Islands Humpback Whale National Marine Sanctuary, National Science Foundation, Marine Mammal Commission, and Western Pacific Fishery Management Council.

Native Hawaiian stakeholder interests hold a unique place on the Sanctuary Advisory Council. Native Hawaiians have a connection to, and interest in, the Northwestern Hawaiian Islands as documented in their oral and written histories, genealogies, songs, dance, archaeological resources, and ongoing spiritual relationship with their environment. Native Hawaiian stakeholder interests in the Northwestern Hawaiian Islands are recognized in the Executive Orders that created the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve and will continue to be honored in the Sanctuary.

**Interagency Committee**

The Interagency Committee is the collaborative management mechanism for planning and implementing effective and coordinated management of the Sanctuary. The Interagency Committee is composed of representatives of federal and state agencies including: the Sanctuary, NOAA NMFS and Office for Law Enforcement (OLE), USFWS, State of Hawai'i DLNR and OHA, U.S. Coast Guard 14th District Prevention and Response, and the U.S. Department of Defense. Within the Interagency Committee, a Core Interagency Committee (CIC) is made up of four agencies, the Sanctuary, State of Hawai'i DLNR, USFWS, and NMFS. The chairmanship of the Interagency Committee will be shared by the CIC and rotated every two years. Guided by the CIC, the Interagency Committee will meet quarterly on all aspects of coordinated Sanctuary management, including review and development of policies, protocols, permits, and other operational aspects of the Sanctuary. Each agency will report on activities and enforcement actions in the Sanctuary. Interagency technical groups will be formed to address specific management topics as needed, such as enforcement, permitting, restoration and information management. The CIC will participate in all aspects of the adaptive management process by conducting joint annual operations planning, five-year plan review, and monitoring and evaluation, and by convening an Ecosystem Management Task Force to provide advice in ecosystem-based management.

**NOAA Coordination**

NOAA has an important mandate from Congress to be the lead federal agency in protecting, managing, and restoring the marine resources of the Exclusive Economic Zone (NOAA 2004a). To meet this mandate, NOAA scientists, specialists, and external partners contribute world class expertise in oceanography, marine ecology, marine archaeology, fisheries management, conservation biology, natural resource management, and risk assessment. One of NOAA's strategic goals is to conserve, protect, manage, and restore living marine resources and coastal and ocean resources as critical to the health of the U.S. economy. A critical component of this mission is to increase public knowledge of ecosystems and to actively engage the public as stewards for coastal and marine ecosystem issues in their communities.

The National Marine Sanctuary Program within the National Ocean Service (NOS), is working to meet NOAA's ecosystem goal: protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management. Under the Matrix Management system, NOS directly supports six of the nine programs to achieve this goal: Habitat, Corals,

Coastal and Marine Resources, Enforcement, Ecosystem Observations, and Ecosystem Research. The Sanctuary is part of this NOAA network of resources which contributes to NWHI management, conservation, and research:

- NOAA's Coral Reef Conservation Program supports effective management and sound science to preserve, sustain and restore valuable coral reef ecosystems;
- NOAA's Marine Debris Program is undertaking a national and international effort focusing on identifying, removing, reducing, and preventing debris in the marine environment;
- NOAA's Office of Marine and Aviation Operations manages the NOAA research ship Hi'ialakai;
- NOAA Coastal Services Center works with resource managers and mapping professionals to promote the use of benthic habitat mapping to address coastal management issues;
- NOAA's National Centers for Coastal Ocean Science (NCCOS) conducts and supports research, monitoring, assessments, and technical assistance to meet NOAA's coastal stewardship and management responsibilities;
- NOAA Office for Law Enforcement is dedicated to the enforcement of laws that protect and conserve our nation's living marine resources and their natural habitat;
- NOAA National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC) has five divisions that support the domestic and international conservation and management of living marine resources: Coral Reef Ecosystems, Protected Species, Ecosystems and Oceanography, Fishery Biology and Stock Assessment, Fishery Monitoring and Socioeconomics;
- The Office of Ocean Exploration is NOAA's center for new activities to explore and better understand our oceans. This office supports expeditions, exploration projects, and a number of related field campaigns for the purpose of discovery and documentation of ocean voyages.
- The Office of Response and Restoration (OR&R) works to prevent and mitigate harm to coastal resources, responding to oil spills and hazardous material releases, and working to restore damaged coastal resources.

NOAA's Coral Reef Conservation Program is an example of NOAA's Matrix Management planning and provides an important link for NMSP sanctuary sites that have coral reef resources. In June of 1998, the President established Executive Order 13089 on Coral Reef Protection, which directs federal agencies to study, restore, and conserve U.S. coral reef ecosystems. The Task Force was established under EO 13089 to strengthen and coordinate cooperation among Federal, State and Territory agencies in the stewardship and conservation of the nation's coral reef ecosystems. Through the U.S. Coral Reef Task Force, several federal agencies are required to take certain actions to protect coral reefs, which include the NWHI. Since the establishment of the NWHI Coral Reef Ecosystem Reserve in 2001, the Coral Reef Conservation Program has provided the funding for operations and programs. In addition, the Coral Reef Conservation Program has funded a number of other NWHI research and marine debris removal initiatives carried out by National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Division (CRED) for ecosystem research and marine debris removal.

**Research Partnerships**

Research partnerships with various organizations will facilitate the development of an integrated ecosystem science research agenda responsive to basic needs and to inform management decision-making and applied science needs of the Sanctuary. Research partnerships will include biological, physical, and social scientists and Native Hawaiian cultural practitioners. An annual ecosystem science workshop will be held to share research results and progress and to identify new areas for research. Research direction and progress will be reviewed every two years and adjustments made to reflect evolving understanding of ecosystem form and function. An ecosystem science symposium will be held every four years to share research results for input into the five-year plan and programmatic review cycle. The symposium will provide a forum for researchers in the Hawaiian Archipelago to present research results relevant to the continued development of ecosystem management in the Sanctuary.

**Educational Partnerships**

Educational partnerships with various organizations will facilitate the development of a robust public education and outreach program designed to build an informed constituency of local, national and international stakeholders supporting Sanctuary conservation measures.

**Native Hawaiian Partnerships**

The Native Hawaiian community will be involved in Sanctuary management through participation in the Sanctuary Advisory Council and its subcommittees and working groups, the Interagency Committee, as well as through partnerships with community organizations and institutions. In addition, furthering understanding of Native Hawaiian culture and history through research, education and outreach, support of Native Hawaiian practices, and the inclusion of traditional knowledge is considered integral to Sanctuary management.

**International Partnerships**

The NWHI National Marine Sanctuary seeks to develop and strengthen partnerships and collaboration with international marine protected areas and scientific organizations to further the Sanctuary's goals and objectives of coordinated and integrated management to ensure protection of this marine ecosystem.

The State of Hawai'i is working on an application to the National Park Service to nominate the Northwestern Hawaiian Islands as a mixed natural and cultural heritage site of outstanding universal value for the U.S. Tentative List of UNESCO's World Heritage Sites. This is being undertaken in partnership and with the support of the U.S. Fish and Wildlife Service and NOAA's National Marine Sanctuary Program. The World Heritage Convention, administered by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), can help protect the natural and cultural values of the NWHI as part of the world heritage of mankind. Designation of the NWHI as an internationally recognized World Heritage Site will help protect and preserve in perpetuity the unique and fragile ecosystems, habitats and communities of flora and fauna, as well as the Native Hawaiian cultural resources and traditional practices.

The Sanctuary is developing partnerships with international organizations and other MPAs who recognize the value of protecting biodiversity, ecosystem integrity and coordinated management of marine resources. These organizations include: the National Institute of Water and Atmospheric Research (NIWA) in New Zealand; the South Pacific Regional Environment

Program (SPREP) in Samoa; the All Islands Coral Reef Initiative Coordinating Committee, based in Hawaii; and the Pacific Marine Protected Area Community (PIMPAC). The Sanctuary is also participating in the Census of Marine Life (CoML), a growing global network of researchers in more than 70 nations engaged in a 10-year initiative to assess and explain the diversity, distribution, and abundance of marine life in the oceans -- past, present, and future.

