

**2008 Papahānaumokuākea Marine National Monument
CONDITION REPORT
REVIEWERS AND AFFILIATIONS**

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The document that follows is a copy of the draft Papahānaumokuākea Marine National Monument Condition report. Reviewer comments are embedded.

Papahānaumokuākea Marine National Monument

Condition Report

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Comment [kb1]: The choice of the term "Condition Report" is wise since the assessment is made without prior baselines and no real quantitative measure of "health" of the coral reef ecosystem.

The report represents the information available after 5 years. There have been apparently very limited assessments of the resources in the Monument. Nevertheless, it does provide a baseline of sorts for the condition of the coral reef ecosystem in the Monument.

Comment [kb2]: General Comments from DAR (specific comments included in the text):

Well written and readable, but needs to be updated with information from the current draft of the State of Coral Reef Ecosystems Report.

All management action sections need to be updated to reflect the current Monument Management Plan

Data is often old and inaccurate

If this is a marine focused report, why is there so much terrestrial information?

Comment [kb3]: First, this is a good description of resource conditions in the Northwestern Hawaiian Islands without over-emphasizing management issues. It is clear that the NMSP staff have good a job putting many pieces of information together. So we are very pleased with that.

Second, the PIFSC comments have been merged from a number of reviewers. We have tried to limit editorial comments by focusing on content, although sometimes since we are editing within the text, we have not been totally restrained in that regard. We have allowed our reviewers to "speak" for themselves in most cases, so there is some difference in approach.

Third, we believe that the fishery sections could benefit from a quick review by Western Pacific Fishery Management Council staff since they tend to have the most holistic view of the factual basis of these fisheries and management measures. We have tried to be comprehensive but our staff tend to focus on one element or another. We would also recommend review by PIRO, even though this is primarily a science document.

Finally, quite by accident we failed to ask the PIFSC Protected Species Division to review this report. They now have a copy and will respond separately if possible.

We hope these comments are useful. Please feel free to contact us if you have questions. – Sam Pooley, PIFSC



Cover photo credits left to right:

Map: The bathymetric data shown on this map is from the 2-Minute gridded global relief data set, also known as ETOPO2 ver 2. Data and metadata may be obtained from: <http://www.ngdc.noaa.gov/mgg/fliers/06mgg01.html>

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Abstract

The Papahānaumokuākea Marine National Monument (the monument) is the single largest conservation area under the U.S. flag, and the largest marine conservation area in the world, encompassing 137,797 square miles of the Pacific Ocean - an area larger than all the country's national parks combined. Thanks to their isolation and past management efforts, the reefs of the Northwestern Hawaiian Islands are considered to be in near pristine condition. Home to the highly endangered Hawaiian monk seal, threatened green sea turtles, and high abundances of endemic species (found nowhere else on earth), the complex and highly productive marine ecosystems of the Northwestern Hawaiian Islands are major contributors to the biological diversity of the oceans. Due to the monument's remoteness and regulations that limit access, impacts from local human uses are relatively few. However, remnants of past activities, and impacts of human activities outside the monument constitute major threats to these ecosystems. Marine debris may be the most significant and immediate human-induced stressor on both the marine and terrestrial environments of the monument resulting in degradation of habitats and mammal entanglement. Other concerns for the monument include climate change and coral bleaching, diseases affecting marine organisms, and marine alien species that can threaten native biodiversity and degrade water quality.

Deleted: among the healthiest and most extensive in the world.

Comment [kb4]: Example? Reference?

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Despite past human uses such as military activities that have left behind contamination on many of the atolls, monument-wide water quality parameters suggest relatively good conditions, due primarily to the monument's remoteness and current regulations that limit access. Habitat structure has been impacted by derelict fishing gear, marine debris and coral bleaching. However, a majority of these habitats have not been significantly affected and are in good condition relative to the heavily impacted marine habitats of the main Hawaiian Islands. Most living resource populations in the monument are in good health, however monk seals, migratory shorebirds and resident seabirds are significantly decreasing. Other significant threats include potential manifestations of global climate change such as seawater acidification, rising sea surface temperatures, and rising sea levels.

Comment [kb5]: The use of the term "good health" may not be accurate. Perhaps, "appear to be in healthy condition" would be more accurate since assessments of reproductive output, etc. has not been made.

Comment [kb6]: What is the definition of good health?

Comment [kb7]: False or misleading statement. There is no indication of a general decline in all seabird populations; be specific, and ensure that the report agrees with statements in the Monument Management Plan

Comment [kb8]: Which?

Information regarding maritime archaeological resources is limited due to the size of the monument. However, known resources do not appear to be a threat to the environment, and there is very little human activity that may threaten the integrity of archaeological resources. The primary threat to these resources is their natural deterioration over time; little can be done to control or protect these resources from natural processes.

The monument management plan, soon to be released, recommends a number of management actions that will address these concerns.

Papahānaumokuākea Marine National Monument

- 137,797 square miles of land and ocean, the largest marine protected area in the world
- Designated by Presidential Executive Order in 2000 as a Coral Reef Ecosystem Reserve; subsequently designated by Presidential Proclamation as a Marine National Monument in 2006
- Among the few large-scale, intact, predator-dominated reef ecosystems left in the world
- High incidence of marine endemism due to the age of the islands and relative isolation from other coral reefs
- A rich cultural history of deep ties between Native Hawaiians and the land and ocean, on genealogical, cultural, and spiritual levels that remain today

Papahānaumokuākea Marine National Monument Condition Summary Table

Condition Summary: The results in the following table are a compilation of findings from the "State of Monument Resources" section of this report. (For further clarification of the questions posed in the table, please see Appendix A.)

Status:

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.
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Trends: ▲ Conditions appear to be improving.
 — Conditions do not appear to be changing.
 ▼ Conditions appear to be declining.
 ? Undetermined trend.
 N/A Question not applicable.

#	Questions/Resources	Rating	Basis for Judgment	Description of Findings	Monument Response
WATER					
1	Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality and how are they changing?	▼	Published literature indicates temperature increases (page 27)	Selected conditions may preclude full development of living resource assemblages and habitats, but are not likely to cause substantial or persistent declines.	Monitoring of physical and biological parameters to evaluate extent of the issue
2	What is the eutrophic condition of monument waters and how is it changing?	—	Lack of anthropogenic inputs (page 27)	Conditions do not appear to have the potential to negatively affect living resources or habitat quality.	Monument designation regulates access and requires reporting for on-going monitoring
3	Do sanctuary waters pose risks to human health and how are they changing?	—	Lack of sources, causes, and human exposure (page 27)	Conditions do not appear to have the potential to negatively affect human health.	No current issues
4	What are the levels of human activities that may influence water quality and how are they changing?	▲	Limited access; regulations prohibit discharges (page 28)	Few or no activities occur that are likely to negatively affect water quality.	Continuous evaluation of possible impacts of ship traffic
HABITAT					
5	What are the abundance and distribution of major habitat types and how are they changing?	▼	Marine debris is degrading beaches (page 29)	Selected habitat loss or alteration has taken place, precluding full development of living resources assemblages, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.	Active marine debris removal program and at-sea detection and removal to reduce accumulations
6	What is the condition of biologically-structured habitats and how is it changing?	▼	Marine debris; coral disease and perhaps bleaching frequency (page 29)	Selected habitat loss or alteration has taken place, precluding full development of living resources, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.	Supporting research to better understand the impacts. Development of best management practices to minimize transfer between sites.
7	What are the contaminant concentrations in monument habitats and how are they changing?	—	Localized contamination is adversely affecting associated habitat and wildlife (page 30)	Selected contaminants may preclude full development of living resource assemblages, but are not likely to cause substantial or persistent degradation.	No management response
8	What are the levels of human activities that may influence habitat quality and how are they changing?	—	Limited visitation (page 30)	Some potentially harmful activities exist, but they do not appear to have had a negative effect on habitat quality.	Rigorous permitting and monitoring of human activities to ensure limited cumulative effects

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Comment [kb9]: Add reference to potential loss of habitat from climate change and sea-level rise.

Comment [kb10]: Accumulation rate is not increasing. He also suggested the text changes.

#	Questions/Resources	Rating	Basis for Judgment	Description of Findings	Monument Response
LIVING RESOURCES					
9	What is the status of biodiversity and how is it changing?	—	Assessment/monitoring activities to date (page 33)	Biodiversity appears to reflect pristine or near-pristine conditions and promotes ecosystem integrity (full community development and function).	Continuing efforts to characterize biodiversity
10	What is the status of environmentally sustainable fishing and how is it changing?	▲	Limited activity; existing fishery to be phased out by June 2011 (page 33)	Extraction does not appear to affect ecosystem integrity (full community development and function).	Developing fisheries independent stock assessment methods that will be implemented post fishing cessation
11	What is the status of non-indigenous species and how is it changing?	?	Few species with isolated distributions; uncertainty of potential impact (page 33)	Non-indigenous species exist, precluding full community development and function, but are unlikely to cause substantial or persistent degradation of ecosystem integrity.	Prevention through hull inspections and cleaning and marine debris removal; monitoring programs documents distribution and abundance
12	What is the status of key species and how is it changing?	?	Monk seal and seabird decline; corals and predatory fish populations high and stable (page 33)	The reduced abundance of certain species may inhibit full community development and function, and may cause measurable but not severe degradation of ecosystem integrity; or selected key species are at reduced levels, but recovery is possible.	Mitigation efforts include predator removal and relocation to improve survivorship. Implementation of recovery plans for monk seals and ongoing research to understand foraging, diet and habitat.
13	What is the condition or health of key species and how is it changing?	?	Monk seal starvation and body condition; debris ingestion by seabirds; predatory fish and most corals in good condition and stable (page 33)	The diminished condition of selected key resources may cause a measurable but not severe reduction in ecological function, but recovery is possible.	Intense research and monitoring target at key endangered species
14	What are the levels of human activities that may influence living resource quality and how are they changing?	—	Limited visitation (page 33)	Some potentially harmful activities exist, but they do not appear to have had a negative effect on living resource quality.	Through regulated activities visitation is monitored to ensure that impacts are minimized
MARITIME ARCHAEOLOGICAL RESOURCES					
15	What is the integrity of known maritime archaeological resources and how is it changing?	▼	Natural deterioration (physical, biological and chemical) (page 34)	The diminished condition of selected archaeological resources has reduced, to some extent, their historical, scientific, or educational value, and may affect the eligibility of some sites for listing in the National Register of Historic Places.	Documentation of known sites. On going surveys to identify new sites
16	Do known maritime archaeological resources pose an environmental hazard and is this threat changing?	—	No known resources with hazardous cargos (page 34)	Known maritime archaeological resources pose few or no environmental threats.	Continued monitoring and exploration to locate potential threats.
17	What are the levels of human activities that may influence maritime archaeological resource quality and how are they changing?	▲	Few instances of resource removal or damage (page 35)	Few or no activities occur that are likely to negatively affect maritime archaeological resource integrity.	All activities are regulated by permits; known locations are protected by federal law; outreach and education increasing awareness of importance for protection

- Comment [kb11]: What about terrestrial prevention protocols
- Comment [kb13]: Change suggested by Pooley
- Deleted: selected
- Deleted: keystone
- Comment [kb12]: False or misleading statement. There is no indication of a general decline in all seabird populations; be specific, and ensure that the report agrees with statements in the Monument Management Plan
- Comment [kb14]: Terrestrial invertebrate diversity may be decreasing (Nysius)
- Comment [kb15]: If they are harmful, how can they have no impact?
- Comment [kb16]: What species are considered "key species" and how were they chosen?