## 2.4 Regulations, Zoning and Action Plans

Regulations, together with action plans, address priority management needs for comprehensive and integrated management of the NWHI. Management of the NWHI is implemented through relevant federal, state and local regulations and administrative rules and action plans. Action plans describe strategies and activities to address priority management needs. Together, these management tools are designed to achieve the goals and objectives of the Sanctuary.

**Regulations and Permits**

Sanctuary regulations promulgated under the National Marine Sanctuaries Act of 1972 as amended, together with other federal regulations and state administrative rules, provide the legal framework to manage and effectively enforce human activities in the NWHI. Other federal acts are part of the regulatory framework. They include the Magnuson-Stevens Fishery Conservation and Management Act of 1976, Marine Mammal Protection Act of 1972, Endangered Species Act of 1972, Clean Water Act of 1972, National Historic Preservation Act 1966, National Wildlife Refuge System Administration Act 1966, and other pertinent statutes.

Sanctuary regulations include prohibitions, permitting requirements, and spatial restrictions in the form of marine zones. Sanctuary regulations effectively prohibit all activities unless allowed by permit (except for passage without interruption, law enforcement and armed forces activities, and activities necessary to respond to emergencies). Sanctuary regulations are provided in Appendix 1. Permits may be issued for some activities in the Sanctuary. Permit applications are evaluated against regulatory and permit thresholds and other application criteria. The NMSP has a three-tiered classification scheme in which thresholds of environmental impact correspond to differing levels of program and outside expert review. In coordination with jurisdictional partners, the state, USFWS, and NMFS, Sanctuary permits may be issued to cover the following types of activities:

1. Research
2. Education
3. Conservation and management
4. Native Hawaiian practices
5. Recreation and sport fishing
6. Special ocean use

These permits cannot allow any of the activities that are prohibited under any circumstance. A permitting system, coordinated with jurisdictional partners, is described in *3.3.1 Permitting Action Plan*, and *Appendix 2: Supplemental Information on Permitting.*

## Zoning

Marine zoning is considered one of several effective management tools for achieving the purposes and policies of the NMSA and goals and objectives of the Sanctuary. Human activities in the Sanctuary are regulated through three types of marine zones; Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), and the Midway Atoll Special Management Area (SMA) (Figure 2.2). Sanctuary marine zoning is designed to meet management goals and objectives, existing partner agency management frameworks, and enforcement challenges posed by the remote and isolated nature of the NWHI. Some of the resource characteristics of the NWHI addressed by marine zoning include protection of habitat and foraging areas of threatened and endangered species, inclusion of a representative range of the diverse array of marine habitats, including shallow coral reef environments, as well as deepwater slopes, banks and seamounts, and minimizing risks associated with fishing and recreational activities. Sanctuary zones also protect the ecological linkages between habitats. Coral reef ecosystems are composed of a mosaic of habitats that through the transfer of energy by biological, chemical, and physical processes define the ecosystem. The location and description of activities prohibited and allowed in each zone are defined in the Sanctuary regulations (see Appendix 1).

### *Sanctuary Marine Zones*

***Sanctuary Preservation Areas (SPA)*:** areas of the Sanctuary that encompass discrete, biologically important areas within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, to avoid concentrations of uses that could result in declines in species populations or habitat, to reduce conflicts between uses, to protect areas that are critical for sustaining important marine species or habitats, or to provide opportunities for scientific research.

***Ecological Reserves (ER)*:** areas of the Sanctuary consisting of contiguous, diverse habitats within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, intended to minimize human influences, to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and also to protect and preserve natural assemblages of habitats and species within the Sanctuary.

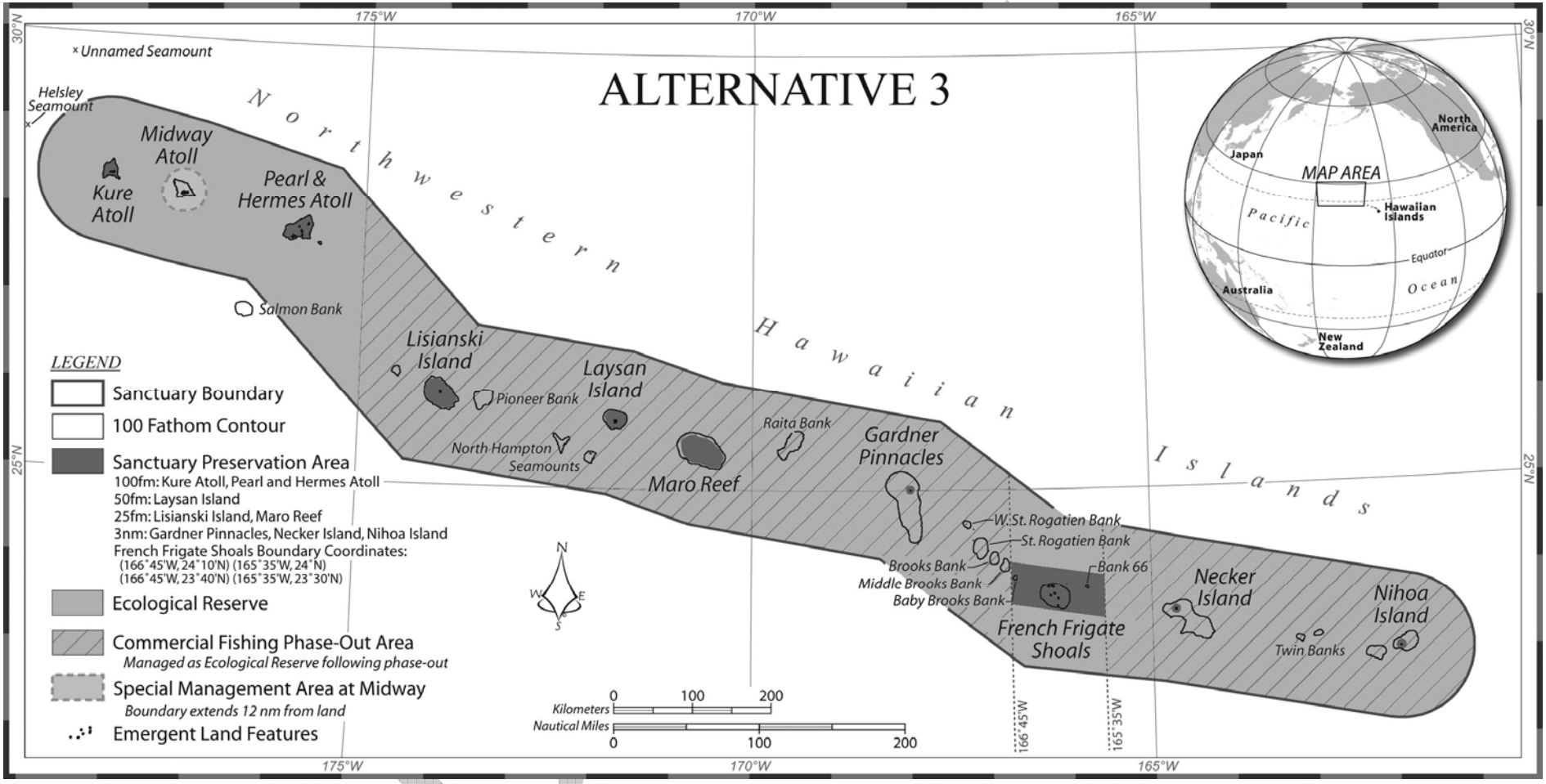
**Midway Atoll Special Management Area (SMA):** a 12 nautical mile area around Midway Atoll. The SMA will be managed to meet the goals and objectives of the proposed Sanctuary which complement and parallel the purposes for establishing Midway Atoll National Wildlife Refuge as defined in Executive Order 13022, and recognize and maintain the historic significance of the Midway Islands consistent with the policy stated in Executive Order 11593 of May 13, 1971, for the Protection and Enhancement of the Cultural Environment, and with Secretary's Order 3217 of September 13, 2000, which established the Battle of Midway National Memorial.

Zoning provides greater protection to highly sensitive habitats, particularly shallow coral reefs. Discrete, biologically important areas of the Sanctuary are designated as Sanctuary Preservation Areas (SPAs) and resource extraction, and almost all forms of discharges are prohibited. Other areas have been designated as Ecological Reserves (ERs), consisting of contiguous, diverse habitats that provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and to protect and preserve natural assemblages of habitats and species within areas representing a broad diversity of resources and habitats. Resource extraction is highly restricted within Ecological Reserves. In the Midway Atoll Special Management Area (SMA), permitted activities are subject to a compatibility determination by the Director of the U.S. Fish and Wildlife Service, to ensure that activities occurring within the waters surrounding Midway Atoll meet the goals and objectives of the Sanctuary and complement and parallel the purposes for establishing the Midway Atoll National Wildlife Refuge (MANWR). Recreational activities and sportfishing in the Sanctuary are restricted to the SMA.

All SPAs overlay the marine area covered by the State of Hawai'i NWHI Marine Refuge. Midway Atoll Special Management Area (SMA) is a 12-nautical mile zone within the Sanctuary. Midway Atoll abounds in natural and cultural resources, including more than 2 million seabirds, nearly pristine populations of apex marine predators, threatened and endangered species, and historic remnants of the Battle of Midway. These abundant resources were the impetus for creating the Midway Atoll National Wildlife Refuge in 1988, and the Battle of Midway National Memorial in 2000.

The SMA overlays the waters and submerged lands administered by the USFWS at the MANWR. The SMA will be managed to meet the goals and objectives of the proposed Sanctuary and would complement and parallel the following purposes for establishing the MNWR as defined in Executive Order 13022: (1) maintaining and restoring natural biological diversity within the refuge; (2) providing for the conservation and management of fish and wildlife and their habitats within the refuge; (3) fulfilling the international treaty obligations of the United States with respect to fish and wildlife; (4) providing opportunities for scientific research, environmental education, and compatible wildlife dependent recreational activities; and (5) in a manner compatible with refuge purposes, recognizing and maintaining the historic significance of the Midway Islands consistent with the policy stated in Executive Order 11593 of May 13, 1971, for the Protection and Enhancement of the Cultural Environment, and with Secretary's Order 3217 of September 13, 2000, which established the Battle of Midway National Memorial.

**Figure 2.2 Map of Sanctuary marine zones.**

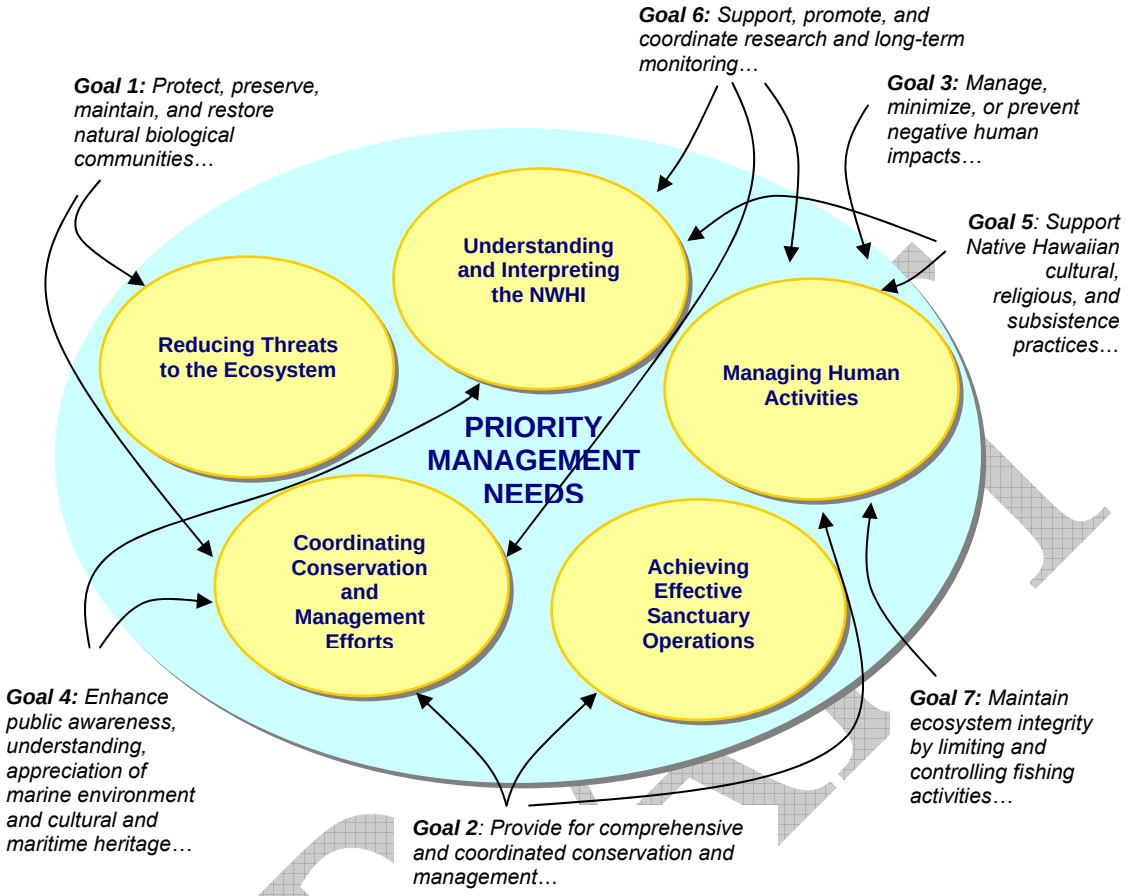


## Action Plans to Address Priority Management Needs

Action plans describe specific strategies to address priority management needs. Each action plan is guided by a desired outcome, specific need for action, and strategies and associated activities designed to achieve that need. Strategies and activities implement Sanctuary regulations, research and educational partnerships, monitoring and evaluation, and other activities programmed over a five-year period. Action plans are evaluated based on site performance measures and activity outputs.

Action plans address five priority management needs as the basis for considering the status of Sanctuary resources, multiple temporal and spatial scales of management issues, inputs from public scoping and workshops, and meetings conducted with managers, scientists and other stakeholders. Priority management needs define specific areas for focused action while addressing multiple Sanctuary goals and objectives. The primary linkages between priority management needs and Sanctuary goals are shown in Figure 2.3.

**Figure 2.3 Primary linkages between priority management needs and Sanctuary goals[1]**




1 - See complete text of goals and objectives in Table 2.2

## Understanding and Interpreting the NWHI

The NWHI represent a unique opportunity to advance our understanding of ecosystem science through research, monitoring, and the incorporation of traditional knowledge. In turn, coordinated research and long-term monitoring is needed to deepen our understanding of the composition, structure, and function of NWHI ecosystems and to provide the predictive tools to make informed management decisions consistent with the conservation and protection of the region. The establishment of a long-term monitoring program is needed to provide vital data and information necessary to monitor changes in ecosystem status over time and to evaluate the effectiveness of management measures in protecting ecosystem integrity. Characterization of Native Hawaiian cultural relationships to the NWHI, as well as oral histories, place names, and practices associated with the NWHI, enriches our understanding of the region. Additionally, traditional ecological knowledge and management practices can inform the Sanctuary's management approach. The physical record of past activities in the NWHI embodies unique aspects of island and Pacific maritime history. Study of historical and archaeological resources provide the basis for developing effective management for resources.

**Reducing Threats to the Ecosystem**

Despite their remote location, marine ecosystems of the NWHI are at risk from a range of threats from human activities within and outside the Sanctuary. Natural and anthropogenic threats to the Sanctuary include habitat alteration or damage from marine debris or storms, introduction of alien species from vessel traffic, and release of hazardous materials from vessel grounding. Development and implementation of threat reduction protocols and monitoring are needed to protect, preserve, maintain and, where appropriate, restore natural communities, including habitats, populations, native species, and ecological processes as a public trust for current and future generations.