About This Report

This report provides a summary of resources in the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service and the State of Hawaii's Papahānaumokuākea Marine National Monument, pressures on those resources, the current condition and trends, and management responses to the pressures that threaten the integrity of the marine environment. Specifically, this document includes information on the status and trends of water quality, habitat, living resources and maritime archaeological resources and the human activities that affect them. It presents responses to a set of questions posed to all sanctuaries and the monument (Appendix A). Resource status is rated on a scale from good to poor, and the timelines used for comparison vary from topic to topic. Trends in the status of resources are also reported, and are generally based on observed changes in status over the past five years, unless otherwise specified. Evaluations of status and trends were made by monument staff, based on interpretation of quantitative and, when necessary, non-quantitative assessments and observations of scientists, managers and users. In many cases, monument staff consulted outside experts familiar with the resources and with knowledge of previous and current scientific investigations. The ratings reflect the collective interpretation of the status of local issues of concern among monument program staff and outside experts based on their knowledge and perceptions of local problems, but the final ratings were determined by monument staff. Similar reports summarizing resource status and trends will be prepared for each marine sanctuary and the monument approximately every five years and updated as new information allows. This information is intended to help set the stage for management plan reviews at each site and to help sanctuary and monument staff identify monitoring, characterization and research priorities to address gaps, day-to-day information needs and new threats. This report has been peer-reviewed and complies with the White House Office of Management and Budget's peer review standards as outlined in the Final Information Quality Bulletin for Peer Review.

The Papahānaumokuākea Marine National Monument is located west north-west of Hawaii's main eight volcanic, high islands, and spans 1,200 miles of the Pacific Ocean.

Introduction

The National Marine Sanctuary Program manages marine areas in both nearshore and open ocean waters that range in size from less than one to almost 140,000 square miles. Each area has its own concerns and requirements for environmental monitoring. Nevertheless, ecosystem structure and function in all these areas have similarities and are influenced by common factors that interact in comparable ways. Furthermore, the human influences that affect the structure and function of these sites are similar in a number of ways. For these reasons, in 2001 the program began to implement System-Wide Monitoring (SWIM). The monitoring framework (National Marine Sanctuary Program, 2004) facilitates the development of effective, ecosystem-based monitoring programs that address management information needs using a design process that can be applied in a consistent way at multiple spatial scales and to multiple resource types. It identifies four primary components common among marine ecosystems: water, habitats, living resources, and maritime archaeological resources.

By assuming that a common marine ecosystem framework can be applied to all places, the National Marine Sanctuary Program developed a series of questions that are posed to every sanctuary and the monument and used as evaluation criteria to assess resource condition and trends. The questions, which are shown on page iii and explained in Appendix A, are derived from both a generalized ecosystem framework and from the National Marine Sanctuary Program's mission. They are widely applicable across the system of areas managed by the sanctuary program and provide a tool with which the program can measure its progress toward maintaining and improving natural and archaeological resource quality throughout the system.

Site History and Resources

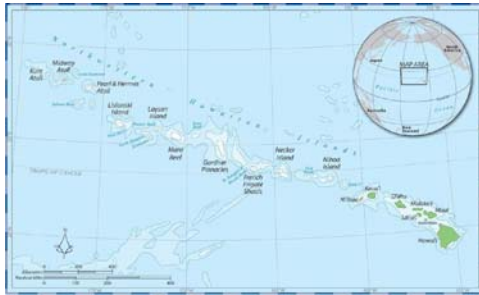
The expansive ecosystems of the Northwestern Hawaiian Islands are among the few large-scale, intact, predator-dominated reef ecosystems left in the world, and one of the most remote. The area is comprised of small islands, islets, and atolls and a complex array of shallow coral reefs, deepwater slopes, banks, seamounts, and abyssal and pelagic oceanic ecosystems supporting a diversity of marine life, 25 percent of which are endemic to the Hawaiian Archipelago. The coral reefs of the Northwestern Hawaiian Islands are the foundation of an ecosystem that hosts a distinctive assemblage of marine mammals, fish, sea turtles, birds, algae, and invertebrates, including species that are rare, threatened, endangered or have special legal protection status. The Census of Coral Reefs (2006) and NWHIRAMP expeditions (between 2000 and 2006) revealed many previously unreported and undescribed species of reef invertebrates and corals, evidence that the reefs within the monument have not been sufficiently explored and surveyed. Additional explorations and analyses are needed to adequately characterize and document rare habitats and species, especially vulnerable endemic species that may require special management.

Comment [kb17]: This statement is always made but how many large-scale, intact, predator-dominated reef ecosystems are left?

Comment [kb18]: This estimate varies, please include citation.

http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf
<http://www.hawaiiireef.noaa.gov/management/mp.html>

Comment [kb19]: Should this be an actual citation in the text?



Hawaiian Archipelago including the Northwestern Hawaiian Islands (Nihoa Island to Kure Atoll) and Main Hawaiian Islands (Islands of Hawaii to Kauai). Inset shows the Hawaiian Archipelago in the Pacific Ocean. (Map: Papahānaumokuākea monument)

Location

A vast, remote, and largely uninhabited marine region, the monument encompasses an area of 137,797 square miles of Pacific Ocean in the northwestern extent of the Hawaiian Archipelago. The monument is comprised of all lands, including emergent and submerged lands and waters of the Northwestern Hawaiian Islands and is approximately 1,382 miles long and 100 miles wide. The area includes the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, the Midway Atoll National Wildlife Refuge/Battle of Midway National Memorial, the Hawaiian Islands National Wildlife Refuge, Kure Atoll Wildlife Sanctuary and the State of Hawaii Northwestern Hawaiian Islands Marine Refuge.

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<http://www.hawaiiireef.noaa.gov/management/mp.html>
http://hawaiiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Designation

In 2000, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was established by Presidential Executive Order with a mission to carry out coordinated and integrated management to achieve the primary purpose of strong and long-term protection of the marine ecosystems in their natural condition, as well as the perpetuation of Native Hawaiian cultural practices and the conservation of heritage resources of the Northwestern Hawaiian Islands. The Executive Orders that created the reserve in 2000 also initiated a process to designate the waters of the Northwestern Hawaiian Islands as a federal national marine sanctuary. In 2006, after substantial public comment in support of strong protections for the area, President George W. Bush signed a proclamation creating the Northwestern Hawaiian Islands Marine National Monument. The president's actions afforded the Northwestern Hawaiian Islands our nation's highest form of marine environmental protection. Subsequently, through an initiative put forth by the Northwestern Hawaiian Islands Native Hawaiian Cultural Working Group, the monument was given the Hawaiian name, the Papahānaumokuākea Marine National Monument in March 2007. The monument is co-managed by the Department of the Interior's U.S. Fish and Wildlife Service, the Department of Commerce's National Oceanic and

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Atmospheric Administration (NOAA), and the State of Hawai'i, and is now the single largest conservation area under the U.S. flag, and the largest marine conservation area in the world.

Deleted: in close coordination with

- <http://www.hawaiireef.noaa.gov/management/mp.htm>
- http://hawaiireef.noaa.gov/PDFs/Citizens_Guide_Web.pdf
- <http://hawaiireef.noaa.gov/about/welcome.html>

Early Settlement and Discovery

One of the most remarkable feats of open-ocean voyaging and settlement in all of human history was the movement of ancestral Oceanic people across the vast Pacific Ocean. In the Hawaiian Archipelago, the northwestern region contained the most peripheral islands that relied heavily on interaction and networking between core islands (the main Hawaiian Islands) as a social mechanism to help reduce the possibility of extinction of their geographically isolated populations.

Comment [kb20]: Reference?



Stones placed several hundred years ago by Polynesian visitors at Mokumanamana, or Necker Island, for spiritual or navigational purposes.

The Northwestern Hawaiian Islands were explored, colonized, and in some cases, permanently settled by Native Hawaiians in pre-contact times. Nihoa and Necker Island (Mokumanamana), the islands closest to the main Hawaiian Islands, have archaeological sites with agricultural, religious, and habitation features. Based on radiocarbon data, it has been estimated that Nihoa and Necker Islands could have been inhabited from 1000 A.D. to 1700 A. D.

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- http://www.coris.noaa.gov/about/eco_essays/nwhi/history.html

Though Hawaiian traditions retained the names of a handful of islands in the Northwestern chain, regular contact had long ceased by the time Captain Cook's two ships made the first European contact with the Hawaiian islands in 1778. Later, many of the reefs and atolls in the Northwestern Hawaiian Islands were rediscovered by westerners in the 1800's either intentionally or when ships ran aground. Some of the locations, such as Maro Reef, Laysan Island, and Pearl and Hermes Atoll, received their historic names from the vessels themselves.

Comment [kb21]: ? We know what this means but how many people outside of Hawaii will?

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Comment [kb22]: References added to the Geology section
Clague DA (1996) The growth and subsidence of the Hawaiian-Emperor volcanic chain. In: Keast A, Miller SD (eds) The origin and evolution of the Pacific Island biotas, New Guinea to eastern Polynesia: patterns and processes. SPB Academic Publishing, Amsterdam, pp 35-50

- <http://www.bishopmuseum.org/research/nwhi/history.htm>

Referred to as the Kūpuna (elder) Islands, the Northwestern Hawaiian Islands are ceded lands and extremely important to the Native Hawaiian people. They hold rich cultural resources that inform us about the origins of Hawai'i's first people, and hold great significance in Native Hawaiian culture and history. Myth and culture join in ancient oli (chant) and mele (song) telling of the fire goddess Pele and her family traversing the Northwestern Hawaiian Islands and stopping at Mokumanamana on their way to the main Hawaiian Islands.

Sharp WD, Clague DA (2006) 50-Ma initiation of Hawaii-Emperor bend records major change in Pacific plate motion. Science 313:1281-1284

- http://hawaiireef.noaa.gov/PDFs/Final_ROP.pdf

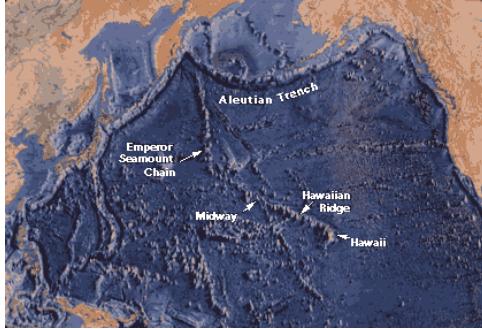
Geology

Over the past 70 million years or more, the combined processes of magma formation, volcano eruption and growth, and continued movement of the Pacific Plate over a magmatic "hotspot" have left a long trail of volcanoes across the Pacific Ocean floor. The Hawaiian Ridge-Emperor Seamount chain extends 3,728 miles from the "Big Island" of Hawai'i to the Aleutian and Kamchatka trenches off Alaska and Siberia respectively. The Hawaiian Islands themselves are a very small part of the chain

Wessel P, Harada Y, Kroenke LW (2006) Towards a self-consistent, high-resolution absolute plate motion model for the Pacific. Geochemistry, Geophysics, Geosystems 7. 7, Q03L12, doi:10.1029/2005GC001000

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and are the youngest islands in the immense, mostly submarine mountain chain composed of more than 80 volcanoes of at least 129 volcanoes (Claque, 1996).



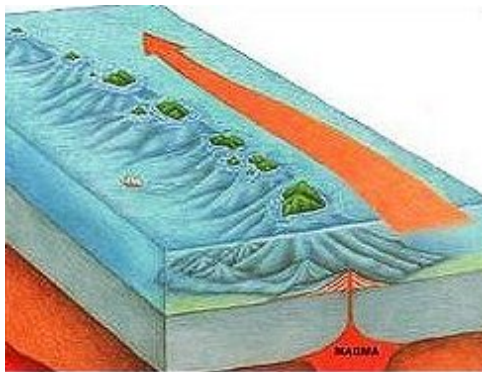
Map of part of the Pacific basin showing the volcanic trail of the Hawaiian hotspot-- 6,000-km-long Hawaiian Ridge-Emperor Seamounts chain. (Base map reprinted by permission from World Ocean Floor by Bruce C. Heezen and Marie Tharp, Copyright 1977.)

A sharp bend in the chain indicates that the motion of the Pacific Plate abruptly changed about 43 million years ago, as it took a more westerly turn from its earlier northerly direction. The formation of the bend coincides with a major reorganization of northern Pacific seafloor spreading centers and the initiation of subduction at the Mariana arc-trench system (Sharp and Claque, 2006).

As the Pacific Plate continues to move west-northwest, the Island of Hawai'i will be carried beyond the hotspot by plate motion, setting the stage for the formation of a new volcanic island in its place. In fact, this process may currently be under way. Loihi Seamount, an active submarine volcano, is forming about 22 miles off the southern coast of Hawai'i. Loihi already has risen about 2 miles above the ocean floor to within 1 mile of the ocean surface. According to the hotspot theory, assuming Loihi continues to grow, it will become the next island in the Hawaiian chain. In the geologic future, Loihi may eventually become fused with the Island of Hawai'i, which itself is composed of five volcanoes knitted together: Kohala, Mauna Kea, Hualalai, Mauna Loa, and Kilauea.

Deleted: Why the Pacific Plate changed direction is not known, but the change may be related in some way to the collision of India into the Asian continent, which began about the same time.¶

<http://pubs.usgs.gov/gip/dynamic/Hawaiian.html>



The Pacific plate slowly moves over the Hawaiian hotspot to the northwest, at an average rate of 9.5 cm/yr since Kure was formed approximately 30 million years ago (Wessel et al., 2006). The area directly over the hotspot is volcanically active. The activity decreases and eventually stops as the plate moves on. The result is the Hawaiian Island chain. (Diagram: U.S. Geological Survey). The balance of recent evidence (plate kinematics and a revised age of the H-E bend of ~50 Ma) suggests that the hotspot has not migrated over time and that paleomagnetic evidence of "plume wander" may be explained by true polar wander.

Comment [s23]: Contact me (john.rooney@noaa.gov) if you like for more information and references). Instead you could say, "On average, the frequency of volcano formation has approximately doubled and the spacing between them has decreased by roughly a third over the approximately 50 million year history of the Hawaiian chain."

The Northwestern Hawaiian Islands constitute the northwest three-fourths of the vast chain of the Hawaiian Archipelago. Moving northwest from the main Hawaiian Islands, this stretch of emergent lands is characterized as small rocky islands, banks, atolls, coral islands and reefs, which become progressively older and generally smaller. The reefs are some of the healthiest and least

Deleted: Geologists have long assumed that the Hawaiian hotspot was stationary. However, current research suggests that it actually drifted southward between 47 and 81 million years ago. <http://news-service.stanford.edu/news/2003/august6/seamount-86.html>¶

disturbed coral reefs remaining and comprise possibly the last large-scale, predator-dominated coral reef ecosystem on the planet. Over millennia, invertebrate animals and algae have constructed massive structures in the shallow seas. Coral animals, bonded to basalt from ancient volcanoes, secreted skeletons of calcium carbonate that formed the substance of which reefs are built. The basaltic islands eventually eroded away and subsided under their massive weight. However, the upward growth of the coral reefs kept pace with the gradual sinking of the volcanic remnants, creating shallow reefs that rise to the surface of the ocean but no further. The reefs and atolls we see today represent the “footprints” of former high volcanic islands. The remote locale of the reefs of the Northwestern Hawaiian Islands made it difficult for reef species from the central tropical Pacific to successfully disperse and become established. These long periods of isolation for the survivors led to the evolution of species distinct from those that evolved independently on the host reefs, resulting in the highest levels of marine endemism recorded for a large archipelago in the world. Surveys and explorations to date have yet to adequately characterize the actual degree of endemism in the Northwestern Hawaiian Islands, especially for reef invertebrates, corals and algae, many of which possess limited dispersal capacities.

Comment [kb24]: since the estimate for endemism among marine organisms in Hawai'i varies, the report should cite the reference used in this analysis.

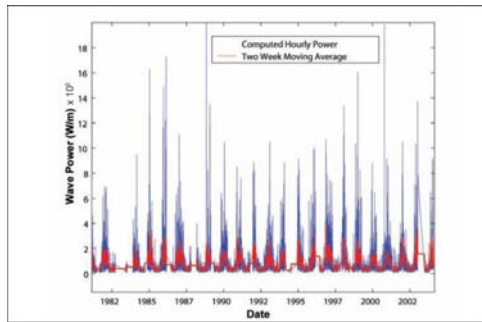
Comment [kb25]: How can you say this when the dispersal capacity for many of these organisms haven't been determined? Nevertheless, what few bits of information we do have does indicate limited dispersal for reef invertebrates.

http://hawaiireef.noaa.gov/PDFs/Final_ROP.pdf
<http://hawaiireef.noaa.gov/about/welcome.html>

Water: Oceanographic Conditions

Ocean currents transport and distribute larvae among and between different atolls, islands, and submerged banks of the Northwestern Hawaiian Islands, and also provide the mechanism by which species are distributed to and from the main Hawaiian Islands, as well as far distant regions. Upper ocean currents in the Northwestern Hawaiian Islands are highly variable in both speed and direction, being dominated by eddy variability. Averaged over time, the resultant mean flow of the surface waters tends to flow predominantly from east to west in response to the prevailing northeast tradewinds (Firing et al., 2004a).

Significant wave events vary over interannual (between year) and decadal time scales, which can also determine distributions of species of corals and algae, and their associated fish and invertebrate assemblages. Interannually, some years experience greater or lesser amounts of cumulative wave energy or numbers of extreme wave events than other years. This apparent decadal variability of wave power is possibly related to well-documented Pacific Decadal Oscillation (PDO) events, which are a mode of North Pacific climate variability at multi-decadal time scales that has widespread climate and ecosystem impacts (Mantua et al., 1997).



Time series of wave power computed from wave data from NOAA Buoy #51001 located near Nihoa Island in the Northwestern Hawaiian Islands. Data courtesy of NOAA Data Buoy Center. (Source: Brainard 2004).

The coral reefs of the Northwestern Hawaiian Islands are exposed to large seasonal temperature fluctuations, particularly Kure, Midway, and Pearl and Hermes Atolls at the northwestern end of the archipelago. Sea surface temperatures at these northerly atolls range from less than 18°C in late winter of some years (17°C in 1997) to highs exceeding 28°C in the late summer months of some years (29°C in 2002). Compared with most reef ecosystems around the globe, these fluctuations are extremely high. While the summer temperatures are generally similar along the entire Northwestern Hawaiian Islands chain, the winter temperatures tend to be 3-7°C cooler at the northerly atolls than at the southerly islands and banks as the subtropical front migrates southward.

Satellite observations reveal a significant chlorophyll front associated with the subtropical front, with high chlorophyll north of the front and oligotrophic waters south of the front. These observations reveal significant seasonal and interannual migrations of the front northward during the summer months and southward during the winter months (Seki et al., 2002). The southward migration

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| of the subtropical front generally brings these high chlorophyll waters into the northern portions of the Northwestern Hawaiian Islands. During some years, these winter migrations of the subtropical front extend southward to include the southern end of the Northwestern Hawaiian Islands. Additional evidence suggests decadal scale movements in the southward extent of the subtropical front.

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http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

Habitat

The monument is comprised of a complex array of reef, slope, bank, seamount, abyssal and pelagic marine environments. The healthy and extensive shallow-water coral reefs encompass over 4,450 square miles of shallow-water coral reef habitat, or about 65 percent of all shallow-water coral reefs in U.S. waters. Pearl and Hermes Atoll, French Frigate Shoals, Maro Reef, and Lisianski Island have the most extensive near-shore reefs. Gardner Pinnacles, Lisianski Island, Maro Reef, and Necker Island have the most extensive shallow-water bank areas.

Comment [kb26]: Citation needed.

http://oceanservice.noaa.gov/websites/retiredsites/sotc_pdf/CRF.PDF



Table corals, such as these *Acropora* are common throughout the tropical Pacific and at French Frigate Shoals, but absent in the main Hawaiian Islands.
(Photo: James Watt)

Within the Northwestern Hawaiian Islands, the reefs differ in coral cover and species organization. Differences in the amount of coral cover within the Northwestern Hawaiian Islands are the result of natural variations between fringing reefs and atolls, and variations in latitude. This vast, shallow-water coral reef ecosystem supports a dynamic system of marine species. Up to 25% of the shallow-water organisms found in the Hawaiian Islands are endemic, or found nowhere else on earth. It has been hypothesized that the Northwestern Hawaiian Islands act as stepping stones and reservoirs for organisms found in the main Hawaiian Islands, just as their predecessors in the Emperor Seamounts served as the stepping stones for the Northwestern Hawaiian Islands.

http://ccma.nos.noaa.gov/products/coast/pdf/Atlas_sec1.pdf

The monument is also comprised of a unique system of terrestrial environments. Many of the Northwestern Hawaiian Islands islets and atolls have been relatively untouched by humans. Nihoa Island is one of the most biologically pristine islands in the Pacific, and probably most closely represents the original island appearance and native species found before humans arrived in the Hawaiian Islands although recent infestations of alien grasshoppers periodically threaten the vegetation and other terrestrial wildlife. Many of the islands provide breeding sites for numerous central Pacific seabirds that nest in burrows and cliffs, on the ground, and in trees and shrubs. For some species, these tiny specks of land provide their only breeding site.

http://hawaiiireef.noaa.gov/PDFs/Citizens_Guide_Web.pdf

Living Resources

The coral reefs of the Northwestern Hawaiian Islands are inhabited by as least 70 species of stony coral, nine species of soft coral, and one species of anemone for a presently recognized total of about 80 species. More thorough and systematic explorations will likely add to these totals. This diversity and species richness now exceeds that of the main Hawaiian Islands. Indeed, the Northwestern Hawaiian Islands host an exceptionally high number of endemic corals and algae (Maragos 2004).

Comment [kb27]: The draft State of the Reef Report lists 80 species of stony coral

The Northwestern Hawaiian Islands ecosystems play an important role in supporting a host of marine mammals. Hawaiian monk seals, and Hawaiian spinner and bottlenose dolphins are resident species that occur within these ecosystems during the entire year. Transient species such as spotted dolphins, humpback whales, and numerous other cetaceans occur seasonally within the monument.



Hawaiian monk seals are the second most endangered marine mammal in the world, only behind its close relative the Mediterranean monk seal. (Photo: James Watt)

The endemic Hawaiian monk seal, the most endangered marine mammal in the United States, is the only seal dependent upon coral reefs for its existence. The first range-wide beach counts of monk seals occurred in the late 1950's. Due to a fifty percent decline discovered in beach counts, the Hawaiian monk seal was listed as endangered throughout its range in 1976. NOAA Fisheries designated critical habitat for the Hawaiian monk seal from shore out to 20 fathoms in ten areas of the Northwestern Hawaiian Islands in May 1988. Since that time additional research has indicated that the seals also forage in very deep waters on offshore banks and seamounts. In recent years the seal population continues to decline. Currently, the mean number of seals older than pups observed in beach counts is about 375 seals. An estimated 1,200 to 1,300 animals remain throughout the island chain.

Comment [kb28]: Throughout?

Comment [kb29]: Reference?

The Northwestern Hawaiian Islands are an important nesting habitat for the threatened green sea turtle, which occupies three habitat types: open beaches, open sea, and feeding and sleeping grounds in shallow, protected waters. Eastern Island at French Frigate Shoals alone accounts for more than 80% of the nesting population for the entire archipelago. Upon hatching, the young turtles gradually crawl from the beach and swim over shallow reef areas and extensive shoal areas to the open ocean. When their shells grow 8-10 inches long, they move to shallow feeding grounds over coral reefs and rocky bottoms. Age at sexual maturity is estimated at 20-50 years. While the green sea turtle is a resident species, the endangered leatherback, the endangered olive ridley, and the threatened loggerhead sea turtles are considered transient species that occur seasonally in this expansive area. The endangered hawksbill turtle is also a resident in Hawaii, with small nesting populations near the southeast end of the archipelago and with feeding populations throughout the islands.