**Managing Human Activities**

The NWHI has experienced a long history of human use with periods of over-exploitation that has resulted in the current endangered status of some marine species, including sea turtles and the Hawaiian monk seal. Although the extent of marine resource exploitation has been limited in recent years, human activities and use of Sanctuary resources must be carefully managed considering historical uses and new threats. Action plans for managing human activities address the need for permitting, enforcement, and managing specific human uses, including fishing, Native Hawaiian cultural practices, and ocean-related ecotourism.

**Action Plans for Coordinating Conservation and Management Efforts**

Comprehensive and coordinated conservation and management of the Sanctuary can only be achieved through effective interagency coordination and partnerships with a broad range of stakeholders. Interagency coordination between NOAA, USFWS, USCG, and the State of Hawai‘i, is needed to maintain existing resource protection measures, increase efficiency and effectiveness of enforcement and to reduce conflicts and overlaps in newly proposed Sanctuary management activities. Education and outreach efforts will require coordination between government agencies, nongovernmental organizations, and other stakeholder groups. Coordination with stakeholders and the public will provide a forum for advice and input on Sanctuary management and improve awareness and understanding of the ecological, Native Hawaiian cultural and maritime heritage significance of the NWHI. Coordination with international initiatives is needed to address Pacific regional and global management issues affecting the Sanctuary.

**Achieving Effective Sanctuary Operations**

Sanctuary operations include site and field operations, information management and overall program evaluation. Site and field operations are essential to support action plans to address all other priority management needs. Site operations are located in the main Hawaiian Islands and include support offices and interpretative facilities and information management facilities. Field operations include shipboard and research diving operations in the NWHI. Sanctuary staff and facilities provide essential operational capacity for effective collaboration between jurisdictional and other partners and outreach to all stakeholders. Operational effectiveness will be evaluated and improved through an adaptive management process that captures lessons learned and transforms them into action.

## 2.5 Toward an Ecosystem-based Management Approach

The first of NOAA's four mission goals is to "protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management" (NOAA 2004a). The G&O Statement for the Sanctuary reflects this goal and calls for the use of an ecosystem-based management approach to maintain ecosystem integrity. While there has been considerable discussion of the meaning of ecosystem-based management or ecosystem approaches to management, few practical examples exist, especially for marine ecosystems. The Sanctuary, working closely with its jurisdictional partners, the State of Hawai'i, the USFWS, NMFS, and other stakeholders, is committed to moving toward an ecosystem-based approach to management for the NWHI: A key activity of which is the convening of an Ecosystem Management Task Force (see the *Interagency Coordination Action Plan*). In order to be effective, such an approach requires that multiple steps be implemented in a comprehensive and integrated way; so concluded the recent Scientific Consensus Statement on Marine Ecosystem-based Management (McLeod et al. 2005). The Sanctuary approach is unique in that it includes each of the key actions recommended in the Statement:

- ecosystem level planning
- cross-jurisdictional management goals
- co-management
- adaptive management
- marine zoning
- habitat restoration
- long-term ocean and coastal observing, monitoring and research

These recommendations complement the Sanctuary Goals and Objectives Statement, which goes further to expand on the importance of Native Hawaiian traditional knowledge. This section introduces concepts and terms related to ecosystem-based approaches to management, traditional knowledge, scales of management, and adaptive management.

Sanctuary Ecosystem Definitions

**Ecosystem:** An ecosystem is a geographically specified system of organisms (including humans), the environment, and the processes that control its dynamics. (NOAA 2004a)

**Ecosystem Integrity:** A condition determined to be characteristic of an ecosystem that has the ability to maintain its function, structure, and abundance of natural resources, including rates of change in response to natural environmental variation and anthropogenic impacts.

**Ecosystem-based Management Approach for the NWHI:** Management that carefully considers impacts to all species and trophic interactions, including maintenance of biological communities and the protection of natural habitats, populations and ecological processes. The approach emphasizes the value of ecosystems and recognizes the importance of species interactions and conservation of habitats, and permits resource utilization in a manner that is consistent with the Sanctuary's primary goal of resource protection.

## Concepts and Terms

### Ecosystem

Over the last decade, considerable scientific discussion and debate has been devoted to developing an understanding of concepts and terms used to describe an ecosystem, ecosystem integrity, and ecosystem-based management. NOAA has defined an ecosystem as a geographically specified system of organisms, the environment, and the processes that control its dynamics, with humans as an integral part of the ecosystem (NOAA 2004a). Ecosystems are organized structurally into populations, species, and communities of organisms that interact with each other and with abiotic features of the environment and, functionally, into production and consumption components that process energy and materials (Limburg et al. 1986). Ecosystems vary in size often with smaller systems embedded within larger ones. Ecosystems have been described as moving targets with multiple potential futures that are uncertain and unpredictable (Walters 1986). The scale of ecosystems depends on the spatial extent of the system dynamics

that are to be studied and influenced by management (Sissenwine and Murawski 2004). Holling (1996) identifies four key features of ecosystem structure and function:

- Ecological change is episodic with slow accumulation of natural capital, such as biomass or nutrients, punctuated by sudden releases and reorganization of that capital
- Spatial attributes are patchy and discontinuous at all scales
- Ecosystems do not have a single equilibrium
- Policies and management that apply fixed rules for achieving constant yields, independent of scale, lead to ecosystems that gradually lose resilience

**Ecosystem Integrity**

Maintaining ecosystem integrity is often cited as the primary goal of ecosystem-based management. A system will retain its integrity if it preserves all its components, as well as the functional relationships among those components (De Leo and Levin 1997). Karr and Dudley (1981) define ecosystem integrity as the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having species composition, diversity, and functional organization comparable to that of natural habitats of the region. Kay (1991) described ecosystem integrity as the ability to maintain ecosystem function and structure in the face of changing environmental conditions; where environment refers to the biotic and external abiotic components which impact upon it, including humans. Considering the dynamic nature of ecosystems, the goal of ecosystem-based management should not be to eliminate all forms of disturbance, but rather to maintain processes within limits or ranges of variation that may be considered natural, historic, or acceptable (Noss 1995). Such an approach must be flexible, adaptive, and experimental at scales compatible with the scales of critical ecosystem functions (Walters 1986).

**Ecosystem-based management approach**

Recently, a scientific consensus statement described ecosystem-based management as an integrated approach to management that considers the entire ecosystem, including humans (McLeod et al. 2005). The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition for their intrinsic value as well as to provide the ecosystem services humans want and need. The consensus statement described key elements of ecosystem-based management:

- Protection of marine ecosystem structure and function
- Place-based management focusing on a specific ecosystem and the range of activities affecting it
- Explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between key species or services
- Integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences

Ecosystem-based management is an approach that recognizes the relationships and interconnectedness among living and non-living ecosystem components through interactions that are affected by a number of natural and anthropogenic factors that vary over space and time. This requires that managers have access to information about 1) baseline conditions, 2) the interactions among the components of the ecosystem, and 3) the consequences of natural

influences and individual and cumulative human activities. Availability of quality science to fill information needs, however, is only one aspect of ecosystem management. Native Hawaiian traditional ecological knowledge is also based on such an approach.

The management needs and social and economic context are critical to defining ecosystem-based management for each place. As an example, in the NWHI the value of the ecosystem is high and human uses are low in contrast to many more populated areas. For the NWHI, protecting the biological communities depends on cooperation of the community of agencies with jurisdictional responsibilities and the involvement of stakeholders. Therefore, an ecosystem-based approach for the NWHI must be concerned with coordinating and integrating fragmented management approaches traditionally taken by agencies under existing legislation and policy, and providing a forum for public discussion about such management.