<http://www.nmfs.noaa.gov/pr/species/turtles/green.htm>



In Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. Their primary nesting site is at French Frigate Shoals. (Photo: Ursula Keuper-Bennett/Peter Bennett)

The Northwestern Hawaiian Islands support numerous species of unique marine, reef, and shore fish and invertebrates that are also found in geographically distant ecosystems. It is believed that the Northwestern Hawaiian Islands provide a bridge to these

ecosystems via associated seamounts and the island groups adjacent to them. Some fish species commonly found on the reefs, such as the slingjaw wrasse, the masked angelfish, and the knifejaw are rare elsewhere in the archipelago. The total number of species in the region is unknown, but initial sampling indicates the presence of approximately 260 fish species at Midway alone.

Comment [kb30]: The current estimate for the total number of species in the marine environment of the Northwestern Hawaiian Islands is likely an underestimate. The report correctly states that there is a real need for a biodiversity assessment for the Hawaiian Archipelago.

Structurally, apex predators, such as sharks and jacks, dominate fish communities on the reefs. In addition, abundance and biomass estimates indicate that the reef community is characterized by fewer herbivores, such as surgeonfishes, and more carnivores, such as damselfishes, goatfishes, and scorpionfishes. The value of these exquisite reef communities extends beyond the intrinsic; they also have the potential to hedge against fisheries collapses in the main Hawaiian Islands by potentially providing sources of recruits and propagules.

The Northwestern Hawaiian Islands are home to millions of seabirds, many of which rely on the coral reef ecosystems for food and other habitat needs and has been the largest seabird rookery under unified management in the Pacific and perhaps the world. Four endangered endemic bird species, which are not seabirds (Laysan duck, Laysan finch, Nihoa finch, and Nihoa millerbird), breed on the islands, along with approximately 14 million seabirds of 18 species.

The coral reefs of the Northwestern Hawaiian Islands support diverse communities of benthic macroinvertebrates. Mollusks, crustaceans, and echinoderms dominate the non-coral invertebrate fauna in the Northwestern Hawaiian Islands, which is typical for most coral reef communities. These cryptic fauna are more abundant in the Northwestern Hawaiian Islands than the main Hawaiian Islands, although remote locations of the main Hawaiian Islands that are not heavily impacted by anthropogenic stressors are comparably abundant. As many as 600 species of macroinvertebrates were identified at French Frigate Shoals alone on the 2000 Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NOWRAMP 2000) expedition, with more than 250 species (not including marine snails) reported as new records. In October 2006 a Census of Coral Reefs (CReefs) expedition to French Frigate Shoals returned with numerous species that have yet to be identified. More than 100 new species records are expected from this expedition.

Comment [kb31]: This is a most likely a serious underestimate from the initial report received from Rusty Brainard.

http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf
http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf
<http://www.hawaiianatolls.org/research/CoML/index.php>

Maritime Archaeological Resources

The Hawaiian Islands have a rich maritime history. During the late 18th and early 19th centuries, European and American traders began to call at the main Hawaiian Islands, and by 1825 Honolulu became the most important port in the Pacific. During the 19th and 20th centuries, the Northwestern Hawaiian Islands experienced a series of extractive activities, including fishing, guano mining, shipwreck salvage cruises, bird poaching (feathers), and pearl oyster cultivation, as well as commercial exploitation of other marine and terrestrial wildlife. The geographical location of the Northwestern Hawaiian Islands became increasingly important to commercial and military planners. Midway was claimed by the U.S. government in 1867 and by the turn of the century had become an important transpacific cable station and stopping point for the flying "Clippers" carrying passengers and mail between San Francisco and Manila. In 1940, the U.S. Navy constructed the Pacific Naval Air Base, and subsequently a submarine base, at Midway. During World War II, patrol vessels were stationed at most of the islands and atolls.



Bow of the USS Macaw ASR-11, which was a 250-foot salvage and rescue ship. During salvage operations in 1944, the Macaw ran aground and subsequently sank during a powerful storm. (Photo: James Watt)

The Northwestern Hawaiian Islands have been a veritable graveyard of marine disaster. Two reasons for this have been the low, inconspicuous character of the islands, and their faulty or insufficient location on marine charts. This, combined with the numerous activities that have occurred over the past few centuries have left a scattered maritime legacy around and on the islands, including shipwrecks and sunken naval aircraft. Currently, there are 60 known shipwreck sites among the Northwestern Hawaiian Islands, the earliest dating back to 1822. Combined with known aircraft, there are a total of 127 known potential maritime resource sites. Twenty-three of these sites have been confirmed by field survey. Many of these heritage resources, as defined by State and Federal Preservation Laws, are of historical and national significance. Some of these ship and aircraft wreck sites fall into the category of war graves associated with major historic events, such as the Battle of Midway in June 1942. They are a physical record of past activities in the Northwestern Hawaiian Islands and embody unique aspects of Island and Pacific history.

http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf
<http://www.hawaiiireef.noaa.gov/maritime/>

Native Hawaiian Cultural Resources

Indigenous Hawaiians have a connection to and interest in the Northwestern Hawaiian Islands, which is documented in their oral and written histories, genealogies, spirituality, songs and dance. Polynesians traveled thousands of miles over hundreds of years in the Northwestern Hawaiian Islands and there is archaeological evidence of human habitation on Nihoa over a period of 500-700 years. There are also recorded visits to these islands by the monarchs of the Hawaiian Nation, which extended out to the Northwestern Hawaiian Islands. [These lands are part of the ceded lands, including submerged lands, which were unlawfully taken with the help of U.S. military force from the Hawaiian government. International law and treaty formally recognized the independent and self-determining authority of the Hawaiian Nation.]

Comment [kb32]: A statement like this, which is inherently political, does not belong in a document of this type.



Archaeological evidence of human habitation on Nihoa. (Photo: Peter Oboyski, U-Cal Berkeley)

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 2006). In accordance with Hawaiian law, which established responsibilities inherited from ancestors, ancestral deities, and a multitude of gods, and in accordance with perpetual indigenous Hawaiian sovereign authority, indigenous people of Hawai'i have inherited inalienable duties to care for and protect the "body forms" that preceded them in the evolutionary process including coral polyps, seaweed, fish, all other ocean life forms, birds, and islands. Connections to these body forms are genealogically based. They are all ancestors, connected to the Hawaiian people in space, time and spiritual energy. Therefore, indigenous people of Hawai'i have the responsibility to honor and protect their ancestors who reside in the Northwestern Hawaiian Islands in their multitude of forms.

Comment [kb33]: Replace with "traditional practices"?

http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf

Pressures on the Monument

Numerous human activities and natural events and processes affect the condition of natural and archaeological resources in marine environments. This section describes the nature and extent of the most prominent pressures on the monument.

Marine Pollution

Marine Debris

Many reefs in the Northwestern Hawaiian Islands and throughout the Pacific have been inundated with large amounts of debris lost by [North Pacific](#) commercial fishing operations or dispersed from other marine or terrestrial sources. These objects degrade reef health by abrading, poisoning, smothering, and dislodging corals and other benthic organisms, preventing recruitment on reef surfaces, and entangling fish, marine mammals, crustaceans, and other mobile species. Marine debris containing hazardous materials such as pesticides, petroleum, toxic chemicals and phosphorus flares wash up on the beaches of the Northwestern Hawaiian Islands, and is a danger to wildlife and humans. It is unknown how much of these toxic compounds are released from the debris while floating in the marine environment. Marine debris and derelict fishing gear hinder the recovery of the critically endangered Hawaiian monk seal and threatened sea turtles through entanglement, drowning and suffocation hazards.

Deleted: is

http://hawaiireef.noaa.gov/PDFs/Final_ROP.pdf

<http://www.hawaiireef.noaa.gov/management/mp.html>



Derelict fishing gear at Midway Atoll. (Photo: J.E. Maragos)

The North Pacific Subtropical Convergence Zone provides a mechanism for derelict fishing gear and other marine debris either lost or discarded throughout the Pacific Rim to accumulate in the Northwestern Hawaiian Islands. Under certain conditions, this convergence zone moves to encompass the Northwestern Hawaiian Islands and deposits tons of net and line on these shallow reef systems. Derelict gear may circulate for years in ocean gyres and currents until it encounters a shoal on which it snags. The extensive shallow reefs of the Northwestern Hawaiian Islands are ideal for such debris settlement. Once derelict gear catches on organisms of the remote reefs and atolls of the Northwestern Hawaiian Islands, it begins a cycle of destructive activity.

<http://www.pifsc.noaa.gov/cred/mdr.php>

Coastal and Terrestrial Pollution

Past uses of the Northwestern Hawaiian Islands have left a legacy of contamination on many of the atolls. The Northwestern Hawaiian Islands have 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 Cold War military missions. Contamination at all these sites includes onshore and offshore debris such as batteries (lead and mercury), PCB-containing transformers, capacitors, and barrels of petroleum and other chemicals. Uncharacterized, eroding, unlined landfills remain on all of these islands. Many of the common contaminants biomagnify so that small amounts found in sediment can result in significant concentrations in upper trophic levels.

Comment [kb34]: The impact of discarded Military debris (seeping oil from buried tanks) at French Frigate Shoals and Midway on key species such as Monk seals needs further assessment.

<http://www.hawaiireef.noaa.gov/management/mp.html>



Sand (forefront) and Eastern Islands at Midway Atoll, the site of a U.S. naval air facility during the WWII and Cold War eras, before Midway was transferred to the U.S. Fish and Wildlife Service in 1996. (Photo: Hawaii Wildlife Fund)

Several areas of contamination have been identified in the Northwestern Hawaiian Islands and include the following:

- Kure and French Frigate Shoals both have point sources of polychlorinated biphenyls (PCBs) due to former USCG LORAN stations. While the USCG has mounted limited cleanup actions at both sites, contamination remains and is found in island soils and in nearshore sediments and biota.
- Tern Island, a part of the French Frigate Shoals atoll, was formed into a runway to serve as a refueling stop for planes enroute to Midway during World War II and served as the site of various Cold War missions. Leaking underground storage tanks were a source of petroleum contamination until removed by the Army Corp Of Engineers (ACOE).
- The U.S. Navy built a naval air facility and submarine base at Midway Atoll, and during Base Reduction And Closure (BRAC) identified and cleaned up numerous contaminated sites. Contamination identified and remediated included petroleum, pesticides, PCBs, and metals. While most known areas were remediated, several areas, including unlined eroding landfills, warrant continued monitoring for potential releases.
- Plutonium from the aboveground nuclear tests in the 1960s at Johnston Atoll has been detected in corals 700 miles to the north at French Frigate Shoals.

Comment [kb35]: When did this removal occur because there are still coast guard reports of oil seaps around Tern Island.

Comment [kb36]: Tests ;)?

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf
<http://www.hawaiianatolls.org/about/ffs.php>

Climate Change and Coral Bleaching

Climatic events play an important role in the ecosystem productivity of the Northwestern Hawaiian Islands. Declines in the productivity of seabirds, monk seals, reef fishes, and chlorophyll have been documented from the early 1980s to the present. This may be associated with multidecadal climate shifts. While severe tropical storms or typhoons are rare, winter storms are common, resulting in a noticeable increase in winds and high seas that impact the reef system both negatively and positively.

Comment [kb37]: There is no indication of a general decline in seabird or reef fish populations; be specific, and ensure that the report agrees with statements in the Monument Management Plan

Comment [kb38]: These "declines" can be attributed to inter-decadal shifts, and are actually fluctuations, not declines. We don't want to give a misleading message here!



Montipora capitata (bleached) and Montipora turgescens (lavender) on the northern backreef of Midway Atoll, September 2002. (Photo: J. Kenyon)

Problems associated with increased sea surface temperatures (SST) have been reported in the Northwestern Hawaiian Islands. SST information obtained from NOAA demonstrated that water temperatures at Midway rose nearly two degrees centigrade over the usual summer maxima in August of 2002. Corresponding with this warm water event, substantial bleaching of corals was observed—a process whereby coral colonies lose their color due to the expulsion of symbiotic microscopic algae (zooxanthellae) from most coral tissues—on reefs at the three northwestern-most atolls: Kure, Midway, and Pearl and Hermes. At the three northern atolls, bleaching was most severe on the backreef, moderate in the lagoon, and low on the deeper forereef [Kenyon et al. 2006]. No significant bleaching was found the following year during surveys conducted in July 2003. Substantial coral bleaching at several reef systems was confirmed in the Northwestern Hawaiian Islands during surveys conducted in September/October 2004 [Kenyon and Brainard, 2004]. Military construction, including the dredging of a ship channel and filling for the airfields, dramatically changed water levels and circulation in the Midway lagoon, and may have exacerbated the effects of 2002 and 2004 lagoon coral bleaching. At Pearl and Hermes Atoll and Midway Atoll, bleaching was most pronounced in the shallow backreef habitat. The incidence of bleaching in the shallow backreef habitat at Kure, the northernmost atoll in the Hawaiian Archipelago, was less than that at Pearl and Hermes and at Midway.

http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf
http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf
http://www.pifsc.noaa.gov/library/pubs/HoekoARB543_Final.pdf
<http://coral.aoml.noaa.gov/pipermail/coral-list/2004-October/001390.html>

Climate models predict that global average sea level may rise considerably this century, potentially affecting species that rely on coastal habitat. Most of the Northwestern Hawaiian Islands are low-lying and therefore potentially vulnerable to increases in global average sea level. The effects of habitat loss on Northwestern Hawaiian Islands biota are difficult to predict, but may be greatest for endangered Hawaiian monk seals and threatened Hawaiian green sea turtles at Pearl and Hermes Reef (Baker 2006).

<http://www.int-res.com/articles/esr2006/2/n002p021.pdf>

Diseases

There has been a worldwide increase in the reports of diseases affecting marine organisms. However, the factors contributing to disease outbreaks are poorly known and hampered due to lack of information on normal disease levels in the ocean. The Northwestern Hawaiian Islands is considered to be one of the last relatively pristine large coral reef ecosystems remaining in the world. As such, it provides the unique opportunity to document what may be the normal levels of disease in a coral reef system exposed to limited human influence.

<http://chge.med.harvard.edu/publications/journals/documents/harvell.pdf>
http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

Recent studies in the Northwestern Hawaiian Islands have begun to document baseline levels of coral disease (Work et al. 2004; Aeby 2006). Tumors, as well as lesions associated with parasites, ciliates, bacteria and fungi, have been found on a number of coral species. During a 2003 survey of 73 sites throughout the Northwestern Hawaiian Islands, evidence of coral disease was found at very low levels at 68.5% of the sites across all regions. The overall average prevalence of disease (number of diseased colonies/total number of colonies) was estimated at 0.5% (range 0-7.1%) compared to the average prevalence of disease of 0.95% in the main Hawaiian Islands. The prevalence of disease varies among different genera of coral with the highest prevalence in species of the genera *Porites* and *Acropora*. Recent disease observed on giant table corals at French Frigate Shoals may have spread from Johnston Atoll about 520 miles to the south.

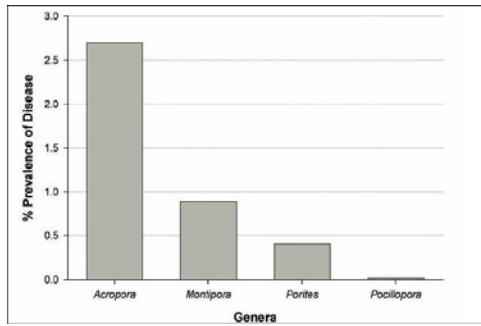
http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf
<http://www.hawaiiireef.noaa.gov/management/mp.html>

Comment [kb39]: Citation suggested by:
Kenyon JC, Aeby GS, Brainard RE, Chojnacki JD, Dunlap MJ, and Wilkinson CB 2006. Mass coral bleaching on high-latitude reefs in the Hawaiian Archipelago. Proceedings of the 10th International Coral Reef Symposium Okinawa 2: 631-643.

Comment [kb40]: Citation suggested by:
Kenyon JC and Brainard RE. 2006. Second recorded episode of mass coral bleaching in the Northwestern Hawaiian Islands. Atoll Research Bulletin 543:505-523.

Comment [kb41]: Missing in this section is a discussion of the diseases of coral reef fish that have been documented.

Deleted: in press



Differences in overall prevalence of disease among coral genera in the Northwestern Hawaiian Islands. (Source: G. Aeby, unpublished data)

In the Hawaiian Archipelago, more than 50 percent of endangered Hawaiian green sea turtles nest at East Island, French Frigate Shoals in the Northwestern Hawaiian Islands. Green sea turtles are affected by fibropapillomatosis (FP), a disease that causes tumors in turtles. Although most cases of FP in the Hawaiian islands have been observed in the main Hawaiian Islands, green sea turtles are highly migratory. The prevalence of FP in the Hawaiian green turtle population was estimated at 40-60%, with the majority of cases found among juvenile turtles. The majority of recent turtle strandings are by juvenile turtles with FP (Work et al. 2004). As such, FB may pose a significant threat to the long-term survival of the species (Quackenbush et al. 2001).

http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf
<http://www.hawaiireef.noaa.gov/management/mp.html>

Alien Species

Alien species can be defined as organisms that are not native to a particular ecosystem, and have been accidentally or deliberately introduced to an area outside of their historic geographic range. An invasive species is one that demonstrates rapid growth and spread, invades habitats, and displaces native organisms. A total of 12 introduced invertebrate, fish, and algal species have been recorded in the Northwestern Hawaiian Islands, and are generally low in number and impact except for the coral disease observed on table coral that may also be caused by an alien (introduced) species. 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. Eleven species of shallow-water snappers and groupers were purposely introduced to one or more of the main Hawaiian Islands in the late 1950s (Randall 1987).

<http://www.hawaiireef.noaa.gov/management/mp.html>

Populations of alien marine species that have already colonized areas of the main Hawaiian Islands represent the most likely source of invasive species in the Northwestern Hawaiian Islands (Godwin et al. 2005).. Most can be found from littoral zones to deep water coral beds. The few alien species known from the Northwestern Hawaiian Islands are mostly restricted to the anthropogenic habitats of Midway Atoll and French Frigate Shoals (Godwin et al., in press).

http://cramp.wcc.hawaii.edu/Downloads/TR_Godwin_et_al%20Invasives_Final%20Draft.pdf

Though not all introduced species will become invasive, those that do could have some of the following potential environmental impacts to the Northwestern Hawaiian Islands:

- loss of native biodiversity;
- functional changes of freshwater, estuarine, other inland waters, and nearshore marine ecosystems;
- alterations in nutrient cycling pathways;
- decreased water quality.

Impacts on native Hawaiian cultural resources can also occur and include:

- competition with native species used in subsistence harvesting;
- degradation of culturally important habitats;

Comment [kb42]: 12 recorded, but only 9 are currently established

Comment [kb43]: this statement certainly needs a reference, and is currently a hypothesis – this should be stated differently

Comment [kb44]: Misleading – only ta'ape is established in the NWHI

Comment [kb45]: not present in the NWHI

- disintegration of cultural resources for use with cultural education and practice of traditional knowledge for children and communities.

Comment [kb46]: Applies to the MHI, but not the NWHI

http://www.state.hi.us/dlnr/dar/pubs/ais_mgmt_plan_final.pdf



Bluestripe snappers (*Lutjanus kasmira*, or "ta'ape") were introduced to the main Hawaiian Islands in the late 1950's for commercial fishing and have since spread to Midway at the opposite end of the Hawaiian archipelago. (Photo: James Watt)

Fishing

Between 1750 and the 1920s, western explorers harvested monk seals, whales, fish, seabirds, and guano from various parts of the Northwestern Hawaiian Islands. More recently, 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 to Russia (1965 to 1977). The most recent fishing regime was born from the research conducted during the Tripartite Studies (1977 to 2006). The fishing regime operates under the direction of fishery management plans for precious corals, bottomfish, pelagics, crustaceans, and coral reef fisheries.

Comment [kb47]: And Hawaiians too right?

Comment [kb48]: Native or territorial? We tend to reserve the term "Hawaiian" for the native Hawaiian people and physical features, e.g., Hawaiian islands, and not for things and activities that just happen to be in Hawaii, e.g., not for people like me, haoles.

Comment [kb49]: The tripartite studies were conducted in the late 70s-early 80s. After that it was NOAA Fisheries stock assessment

Comment [kb50]: NOT! 1981 or 1982. Check reference.

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Deleted: operated

Comment [kb51]: This section should state the current condition, and the phase out plan, and leave it at that.

Comment [kb52]: The appropriate source of information for this section is: <http://www.pifsc.noaa.gov/bottomfish>

Comment [kb53]: "By-catch" in this case relates primarily to return alive of non-marketable species (kahala, for example)

Comment [kb54]: Reference? I'm not certain this is "wrong" but it seems like an odd terminology. The appropriate reference would be to the FMP that regulates the fishery.

Comment [kb55]: Let's not confuse the MHI with the NWHI in terms of "stress"

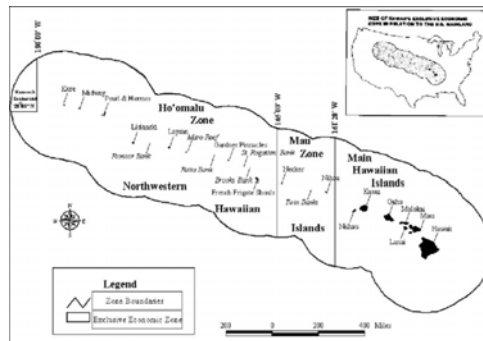
Not in the NWHI, or at least not in a significant manner.

Commercial Bottomfish

The federally permitted Northwestern Hawaiian Islands commercial bottomfish fishery has been regulated under the current management regime since 1986. The fishery targets deepwater (generally > 75-100 fm) snappers and one endemic species of grouper (WPRFMC 2004). The allowable gear and fishing requirements were designed to minimize habitat impacts and maintain by-catch levels of approximately 25%. However, the fishery showed signs of stress in 2002.

http://hawaiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf

<http://www.hawaiireef.noaa.gov/management/mp.html>



Bottomfish fisheries are divided into management subareas in the Hawaiian Archipelago. As of 2003, five bottomfish vessels operate in the Maui Zone and four operate in the Ho'omalulu Zone, (Map: WPRFMC) (<http://www.wpcouncil.org/NWHI/Documents/2006CombinedNWHIAmendments-04032006.pdf>)

2002 data indicated that fishing effort in the main Hawaiian Islands contributed overwhelmingly to the overfishing status of the Hawaiian archipelago and suggested that effort exceeded acceptable levels in the Mau zone (one of two fishing zones established in the Northwestern Hawaiian Islands). However, 2003 data indicated that the overfishing condition was no longer occurring in the area, and currently there is no reason to believe that the fishing mortality metrics for either Northwestern Hawaiian Islands zone (Mau or Ho'omaluu) will change significantly. Nonetheless, it has been recognized that the assessment methods rely heavily on biased fishery-dependent data sets that lack information on important segments of the population. As such, a Bottomfish Stock Assessment Panel was convened by the Western Pacific Regional Fishery Management Council in January 2004 to develop a plan to improve data collection and assessment methodologies.

http://hawaiiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf
<http://www.hawaiiireef.noaa.gov/management/mp.html>

Commercial Pelagic Trolling

A very small number of commercial pelagic trolling fishermen have recently operated or currently operate in the Northwestern Hawaiian Islands. These fishermen do not have federal fishing permits, as the fishery management plan for pelagic species does not regulate this small fleet. The fishermen operate under a State of Hawai'i commercial marine license that enables them to sell their catch. Commercial pelagic longlining was prohibited within 50 nm of the Northwestern Hawaiian Islands in 1991 due to interactions with endangered and threatened species by the WPRFMC's designation of a Protected Species Zone.