## Native Hawaiian Resource Management

Ua lehulehu a manomano ka ʻikena a ka Hawaiʻi

*Great and numerous is the knowledge of the Hawaiians* (Pukui 1983)

There are many similarities between an ecosystem-based management approach for the Northwestern Hawaiian Islands and the traditional ecological knowledge and practices implemented by Native Hawaiians to manage their natural resources. Both approaches share the view of nature as a holistic and dynamic system of interrelated parts and emphasize the need for long-term sustainability and health of our ocean resources. Complimentary

**Some Basic Principles of Native Hawaiian Traditional Ecological Knowledge and Resource Management**

- *ʻOhana*-based (familial) and spiritual relationship between people and the natural environment
- *Kuleana* (responsibility) to *mālama* (care for) and *kūpale* (protect) elder siblings, who in turn provide for the younger
- Continuity and a complimentary dualistic relationship between land and sea
- Seasonal and lunar cycles forecast natural processes and help to determine activities
- Recognition of variations and common themes in ecological processes and practices from place to place
- Reliance on local knowledge and place-specific observations
- *Kapu* (restrictions/prohibitions) regulate planting, fishing, harvest, and other activities
- Adaptation and innovation based on new knowledge

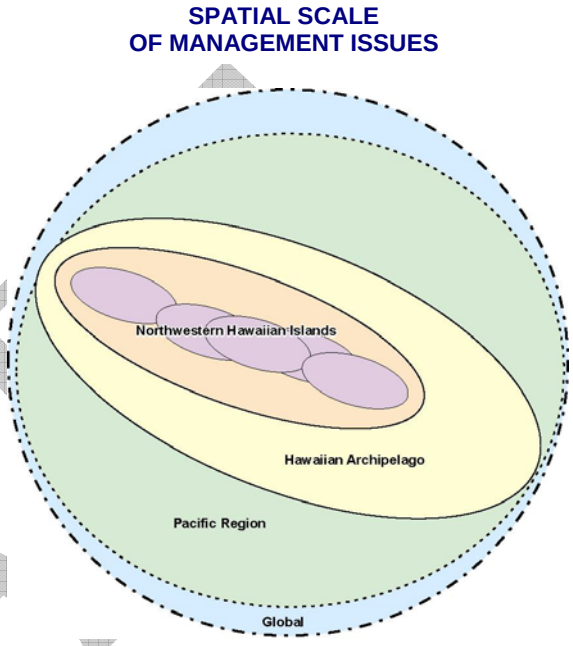
The Native Hawaiian traditional ecological knowledge and worldview is valued for its rich base of empirical knowledge and practical methods of resource management developed over hundreds years of living and interacting with the lands and ocean waters of Hawaiʻi (Titcomb and Pukui 1952; Kikuchi 1976; Titcomb et. al. 1978; Poepoe et. al 2003; Kikiloi 2003). Traditional management practices take advantage of understanding seasonal patterns in weather, growing patterns of biological species, and the designation of ecological zones (Handy et al. 1972; Kelly 1989; Gon 2003; DLNR 2003b).

Through detailed observations of the oceanic environment, its interrelation to the terrestrial environment, seasonal and lunar patterns, and species life cycles, species of the ocean and land realms were taxonomically partnered and systems for resource management developed (Kamakau 1976 , Malo 1951, Beckwith 1951). Restrictions to resource extraction (*kapu*) were implemented based on these ecological understandings (Pukui and Handy 1950; Handy et al.1972). Other traditional strategies were set up to naturally enhance marine resources through increased protection, growth, and reproduction (Kikiloi 2003). Understanding the Native Hawaiian worldview of ecosystems and relationships, along with traditional approaches to ocean

resource management, aids in moving toward an ecosystem-based management approach for the Northwestern Hawaiian Islands. These core principles include viewing ecosystems holistically, recognizing variations in space and time, and continuously building a knowledge base to inform management and successfully care for the environment. The perspective that Native Hawaiian traditional knowledge and resource management approaches bring to the Sanctuary can provide insight into ecosystems and relationships.

**Scales of management**

An ecosystem approach to management of the NWHI must address a range of spatial and temporal scales of ecosystem structure and function. The NWHI are composed of complex and interconnected shallow coral reef and deepwater bank ecosystems and, at the same time, are embedded in the Insular Pacific-Hawaiian Large Marine Ecosystem (Duda and Sherman 2002). Physical damage to coral reefs from marine debris is an existing, local issue requiring site-specific management measures, whereas the generation of marine debris (in particular, derelict fishing gear from distant fishing fleets) is a threat that must be addressed at the Pacific regional level.



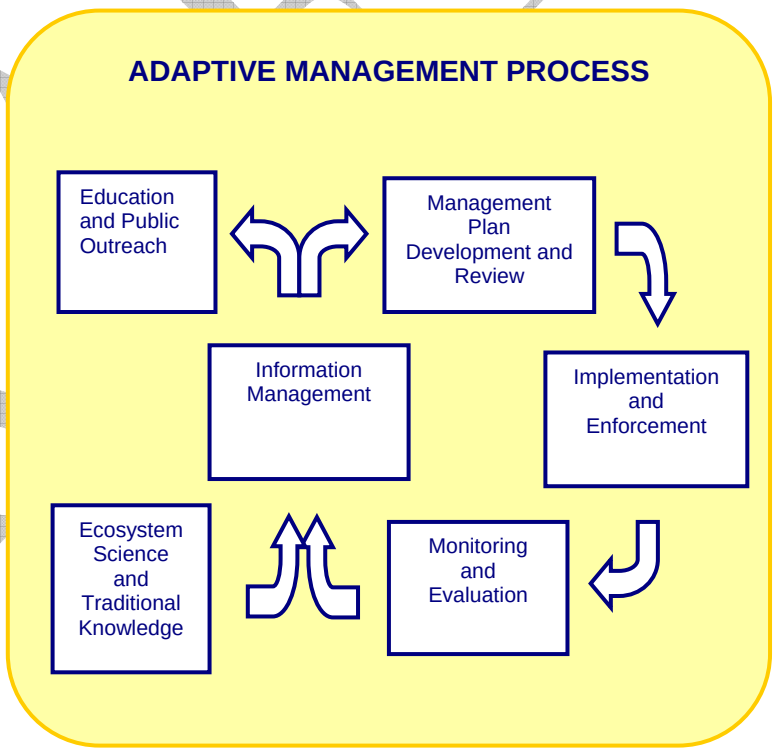

Decadal oscillations in oceanic productivity are a Pacific regional phenomenon influencing NWHI ecosystems. The spread of alien species from the main Hawaiian Islands to the NWHI is a threat that must be addressed at the level of the Hawaiian Archipelago and Pacific region. The current endangered status of the Hawaiian monk seal resulted largely from a historic condition of overexploitation during the late 1800s exacerbated by a range of other past and present conditions. Located at the northern extremes of coral reef growth, the NWHI are influenced by a complex and dynamic array of physical and biological forces that vary in time and space, such as decadal oscillations and physical oceanographic regimes that reflect a complex cycle of productivity and genetic connectivity that extends both within and beyond the Hawaiian Archipelago. Past and present problems, as well as future threats and uncertainties, represent a complex of temporal and spatial issues that must be considered in developing an ecosystem approach to management of the NWHI.

## Adaptive Management

**Adaptive management** is a process that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing management measures as tools **for learning. (CBC 2004)**

The Sanctuary provides a unique opportunity to take incremental and informed steps toward an ecosystem approach to management. The management framework serves as the basis for taking actions consistent with an ecosystem approach to management. The G&O Statement provides overarching policy direction and guidance for ecosystem-based management. Interagency collaboration and stakeholder partnerships and participation provide mechanisms for establishing cross-jurisdictional management goals needed for comprehensive and integrated management. Regulations establish a network of marine protected areas covering representative ecosystems. Action plans prioritize strategies to enhance ecosystem knowledge, to restore habitats, and to reduce threats from external influences. To progress consistently toward an ecosystem approach to management, new information and data must be used to inform and refine management strategies consistent with the G&O Statement for the Sanctuary.

Adaptive management is a learning process designed to inform management decision-making-based research, monitoring and evaluation. The adaptive management process includes the following phases: management plan development and review, implementation and enforcement, monitoring and evaluation, integration of ecosystem science and traditional knowledge, information management, and education and public outreach. Ecosystem science and traditional knowledge are inputs to the learning process together with the results of monitoring and evaluation. A comprehensive information management system facilitates the compilation of information and data from research, monitoring, facilitates plan review, education and public outreach.