Hawai'i's commercial pelagic fishery is divided into four distinct types of fisheries: aku (pole and line) boats, handline (ika shibi and palu ahi) boats, and pelagic trolling boats, and pelagic longline (swordfish and tuna). Of these, pelagic trolling is the most popular statewide, with 90 percent of the participants and 50 percent of the small boat landings (WPRFMC 2003). The 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 Northwestern Hawaiian Islands between 1991 and 2000. The current fishing gear and methods have little to no impact on the habitat and have very low levels of bycatch. However, activities associated with fishing vessels, such as anchoring, could damage submerged historic shipwreck and aircraft sites.

http://hawaiiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf

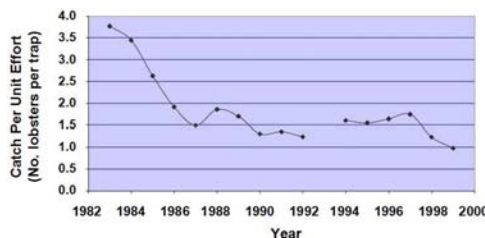
The recent Presidential Proclamation that established the monument determined that commercial fishing for bottomfish and associated pelagic species may continue within the monument until June 15, 2011. The Proclamation established caps for total landings for each fishing year at 350,000 pounds for bottomfish species and 180,000 pounds for pelagic species. After June 15, 2011, commercial fishing for bottomfish and associated pelagic species will be prohibited in the monument.

<http://www.whitehouse.gov/news/releases/2006/06/print/20060615-18.html>

Commercial Lobster Fishery

The now-closed, commercial lobster fishery began in 1976. Advances in trap design and processing techniques led to huge increases in total landings. Moving from a live lobster fishery to a frozen tail fishery allowed fishermen to remain at sea longer and return with a larger catch. Catch per unit effort (CPUE) (lobsters per trap) declined dramatically between 1983 and 1990, causing NOAA Fisheries to issue an emergency closure of the 1991 fishing season. Reasons for closure included (1) continual increase in fishing effort, (2) decrease in CPUE to an all-time low, (3) poor recruitment, and (4) an indication that the spawning stock biomass was at 22 percent of pre-exploitation levels, dangerously close to the 20 percent definition of overfishing.

http://hawaiiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf



Commercial Lobster Catch Per Unit Effort (all species) in the Northwestern Hawaiian Islands. (Diagram: Papahānaumokuākea monument, based on data from DiNardo and Marshall 2001.)

- Comment [kb56]: Why are you starting with a year and reference that is subsequently (the next sentence) obsolete?
- Deleted: the
- Deleted: s
- Comment [kb57]: Reference? This is a loaded term in this context.
- Comment [kb58]: Presumably something has happened in the past 3 years? I would recommend sending this entire section to the Council for review.
- Comment [kb59]: This section should state the current condition, and the phase out plan, and leave it at that.
- Comment [kb60]: This section is a mess and needs to be rewritten
- Deleted: are not federally permitted
- Comment [kb61]: Doesn't belong in this section
- Deleted: legally
- Comment [kb62]: Since this has been prohibited since 1991 –DELETE this paragraph
- Deleted: the
- Comment [kb63]: Change suggested by Pooley
- Deleted: C
- Deleted: trolling
- Deleted: three
- Deleted: fishermen
- Comment [kb64]: Why would trollers anchor?
- Comment [kb65]: Check PIRO for the analysis contained in the anchoring permit.
- Comment [kb66]: This paragraph should be moved to the start of the fishing section.

- Deleted: Crustacean
- Deleted: n

The Northwestern Hawaiian Islands lobster fishery was closed in 2000 by both federal court order related to NEPA and protected species issues, and by NOAA Fisheries to protect lobster stocks because of (1) shortcomings in understanding the dynamics of the Northwestern Hawaiian Islands 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 Northwestern Hawaiian Islands. ~~Adding to the concern over the decline of the lobsters was the concurrent decline of adults and pups of the endangered Hawaiian monk seal. Dietary studies of monk seals are inconclusive because they were initiated too late to assess the extent to which the seals or pups relied on lobsters.~~ The Presidential Proclamation of the Northwestern Hawaiian Islands as a marine national monument has determined that any commercial lobster fishing permit shall be subject to a zero annual harvest., which effectively closes the lobster fishery in perpetuity.

<http://www.whitehouse.gov/news/releases/2006/06/print/20060615-18.html>
http://hawaiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf

Recreational and Sport Fishing Activities

Recreational catch and keep fishing (as separate from charter fishing) is virtually non-existent in most parts of the Northwestern Hawaiian Islands and is currently prohibited in the monument. Some recreational fishing had previously taken place 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 differed from sustenance fishing and recreational catch and release fishing (largely by charter boats) as catch was generally not consumed on site but kept for later consumption. Catch and effort data is unavailable for this fishing activity.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Historical 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 Northwestern Hawaiian Islands since the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve in 2000 by Executive Order.



Black-lipped pearl oysters, at one time very common, were harvested in the late 1920s to make buttons from their shells. (Photo: Bill Walsh)

No domestic commercial precious coral fishery has ever operated in the Northwestern Hawaiian Islands, although a fishery management plan was issued in 1981. Only one permit has ever been issued to harvest coral under an experimental fishing permit, but the venture was unsuccessful. Although harvest of coral reef species such as black-lipped pearl oysters, turtles, and reef fish occurred in the early and mid-1900s, coral reef species are no longer commercially harvested in the Northwestern Hawaiian Islands.

http://hawaiireef.noaa.gov/designation/pdfs/Final_NMSA_304a5.pdf

Other Fishing Activities

A short-lived commercial fishing operation involving a single vessel using bottom longlines to catch sharks was conducted at French Frigate Shoals and nearby banks in the year 2000. During one 21-day fishing trip, this vessel caught 990 sharks in the

Comment [kb67]: The deleted is incorrect. The evidence clearly shows that lobsters are not an important component of the diet, which is similar to earlier work on spat and spew. The initiation date of the study is irrelevant since many species of lobster are plentiful in the NWHI.

Comment [kb68]: Delete this – it was speculative at the time, and later proven untrue.

Comment [kb69]: No lobster fishing is allowed in the Monument. This section is misleading and not needed in a condition report.

Comment [kb70]: Midway Charter Ops?

Comment [kb71]: Some? I suspect there was quite a lot, although probably little actual data.

Deleted: t

Deleted: reef

Northwestern Hawaiian Islands consisting mainly of sand-bar sharks at 69%, Galapagos sharks at 18%, and tiger sharks at 10% (Vatter 2003).

Recreational fishing and Native Hawaiian sustenance fishing had previously been limited. Sustenance fishing included fishing for pelagic reef and bottomfish species using trolling, handline, and pole and line fishing techniques. Sustenance fishing has taken 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, but efforts have been made to collect this information from NOAA ships. NOAA conducted a pilot sustenance fishing survey on all NOAA permitted vessels in 2005-2006. Survey results indicated that very few fish were caught during the time surveyed. The Presidential Proclamation allows for sustenance fishing and defines it as fishing for bottomfish or pelagic species in which all catch is consumed within the monument, and that is incidental to an activity permitted by the monument. Some illegal foreign fishing activities have also been known to occur around the Northwestern Hawaiian Islands. Regulations are enforced primarily by the U.S. Coast Guard, but enforcement is difficult primarily due to the size of the monument.

Comment [kb72]: Restricted? Or low level?

Deleted: is

Deleted: known to take place

Deleted: were

Comment [kb73]: How much is "very little"?

<http://www.hawaiiireef.noaa.gov/management/mp.html>

Vessel Hazards and Groundings

Hazards to shipping and other forms of maritime traffic are inherent in the Northwestern Hawaiian Islands 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 severe winter storm and wave events. Vessel groundings and the release of fuel, cargo, rats, and other items pose real threats to the Northwestern Hawaiian Islands. The Northwestern Hawaiian Islands region contains 127 known potential maritime resource sites. Some represent environmental threats, while others consist chiefly of marine debris and are of little specific value. Wrecks of historic sailing vessels in high energy environments are considered artifact "scatter sites," and do not pose an immediate or critical threat to their surroundings. More modern shipwrecks, such as the fishing vessels *Hoei Maru #5* and *Paradise Queen II* at Kure, or the tanker *Mission San Miguel* lost at Maro Reef, are greater 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 fuel/oil or hazardous contents are all issues to be considered. 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.

Comment [kb74]: What about the Casitas?



Swordman I aground on Pearl and Hermes Reef. (Photo: Hawaii Dept. of Land and Natural Resources)

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. In 2000, researchers found broken coral, 600 lobster traps, and the bodies of two monk seals among piles of nets surrounding the decaying wheelhouse (USFWS 2000). Also in 2000, 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, costs for which the government had to sue to recover. Since 1976 at least nine vessels have run aground in the Northwestern Hawaiian Islands.

Comment [kb75]: Update with information regarding the *M/V Casitas* and the *SV Grendel* grounding/sinkings.

<http://www.hawaiireef.noaa.gov/management/mp.html>
http://hawaiireef.noaa.gov/PDFs/Final_ROP.pdf
http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

Tourism and Recreation

Due to the Northwestern Hawaiian Islands 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 U.S. Fish and Wildlife Service since 1996. Midway Atoll National Wildlife Refuge (NWR) accommodates visitor use including historic preservation service projects, guided tours, diving and snorkeling trips, and sport fishing operations (extraction and non-extraction). In addition, Midway Atoll has been a destination for a limited number of cruise ships. However, visitor use in recent years has been minimal due to the lack of routine, affordable air charter service to transport visitors to and from Midway Atoll NWR. With the plans for future tourist activities around Midway Atoll, historic shipwreck sites in the vicinity may become more vulnerable to the impacts from divers and snorkelers. Impacts include artifact removal and damage to sites due to improper diving techniques. Many of these can be mitigated with education and outreach efforts that inform visitors of site preservation protocols.

Comment [kb76]: Update this section with information from the MMP

Comment [kb77]: This entire section is weak. It does not address impacts to seals, turtles and sea birds and their habitat resulting from increased disturbance.

Comment [kb78]: What about the Casitas?

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf
<http://www.hawaiireef.noaa.gov/management/mp.html>

Coastal Development

Historically, coastal development in the Northwestern Hawaiian Islands consisted of guano mining at Laysan Island a century ago, naval base construction at Midway and French Frigate Shoals during the first half of the 20th century, and U.S. Coast Guard (USCG) LORAN station construction and operations at Kure and French Frigate Shoals for several decades following World War II. The Midway Naval Air Station supported several hundred to several thousand soldiers and dependents during pre- to post-WW II. Navigation channels for the naval bases at Midway and 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 in the past has contributed to point and nonpoint sources of pollution to the marine environment.

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Photo: George H. Balazs (1978-81)

Tern Island at French Frigate Shoals, which was enlarged during World War II to create an air strip. Today the island is part of the Hawaiian Islands National Wildlife Refuge, operated year-round as a field station by the U.S. Fish & Wildlife Service and seasonally visited by National Marine Fisheries Service marine mammal and sea turtle scientists and FWS seabird biologists and volunteers.

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 French Frigate Shoals 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 French Frigate Shoals in 2004. Current human population levels are limited to a few workers and volunteers at wildlife stations operated at Laysan, French Frigate Shoals, and Midway year round and at Kure, Lisianski, and Pearl and Hermes atolls, seasonally.

<http://www.hawaiireef.noaa.gov/management/mp.html>

State of Monument Resources

This section provides summaries of the condition and trends within four resource areas: water, habitat, living resources, and maritime archaeological resources. For each topic, monument staff and selected outside experts considered a series of questions, based on existing resources. Answers are supported by specific examples of data, investigations, monitoring, and observations, and the basis for judgment is provided in the text and summarized in the table for each resource area. Where published or additional information exists, the reader is provided with appropriate references and web links. A fifth category, Hawaiian cultural resources, is also summarized for the monument Condition Report but does not include a status and trends rating by experts.

Water

The marine environment of the Northwestern Hawaiian Islands is considered to be nearly pristine due to its remoteness, the fact that most of the islets and shoals remain uninhabited, and the oceanographic conditions of the central Pacific Ocean. While there have been very few studies conducted on contamination, the lack of major pollution sources and the health and productivity of the coral reef ecosystems in the area strongly suggests that the marine environment is relatively unpolluted except during the duration of oil spills and other pollution discharges during ship groundings.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Although the waters surrounding the Northwestern Hawaiian Islands are minimally affected by anthropogenic stressors, some environmental impacts due to past human activities remain. In response to concerns by U.S. Fish and Wildlife scientists over high levels of toxic contaminants (e.g., PCBs and lead) in Northwestern Hawaiian Islands wildlife (e.g., moray eels, Hawaiian monk seals, and albatrosses), near-shore sediment sampling was conducted in 2000 (see State of "Habitat" Resources). Results of this study suggest the potential for water contamination, because contaminants in sediments can contribute to water quality degradation of overlying water.

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

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

The following information provides an assessment by monument staff of the status and trends pertaining to water quality and its effects on the environment:

1. Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality and how are they changing?

Sea level rise and acidification are of concern on a time scale of several decades, and are likely to affect beach erosion and all associated processes (e.g., nesting by birds and sea turtles). Acidification is projected over the next century to affect calcification by shallow and deep corals as well as calcifying organisms, including plankton. Temperature rise has been documented in the Northwestern Hawaiian Islands and may be associated with the increasing level and frequency of coral bleaching (Jokiel and Brown 2004). Changes in the oceanographic regime, specifically the position of the subtropical convergence zone, could affect productivity and other ecosystem dynamics in the region. Wave energy in the region could result from projected changes in the location and intensity of the Aleutian Low. Though climate related changes may be extreme over the period of several decades, the status and trends recorded here are based on a time frame of five to ten years. While impacts from sea level rise and acidification may not manifest in the near term, short term consequences of temperature change are more likely to be observed, possibly in the form of continued bleaching events.

2. What is the eutrophic condition of sanctuary waters and how is it changing?

The waters are essentially pristine. The addition of micronutrients may occur from oxidation of discarded equipment. Climate change could potentially affect the location of subtropical convergence and possibly result in periods of eutrophication.

3. Do sanctuary waters pose risks to human health and how are they changing?

Ciguatera is present, but humans are not exposed at this time because harvesting is not permitted. However, sustenance fishing and subsistence fishing (which may be allowed for native Hawaiians), could pose risks to human health.

Comment [kb79]: Has the water been analyzed and has the sediment been analyzed at different sites? Reference data?

Comment [kb80]: Cite baseline data here. For ocean pH at different sites.

Comment [s81]: We're suggesting this and subsequent comments on water quality, we're not actually aware of any monitoring of water chemistry.

Comment [kb82]: Cite reference.

Comment [kb83]: Harvesting is allowed both commercially and for sustenance. Although the commercial fishery tends not to sell kahala (so they become "bycatch.")

4. What are the levels of human activities that may influence water quality and how are they changing?

There is currently very limited access to the Monument, however, there are plans to open Midway Atoll to tourism. Vessels can no longer pump holding tanks within the monument. (This former activity was limited, so improvements may not be measurable.)

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 Comment [kb84]: Are there baseline measures against which to compare?

Water Quality Status & Trends

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.
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▲ = Improving — = Not changing ▼ = Getting worse
 ? = Undetermined trend N/A = Question not applicable

#	Issue	Rating	Basis for Judgment
1	Stressors	▼	Published literature indicates temperature increases
2	Eutrophic Condition	—	Lack of anthropogenic inputs
3	Human Health	—	Lack of sources, causes, and human exposure
4	Human Activities	▲	Limited access; regulations prohibit discharges

Habitat

The remoteness and limited fishing activities in the Northwestern Hawaiian Islands have resulted in minimal anthropogenic impacts on habitat resources. The reefs in the Northwestern Hawaiian Islands are among the few large-scale, intact reef ecosystems remaining in the world, and offer scientists an opportunity to study how unaltered ecosystems are structured, how they function, and how they can most effectively be preserved. However, despite the limited human activity currently occurring in the Northwestern Hawaiian Islands, impacts from distant marine, and past terrestrial activities have been observed.

Comment [kb85]: Why specify fishing activities in the NWHI as a potential source of habitat destruction? Obviously it is a possibility but much less than marine debris and terrestrial activities.

Many of the terrestrial and nearshore habitats were physically altered by the military prior to WWII by dredging the shallow marine areas to enlarge islands at Midway, Kure, and French Frigate Shoals. Subsequent military and USCG operations on these islands resulted in further disturbance and contamination. Since the military and USCG termination of missions on the islands much of the contamination has been remediated and habitats are being restored. However, remaining uncharacterized and unlined landfills are contaminating seabird and sea turtle nesting areas and eroding contamination into the nearshore environment. Lead paint used on most of the structures on the islands affects albatross and other seabirds nesting near the buildings. A rabbit farm on Laysan Island at the beginning of the 1900's destroyed most of the native vegetation and introduced many invasive plants. USFWS has successfully eradicated the most aggressive of the invasive plants and is actively cultivating and outplanting native species to restore the island.

Comment [kb86]: The entire document suffers from passive voice: either these activities occurred or they didn't.



Debris pile on Midway Atoll. (Photo: NOAA NMFS Pacific Islands Fisheries Science Center)

Marine debris, mostly derelict fishing gear from distant trawl and gillnet fisheries around the Pacific Rim, is perhaps the greatest anthropogenic impacts to the reefs of the Northwestern Hawaiian Islands. It has been estimated that at most, 1,000 tons of debris have accumulated in the Northwestern Hawaiian Islands over the past several decades. Assuming accumulation rates have been relatively constant over the past four decades, long-term average accumulation rates are approximately 52 tons per year. Since 1996, the NOAA Fisheries Pacific Islands Fisheries Science Center has led a highly successful multi-agency effort

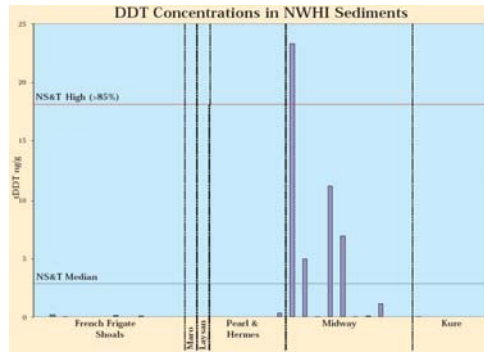
Comment [kb87]: Reference?
 Comment [kb88]: Should be cited: Dameron OJ, Parke M, Albins M, Brainard R 2007. Marine debris accumulation in the Northwestern Hawaiian Islands: An examination of rates and processes. Mar. Poll. Bull. 54(4): 423-433

to remove and recycle over 550 metric tons of derelict fishing gear from the Northwestern Hawaiian Islands. However, until substantial efforts are made to significantly reduce the sources of debris and until debris can be effectively removed at sea, accumulation is expected to continue indefinitely.

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

Past land-based human activities in the Northwestern Hawaiian Islands have also imposed potential impacts on marine habitat resources in the form of numerous toxic contaminants. Midway Atoll bears the highest levels contamination among the Northwestern Hawaiian Islands, and is primarily associated with previous military activities. Green Island at Kure Atoll, and Tern and East Islands at French Frigate Shoals were sites of former USCG stations and associated PCB contamination.

<http://www.hawaiiireef.noaa.gov/management/mp.html>



(Source: Turgeon 2002 <http://coastalscience.noaa.gov/documents/norwamp.pdf>)

Numerous studies on contamination in the monument have been conducted including remediation of the Navy BRAC closure at Midway, USCG site assessments at Kure and French Frigate Shoals, USFWS studies on fish, albatross, seals, and turtles at Midway and French Frigate Shoals, USFWS investigation and removal of the Dead Zone at Laysan, and contamination in Albatross at Midway. In 2000, the Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NOWRAMP) conducted a survey of island near-shore sediments. Thirty-six sediment samples were analyzed for over 70 toxic contaminants. A few of the chemical concentrations were high; that is, above the 85th percentile of concentrations measured in the coastal U.S. by the NOAA National Status and Trends (NS&T) Program. The concentrations of organic compounds (aggregated into groups) PCB, DDT, Dieldrin, Chlordane, and PAH were undetectable, very low or at least below the NS&T median at all sites except three. One Midway site had DDT concentrations above the NS&T median. Two other Midway sites had high levels of PCH, DDT, and PAH, and one of these had a high concentration of arsenic and above-median concentrations of cadmium, lead and tin. A fourth site on Kure Atoll was the only site with high concentrations of copper and nickel (Turgeon 2002).

<http://coastalscience.noaa.gov/documents/norwamp.pdf>

The following information provides an assessment by monument staff of the status and trends pertaining to the current state of the marine habitat:

5. What are the abundance and distribution of major habitat types and how are they changing?

Deep sea habitats have not been impacted and are in good condition. However, the loss of beaches and shoals due to the creation of seawalls and shallow habitats that have become littered with dangerous marine debris are of great concern, as debris is known to have severe impacts on seals, seabirds and sea turtles. (The judgment of status is based on the overall marine resources of the monument, but the declining trend reflects the need for special attention to be applied to these shallow/interface areas and beaches.)

6. What is the condition of biologically-structured habitats and how is it changing?

In general, biologically-structured habitat is in pristine condition. Some localized habitats appear to be somewhat degraded due to coral bleaching, marine debris and derelict fishing gear on reef structures. There have been two documented bleaching events since 2002, which were exacerbated around Midway by dredging. Estimates of accumulated marine debris is of major concern; specifically, table coral are declining and are a limited distribution coral, although others seem to be doing well. Table

- Comment [kb89]: As of 2006, this was 511 MT (from SORR)
- Comment [kb90]: Just gear.
- Deleted: 329
- Deleted: and other marine debris

- Comment [kb91]: This doesn't actually answer the question. It asks about the distribution of habitats across the areal extent of the NWHI.
- Comment [kb92]: Reword –tone this statement down. It sounds like all the nearshore areas in the NWHI are covered by seawalls and marine debris.
- Comment [kb93]: What does 'somewhat' mean?
- Deleted: L

coral are also affected by two serious diseases which are contributing to their declining populations. Unpublished data suggests that the disease is spreading from Johnston Atoll.

Comment [kb94]: Need to cite a personal communication for something as alarming as this.

Comment [kb95]: localized habitats appear to be degraded due to coral bleaching, marine debris and derelict fishing gear on reef structures. There have been two documented bleaching events since 2002, which were exacerbated around Midway by dredging. Estimates of accumulated marine debris is of major concern; specifically, table coral are declining and are a limited distribution coral, although others seem to be doing well. Table coral are also affected by two serious diseases which are contributing to their declining populations. Unpublished data suggests that the disease is spreading from Johnston Atoll.

7. What are the contaminant concentrations in sanctuary habitats and how are they changing?

Contamination from Navy, USCG, and other military operations exist at Kure, Midway, and French Frigate Shoals, and there are isolated incidents of contaminant releases from marine debris. A release of the pesticide carbofuran from marine debris on the beach at Laysan caused the deaths of the endangered Laysan finch. There has been an impact at Tern Island due to contaminants. Eels, crabs, and other biota have been shown to have high concentrations of metals and PCBs. The majority of the monument is in good condition, although a few terrestrial areas and superlittoral regions have experienced varying degrees of anthropogenic impact.