### Management Plan Development and Review

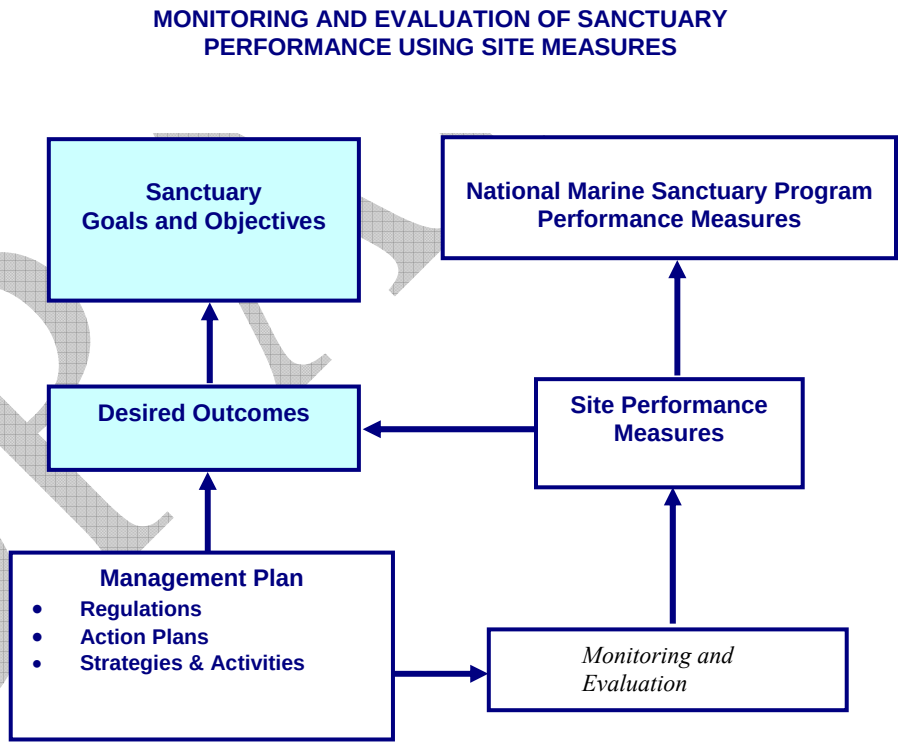
Management plan review is required every five years by the NMSA for all national marine sanctuaries to ensure that each site properly conserves and protects its living and cultural resources. The review represents an essential element of the adaptive management process and includes public scoping, characterization of issues and development of action plans, and preparation of draft and final management plans and relevant NEPA documentation.

This Sanctuary Management Plan was developed and finalized based on this process and represents the current state of knowledge on the most appropriate management measures. These management measures consist of regulations and action plans to govern the first five years of Sanctuary operations. Action plans will be implemented and, in the case of regulations, enforced through interagency collaborative mechanisms and based on the jurisdiction of each government agency. After five years, the Sanctuary management plan will be reviewed, incorporating lessons learned and new data and information from monitoring, ecosystem science and traditional knowledge, and a comprehensive evaluation to develop or refine management strategies and actions as required by the NMSA.

**Monitoring and Evaluation**

Monitoring and evaluation of Sanctuary performance is a vital component of the adaptive management process. It provides insights on the effectiveness of Sanctuary regulations and management strategies and activities, as well as progress toward achieving the goals and objectives of the Sanctuary. A comprehensive evaluation process is described in the *Evaluation Action Plan*.

The NMSP has defined a set of program-wide performance measures to guide the evaluation of Sanctuary management activities and to evaluate performance in the context of mandates set forth in the NMSA. See Table 3.5.4a in the *Evaluation Action Plan*. Specific Sanctuary site performance measures were developed to serve as indicators for both program performance and site performance. Site performance measures provide quantitative indicators of desired outcomes and will be used to evaluate the effectiveness of regulations, strategies and activities in achieving the goals and objectives of the Sanctuary.




Site measures include annual benchmarking, management capacity, and long-term outcome measures of Sanctuary performance. See Evaluation Action Plan Table 3.5.4b. All site measures will be used to evaluate Sanctuary performance over five years, and a State of the Sanctuary Report will be prepared to summarize the comprehensive evaluation conducted for the five-year management plan review. The relationship among the site measures, strategies, and desired outcomes is summarized for each priority management need in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.

Lalakea, whitetip reef shark at French Frigate Shoals.
Photo: James Watt

*In Hawaiian tradition, humans share a familial relationship with the rest of the natural world. ʻAumākua are family guardians that usually take the form of an animal. Some Hawaiian families have a manō, or shark, as their ʻaumākua. This familial, ancestral relationship requires Native Hawaiians to mālama (care for) the land and sea.*

# Action Plans to Address Priority Management Needs

# 3.0 Action Plans to Address Priority Management Needs

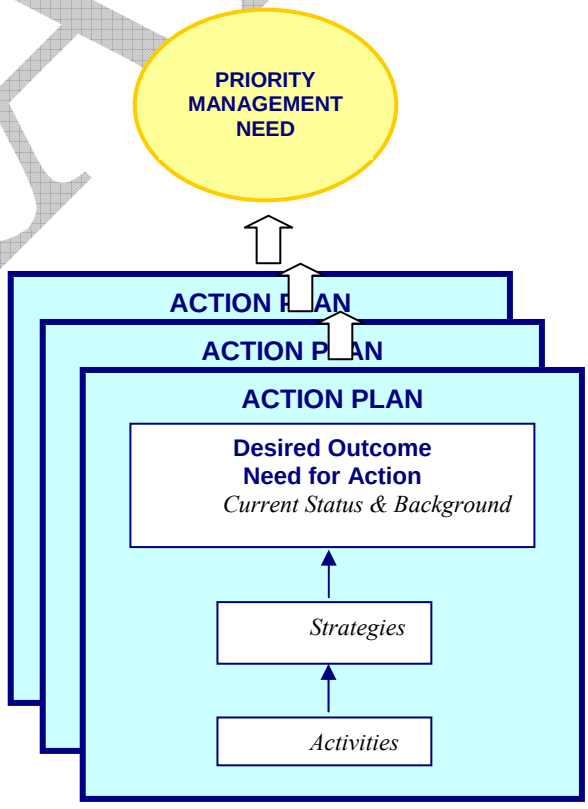
Five Priority Management Needs (PMN) and 22 Action Plans make up the core of the Sanctuary Management Plan. Priority management needs focus management efforts on improving our understanding of the NWHI, reducing threats to the ecosystem, managing human activities, facilitating collaboration and partnerships, and achieving effective Sanctuary operations. Action plans address specific issues related to each PMN. Together they are aimed at achieving long-term ecosystem protection in the NWHI. Action plans provide an organizational structure for implementing management strategies. Table 3.0 summarizes the action plans, the estimated annual cost for each action plan, and the estimated Sanctuary budget over the five-year implementation period.

**PRIORITY MANAGEMENT NEEDS**

- Understanding and Interpreting the NWHI
- Reducing Threats to the Ecosystem
- Managing Human Activities
- Coordinating Conservation and Management Activities
- Achieving Effective Sanctuary Operations

## Action Plans

Action plans were developed considering the current status and background of previous and ongoing actions by the Reserve and partner agencies, the status of Sanctuary resources, temporal and spatial scales of management issues, and inputs from jurisdictional partners and the Reserve Advisory Council and its subcommittees. The action plans are aimed at achieving a desired outcome. Each action plan describes the issue or management need, and why it is important, the context and history of the action plan's particular issue or management activity, and the strategies and activities planned for the Sanctuary over the next five years. Table 3.0 provides the estimated cost for each strategy and summary tables in the action plans illustrate the implementation timeline for each activity.




Each action plan is also connected to the Sanctuary's performance measures. These measures are utilized to evaluate Sanctuary performance and are linked to NMSP program-wide performance measures. Site performance measures are detailed in the *Evaluation Action Plan*. Tables linking strategies to performance measures are included in each of the five priority management need introductory sections.

**Table 3.0: Priority management needs, action plans, and estimated cost per year (in thousands of dollars)**

| Priority Management Needs | Action Plans | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Yr 5 |
|---|---|---|---|---|---|---|
| **Understanding & Interpreting the NWHI** | Ecosystem-level Characterization, Monitoring & Research* | | | | | |
| | Native Hawaiian Culture & History | | | | | |
| | Maritime Heritage | | | | | |
| **Reducing Threats to the Ecosystem** | Protected Species | | | | | |
| | Marine Debris* | | | | | |
| | Alien Species | | | | | |
| | Vessel Hazards | | | | | |
| | Emergency Response | | | | | |
| | Restoration | | | | | |
| **Managing Human Activities** | Permitting | | | | | |
| | Enforcement | | | | | |
| | Native Hawaiian Practices | | | | | |
| | Ocean-based Ecotourism & Recreation | | | | | |
| | Fishing | | | | | |
| **Coordinating Conservation & Management Efforts** | Interagency Coordination | | | | | |
| | Sanctuary Advisory Council | | | | | |
| | Native Hawaiian Community Involvement | | | | | |
| | Ocean Literacy & Constituency Building | | | | | |
| **Achieving Effective Sanctuary Operations** | Site Operations | | | | | |
| | Information Management | | | | | |
| | Coordinated Field Operations | | | | | |
| | Evaluation | | | | | |
| **Total Estimated Annual Costs**** | | | | | | |

*NOAA's Coral Reef Conservation Program (CRCP) funded activity. Includes projected funding to the Sanctuary and NMFS Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division (PIFSC CRED).
** NOAA, partnership, and outside funding contributions anticipated.

The action plans were developed to address both management issues and Sanctuary goals and objectives through an extensive collaborative process. Table 3.0.1 illustrates the links between the goals and objectives in each action plan strategy, as well as their relative implementation priority. The Reserve Operation Plan (ROP), finalized in 2005, provided a foundation for this management plan by implementing, continuing or expanding on ROP strategies and activities. Action plans in the ROP were largely based on functional management areas, in contrast to the action plans presented here which address specific management issues, such as alien species and managing human activities. *Appendix 3* draws together activities from across the action plans to illustrate how key functional areas ─ education, Native Hawaiian, and research ─ are implemented throughout the management plan to address management issues.

**Partnerships**

Many government agencies and nongovernmental organizations work in partnership to achieve Sanctuary goals and objectives. Implementation relies on resources and efforts from a variety of partners. Table 3.0.1 describes the extent to which each of the action plans and strategies can be implemented under three funding scenarios. Funding from both NOAA and other partners is considered in the ranking level of implementation. Table 3.0.2 illustrates the agencies and organizations the Sanctuary collaborates with for each action plan and the anticipated level of involvement of each group, ranging from integral involvement to consultation. Jurisdictional partners and other members of the Interagency Management Committee generally have a high level of involvement for most action plans; other governmental agencies and nongovernmental organizations also contribute to action plans at varying levels. As Sanctuary projects develop, more organizations will likely be involved. See *Section 2.2* and *3.4.1 Interagency Coordination Action Plan* for discussions on the importance of collaboration and partnerships to effective Sanctuary management.

**Estimated Annual Costs**

The Action Plans were designed to address the priority management needs and issues identified for the Sanctuary through an extensive consultation process which began with public scoping in April 2002. The projected costs for each Action Plan (Table 3.0) were based on the best estimate of the true cost of fully implementing each of the strategies and activities over a five-year period. Salary and non-salary costs were considered, based on 2005 and 2006 budgets, with small inflation and COLA increases built in over time. Estimated total costs peak in year four, when additional funding needs are anticipated to prepare for the Sanctuary's five-year management plan review and a field facility build-out.

The budget is meant to reflect the total cost of management in the NWHI, with the exception of the USFWS budget for managing the HINWR and MANWR. It incorporates current and expected collaboration with multiple partners, and anticipates funding from cross-cutting NOAA programs, partner agencies, and other organizations. Extensive collaboration efforts are expected to continue and expand in particular other areas where agency jurisdiction and responsibilities coincide, such as those for ecosystem-level characterization, monitoring and research, marine debris removal, alien species prevention, permitting, enforcement, information management, field operations, and education and outreach.

## Table 3.0.1: Action plan strategy implementation over five years under three funding scenarios and connection to Sanctuary Goals and Objectives

| **Implementation* with NOAA Funding**<br>1 – High<br>2 – Medium | **Implementation* with Partner Funding**<br>A – High<br>B – Medium | | | | |
|---|---|---|---|---|---|
| *Implementation ranking considers the priority of each strategy, as well as the percentage of activities that could be initiated, maintained, and/or completed under differing funding scenarios. Scenario 1: Level Funding; Scenario 2: Five percent per year increase; Scenario 3: Ten percent per year increase. | | | | | |
| **3.1 Understanding and Interpreting the NWHI Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.1.1 Ecosystem-based Characterization, Monitoring and Research** | | | | | |
| *ECMR-1 Assess and prioritize research and monitoring activities* | 1 A | 1 A | 1 A | Goal 6 | 6a |
| *ECMR-2 Conduct research that supports ecosystem-based management* | 1 A | 1 A | 1 A | Goal 6 | 6a |
| *ECMR-3 Conduct monitoring to understand ecosystem change over time* | 1 A | 1 A | 1 A | Goal 6 | 6a |
| *ECMR-4 Communicate results of research and monitoring* | 1 A | 2 A | 1 A | Goal 6 | 6f |
| **3.1.2 Native Hawaiian Culture and History** | | | | | |
| *NHCH-1 Support Native Hawaiian cultural and historical research* | 2 B | 2 B | 1 B | Goals 4, 5, 6 | 4d, 5c, 5d, 6a, 6e |
| *NHCH-2 Provide cultural outreach and educational opportunities to the Native Hawaiian community and the general public* | 2 B | 2 B | 1 B | Goals 4, 5 | 4d, 5d |
| **3.1.3 Maritime Heritage** | | | | | |
| *MH-1 Document and inventory maritime heritage resources* | 2 | 2 | 2 | Goal 6 | 6a |
| *MH-2 Incorporate maritime heritage into public education and outreach* | 2 | 2 | 2 | Goal 4 | 4b. 4c |
| *MH-3 Coordinate interagency efforts to protect maritime heritage resources* | 2 B | 2 B | 2 B | Goal 2 | 2a |
| **3.2 Reducing Threats to the Ecosystem Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.2.1 Protected Species** | | | | | |
| *PS-1 Coordinate with partners on protected species needs* | 1 | 1 | 1 | Goals 1 | 1a, 2a |
| *PS-2 Support and facilitate research on protected species* | 2 A | 2 A | 2 A | Goal 6 | 6a |
| **3.2.2 Marine Debris** | | | | | |
| *MD-1 Remove marine debris* | 1 A | 1 A | 1 A | Goals 1, 2 | 2c |
| *MD-2 Contribute to marine debris prevention efforts* | 2 B | 2 B | 2 B | Goal 1 | 1e |
| **3.2.3 Alien Species** | | | | | |
| *AS-1 Prevent, monitor and control alien species introductions* | 1 A | 1 A | 1 A | Goals 1, 2 | 1a, 1c, 2a |
| *AS-2 Engage Sanctuary users and the public in preventing the introduction and spread of alien species* | 1 A | 1 A | 1 A | Goal 1, 4 | 4c |
| *AS-3 Participate in statewide and Pacific regional alien species efforts* | 2 | 2 | 2 | Goal 1 | 1e |
| **3.2 Reducing Threats to the Ecosystem Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.2.4 Vessel Hazards** | | | | | |
| *VH-1 Address known vessel hazards and impacts* | 1 A | 1 A | 1 A | Goal 1 | 1a, 1c |

| **Implementation* with NOAA Funding**<br>1 – High<br>2 – Medium | **Implementation* with Partner Funding**<br>A – High<br>B – Medium | | | | |
|---|---|---|---|---|---|
| *Implementation ranking considers the priority of each strategy, as well as the percentage of activities that could be initiated, maintained, and/or completed under differing funding scenarios. Scenario 1: Level Funding; Scenario 2: Five percent per year increase; Scenario 3: Ten percent per year increase. | | | | | |
| *VH-2 Conduct research on vessel hazards and impacts* | 2 B | 1 A | 1 A | Goal 6 | 6a |
| **3.2.5 Emergency Response** | | | | | |
| *ER-1 Develop emergency response and assessment capacity* | 2 A | 2 A | 1 A | Goals 1, 6 | 6d |
| **3.2.6 Restoration** | | | | | |
| *R-1 Assess and support ecosystem restoration needs* | 2 A | 2 A | 2 A | Goal 1 | 1a |
| **3.3 Managing Human Activities Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.3.1 Permitting** | | | | | |
| *P-1 Develop and implement a coordinated permitting system* | 1 A | 1 A | 1 A | Goals 2, 3 | 2b-c, 3a-e |
| *P-2 Track and monitor permitted activities and their impacts* | 1 B | 1 B | 1 B | Goal 3 | 3d |
| *P-3 Coordinate outreach and education for Sanctuary permits and regulations* | 1 A | 1 A | 1 A | Goals 3, 4 | 4a-d |
| **3.3.2 Enforcement** | | | | | |
| *EN-1 Initiate an integrated surveillance and enforcement program* | 1 A | 1 A | 1 A | Goals 1, 3 | 1d |
| *EN-2 Implement NWHI Enforcement Workshop recommendations* | 1 A | 1 A | 1 A | Goal 1 | 1d |
| *EN-3 Develop and implement an interagency interpretive enforcement program* | 2 B | 2 B | 1 A | Goal 1 | 1d |
| **3.3.3 Native Hawaiian Practices** | | | | | |
| *NHP-1 Implement a permitting program for Native Hawaiian practices* | 1 | 1 | 1 | Goals 3, 5 | 3b, 5b |
| *NHP-2 Support Native Hawaiian practices* | 2 | 2 | 1 | Goals 3, 5 | 3b, 5b |
| **3.3.4 Ocean-based Ecotourism and Recreation** | | | | | |
| *OER-1 Develop a process to assess and manage recreation and ocean-based ecotourism activities* | 2 A | 2 A | 1 A | Goal 3 | 3a, 3e |
| **3.3.5 Fishing** | | | | | |
| *F-1 Prepare for closure of commercial fishing in the NWHI* | 1A | 1A | 1A | Goals 1, 6, 7 | 1a,1b,7e,7f |
| *F-2 Monitor and analyze non-commercial fishing data for management* | 1B | 1B | 1B | Goal 1, 7 | 6a, 7d |
| **3.4 Coordinating Conservation & Management Activities Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.4.1 Interagency Coordination** | | | | | |
| *IC-1 Establish and support cooperative management agreements with jurisdictional agency partners* | 1 A | 1 A | 1 A | Goal 2 | 2a, 2c |
| *IC-2 Develop and support interagency communication and collaboration* | 1 A | 1 A | 1 A | Goal 2 | 2a |
| **3.4 Coordinating Conservation & Management Activities Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.4.2 Sanctuary Advisory Council** | | | | | |
| *SAC-1 Support the Sanctuary Advisory Council* | 1 | 1 | 1 | Goal 2 | 2d |
| **3.4.3 Native Hawaiian Community Involvement** | | | | | |

| **Implementation* with NOAA Funding**<br>1 – High<br>2 – Medium | **Implementation* with Partner Funding**<br>A – High<br>B – Medium | | | | |
|---|---|---|---|---|---|
| *Implementation ranking considers the priority of each strategy, as well as the percentage of activities that could be initiated, maintained, and/or completed under differing funding scenarios. Scenario 1: Level Funding; Scenario 2: Five percent per year increase; Scenario 3: Ten percent per year increase. | | | | | |
| *NHCI-1 Involve the Native Hawaiian community* | 1 | 1 | 1 | Goals 2, 5 | 2d, 5a-d |
| *NHCI-2 Develop partnerships with Native Hawaiian organizations and institutions* | 2 | 2 | 1 | Goals 2, 5 | 2d, 5d |
| **3.4.4 Ocean Literacy and Constituency Building** | | | | | |
| *OLCB-1 Conduct outreach to increase ocean literacy and promote stewardship values* | 1 A | 1 A | 1 A | Goal 4 | 4a-d |
| *OLCB-2 Develop and implement educational programs to increase ocean literacy and promote stewardship values* | 2 B | 1 A | 1 A | Goal 4 | 4a-d |
| *OLCB-3 Develop new perspectives and tools for understanding the value of NWHI marine ecosystems* | 2 B | 1 A | 1 A | Goal 4 | 4b, 4d, 5d |
| **3.5 Achieving Effective Sanctuary Operations**<br>**Action Plans & Strategies** | **Level** | **+5%** | **+10%** | **Goal(s)** | **Objective(s)** |
| **3.5.1 Site Operations** | | | | | |
| *SO-1 Conduct annual site operations planning and implementation* | 1 | 1 | 1 | Goal 1 | 1a |
| *SO-2 Enhance human resource and organizational capacity* | 1 | 1 | 1 | Goal 1 | 1a |
| *SO-3 Maintain and enhance facilities* | 1 | 1 | 1 | Goal 1 | 1a |
| **3.5.2 Information Management** | | | | | |
| *IM-1 Develop and implement a system for handling NWHI data* | 1 A | 1 A | 1 A | Goal 6 | 6c, 6f |
| *IM-2 Facilitate appropriate access and use of NWHI-Information Management System* | 2 B | 2 B | 1 B | Goal 6 | 6f |
| **3.5.3 Coordinated Field Operations** | | | | | |
| *CFO-1 Conduct coordinated planning of field operations with partners* | 1 A | 1 A | 1 A | Goals 2, 6 | 2c, 6b, 6c |
| *CFO-2 Plan for the use of NOAA vessels and aircraft resources* | 2 | 1 | 1 | Goal 6 | 6b |
| *CFO-3 Support Sanctuary-related diving operations* | 2 | 1 | 1 | Goal 6 | 6b |
| **3.5.4 Evaluation** | | | | | |
| *EV-1 Implement a comprehensive evaluation process* | 1 | 1 | 1 | Goal 1 | 1a |

**Table 3.0.2 Partner Involvement in Action Plan Implementation**

| Priority Management Need | Action Plan | USFWS | State of Hawai'i | NOAA NMFS | US Coast Guard | University of Hawai'i | NGOs | Other Partner Agencies |
|---|---|---|---|---|---|---|---|---|
| Understanding & Interpreting the NWHI | Ecosystem-level Characterization, Monitoring & Research | ● | ● | ● | | ● | ⊙ | ● |
| | Native Hawaiian Culture & History | ⊙ | ⊙ | | | ● | ◉ | |
| | Maritime Heritage | ⊙ | ⊙ | ◉ | | | ⊙ | ◉ |
| Reducing Threats to the Ecosystem | Protected Species | ● | ● | ● | | | ◉ | ⊙ |
| | Marine Debris | ● | ● | ● | ● | ● | ◉ | ● |
| | Alien Species | ● | ● | ◉ | ● | ● | ◉ | ● |
| | Vessel Hazards | ● | ● | ◉ | ● | ● | | ● |
| | Emergency Response | ● | ● | ● | ● | | | ● |
| | Restoration | ● | ● | ◉ | ● | | | ◉ |
| Managing Human Activities | Permitting | ● | ● | ● | | | | ◉ |
| | Enforcement | ● | ● | ● | ● | | | ⊙ |
| | Native Hawaiian Practices | ● | ● | | | | ◉ | |
| | Ocean-based Ecotourism & Recreation | ● | ● | ◉ | | | ◉ | |
| | Fishing (not included) | ⊙ | ⊙ | ● | | | | |
| Coordinating Conservation & Management Efforts | Interagency Coordination | ● | ● | ● | ● | | | ● |
| | Sanctuary Advisory Council | ● | ● | ● | ● | | ● | ● |
| | Native Hawaiian Community Involvement | ◉ | ◉ | | | ● | ● | |
| | Ocean Literacy & Constituency Building | ● | ● | ● | | ● | ● | ● |
| Achieving Effective Sanctuary Operations | Site Operations | | | | | | | |
| | Information Management | ● | ◉ | ● | ◉ | ● | ● | ● |
| | Coordinated Field Operations | ● | ● | ● | ⊙ | ⊙ | | ● |
| | Evaluation | ◉ | ◉ | ◉ | ⊙ | | | |

Level of agency or organization involvement: ●= Essential; ◉= Involved; ⊙= Affiliated

1