Comment [kb96]: Reference? Details?

Comment [kb97]: Reword – it reads as if ALL the finches died.

Deleted: some

Deleted: some severe impacts.

8. What are the levels of human activities that may influence habitat quality and how are they changing?

Overall levels of human activities are very low, although marine debris, climate change, and remaining contamination from military and USCG LORAN stations are major caveats. Both marine debris and climate change are problems emanating from factors outside the monument but the effects are being felt within. Other activities include research and some bottom fishing which may affect bottom habitat through anchoring, coring, or instrumentation. Permitted activities such as research comprise the majority of human activities and can be controlled. Illegal activities exist and are difficult to quantify, but surveillance is increasing.

Deleted: e

Comment [kb98]: Define level of activity of research and bottomfishers.

Deleted: rs

Comment [kb99]: What are they?

Habitat Status & Trends

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.
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▲ = Improving — = Not changing ▼ = Getting worse
 ? = Undetermined trend N/A = Question not applicable

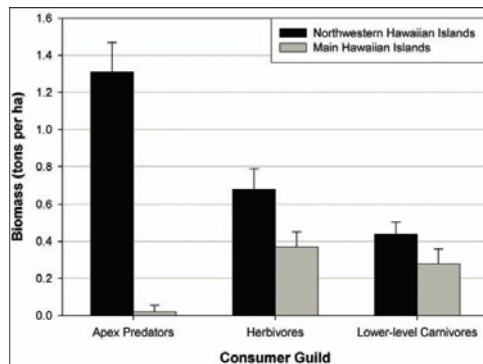
#	Issue	Rating	Basis for Judgment
5	Abundance/Distribution	▼	Increasing marine debris is degrading beaches
6	Structure	▼	Marine debris; coral disease and perhaps bleaching frequency
7	Contaminants	—	Localized contamination is adversely affecting associated habitat and wildlife
8	Human Activities	—	Limited visitation

Living Resources

Coral reefs in the Northwestern Hawaiian Islands are among the few remaining large-scale, intact, predator-dominated reef ecosystems left in the world. Areas with the highest apex predator biomass include Pearl and Hermes Atoll, followed by Lisianski and Laysan Islands. Apex predator biomass of the Northwestern Hawaiian Islands 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 main Hawaiian Islands. Apex predator biomass on fore-reef habitats in the Northwestern Hawaiian Islands is 1.3 metric tons per hectare compared to less than 0.05 metric tons per hectare in the main Hawaiian Islands. Overall, reef fish standing stock is more than 260 percent greater than the main Hawaiian Islands across similar habitats.

Comment [kb100]: The report continually refers to the Northwestern Hawaiian Islands as one of the few remaining large-scale, intact, predator-dominated reef ecosystems. How many are there and what criteria were actually used to make that statement?

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf



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

Coral reef ecosystems consist of much more than the reef-building corals for which they are named. Coral reefs also include sand and unconsolidated sediments, colonized hard-bottom, non-reef-building corals, crustose coralline algae, and macroalgae. Corals are the keystone organisms of this ecosystem, comprising approximately 50 percent of the biomass and providing habitat structure, refuge, and food to a diverse group of microscopic organisms and crustaceans, mollusks, fish, and other species of the tropical reef environment (Garrison 1999).

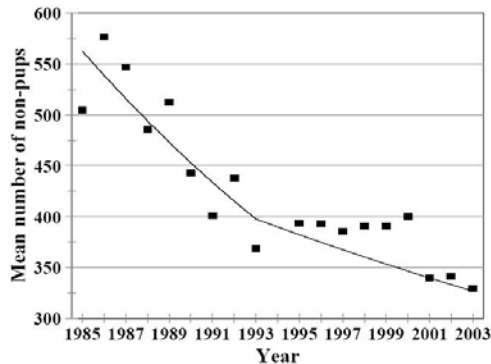
<http://www.hawaiireef.noaa.gov/management/mp.html>

Endangered Species

The Northwestern Hawaiian Islands host more than 7,000 species including marine mammals, fishes, sea turtles, birds, invertebrates, and marine algae. Twenty-three species of plants and animals known to occur in the Northwestern Hawaiian Islands are listed under the Endangered Species Act. Of particular concern are the Hawaiian monk seal, green sea turtle, and nesting seabirds. Additionally, results of the 2006 Census of Coral Reefs expedition will likely identify rare and vulnerable species warranting status on the threatened or endangered lists.

Hawaiian Monk Seals – Hawaiian monk seals are distributed throughout Hawai'i predominantly in six Northwestern Hawaiian Islands subpopulations at French Frigate Shoals, Laysan and Lisianski Islands, Pearl and Hermes Reef, and Midway and Kure Atoll. The current population size of the Hawaiian monk seal is estimated between 1,200 and 1,300 individuals, and depends almost entirely on the islands of the Northwestern Hawaiian Islands for breeding and the surrounding reefs for sustenance. Reproductive success has declined, with a total of mean non-pup beach counts at the main reproductive Northwestern Hawaiian Islands subpopulations in 2003 approximately 60 percent lower than in 1958.

Trends in abundance vary considerably among the six main subpopulations. For example, the decline since the mid-1980's was largely due to a severe decline at French Frigate Shoals, where non-pup beach counts decreased by 70% from 1989-2003. Populations at Laysan and Lisianski Islands have remained relatively stable since approximately 1990, though the former has tended to increase slightly while the latter has decreased slowly.



Mean beach counts of Hawaiian monk seals at the six main Northwestern Hawaiian Islands subpopulations, 1985-2003. (Source: Antonelis 2004)

Until recently, populations at Kure, Midway, and Pearl and Hermes reef exhibited substantial growth. The subpopulation at Kure Atoll grew at an average rate of 5% per year from 1983 to 2000, due largely to decreased human disturbance and introduced females. Since 2000, counts at Kure have declined coinciding with very low survival of the 2000-2002 cohorts from weaning to age 1 year (15% to 22%). The subpopulation at Pearl and Hermes Reef increased after the mid-1970s, however, growth of this subpopulation has slowed recently and early survival has declined. Recovery of the small subpopulation at Midway Atoll appears to have slowed or stopped, also accompanied by relatively poor juvenile survival. These declines may be related to reduced food sources or increasing competition for prey items with apex predators, fewer pupping sites, and increased predation of pups by sharks. The lack of recovery of the lobster populations may also be contributing to the loss of pups since many die starving and emaciated. Implementation of the National Marine Fisheries Service 2006 Recovery Plan for the Hawaiian Monk Seal will hopefully show an upward trend in seals before the population of reproductive female seals decline to precipitous levels.

Comment [kb101]: Given that the NOWRAM/REA surveys have significant design flaws and bias results, there is uncertainty about what can be said about biomass or biological communities.

Comment on this comment: although the survey designs are being altered, that doesn't mean the results are meaningless. I would recommend a quick check by Ed DeMartini or Alan Friedlander.

Comment [kb102]: This is probably an underestimate and only represents the numbers that can be counted on the surface areas of the reef. The invertebrates are more than likely underrepresented in the analysis.

Comment [kb103]: Something should be said about cetaceans – see Johnston et. al. 2007

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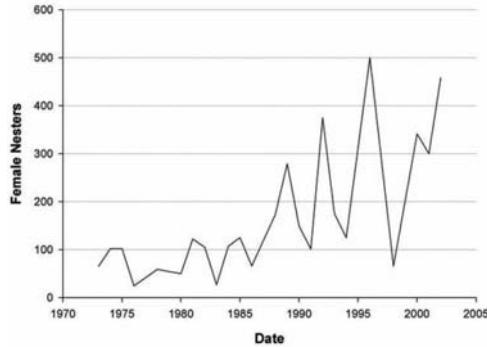
Comment [kb104]: Reference? Not consistent with current PIFSC studies

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Comment [kb105]: Delete – this was speculative at the time, and later proven not to be a major contributing factor

Deleted: Long term monitoring on the monument in the absence of all commercial fishing and i

<http://www.nmfs.noaa.gov/pr/pdfs/sars/po2005sehm-hi.pdf>
<http://www.hawaiiireef.noaa.gov/management/mp.html>
<http://www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/hawaiianmonkseal.htm>



Nester abundance shown as the number of female green sea turtles nesting each year at East Island (French Frigate Shoals) from 1973 to 2002. (Source: Balazs and Chaloupka 2004.)

Green Sea Turtles –The green sea turtle was listed as threatened in 1978. Although the population has increased significantly since the 1970's, the total number of nesting females is still well below the historical levels of the late 1800's. However, 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 (Balazs and Chaloupka 2003). Over 90% of all sub-adult and adult green turtles found throughout Hawai'i come from the Northwestern Hawaiian Islands. The primary nesting site for green turtles is French Frigate Shoals, and accounts for 400 nesting sites, or 90% of all nesting within the Hawaiian Archipelago. Nesting also occurs at Pearl and Hermes Atoll and Lisianski Island. However, massive beach and island erosion witnessed at the principal nesting island in 2006 (Eastern Island, French Frigate Shoals) may reduce the number of suitable nesting sites for turtles or reduce the survivorship of hatchlings. Military construction, including the dredging of a ship channel and filling for the airfields, may have affected water levels.

Comment [kb106]: Do we envision a stock recovery to late 1800 levels given the development in Hawaii since then?

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<http://www.hawaiiireef.noaa.gov/management/mp.html>
http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf

Nesting Seabirds – The importance of seabirds in the Northwestern Hawaiian Islands was recognized in 1909 with the establishment of the Hawaiian Islands National Wildlife Refuge. Early protection and active management in the Northwestern Hawaiian Islands resulted in large, diverse and relatively intact seabird populations. The conservation status of Hawaiian seabirds was more recently 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.



The Christmas Shearwater can grow to have wingspans of up to nearly 32 inches. Adults return to colonies in the Northwestern Hawaiian Islands in March and depart in early fall. (Photo: Bishop Museum)

The greatest threats to seabirds in the Northwestern Hawaiian Islands have been introduced mammals (e.g., rabbits, rats and mice) 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 at Midway Atoll and Polynesian rats 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. (Draft MP 2006)

Comment [kb107]: Include current status and population trends – ensure consistency with the MMP

Introduced Species

Eleven species of shallow-water snapper and grouper were purposefully introduced to the main islands of the Hawaiian Archipelago in the late 1950s and early 1960s. Two snappers, the bluestripe snapper and the blacktail snapper, and one grouper, the peacock grouper, are well-established and have documented patterns of colonization along the island chain (Randall, 1987). Bluestripe snappers have been by far the most successful fish introduction to the Hawaiian coral reef ecosystem. From some 3,200 individuals introduced on the island of Oahu in the 1950s, the population has expanded its range by 1,491 miles and has been reported as far north as Midway in the Northwestern Hawaiian Islands. These records suggest a dispersal rate of about 20-80 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.

http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/NWHI_Ch10_C.pdf

The following information provides an assessment by monument staff of the status and trends pertaining to the current state of the monument's living resources:

9. What is the status of environmentally sustainable fishing and how is it changing?

The only substantial fishery in the NWHI is for bottomfish. Population analysis by the National Marine Fisheries Service indicates these fisheries are operating at fishing levels below that required to harvest Maximum Sustainable Yield. (Reference: web site cited earlier)

The research community is still in an exploratory phase with its understanding of biodiversity. Therefore, ratings here are made based on limited existing information. There are known terrestrial extinctions; however, this document is limited to the marine environment and therefore these extinctions are not considered in the assessment.

Comment [kb108]: Say what? This is a non-sequiter. Just state that the only fishery (bottomfish) is being phased out

10. What is the status of environmentally sustainable fishing and how is it changing?

The only substantial fishery in the NWHI is for bottomfish. Population analysis by the National Marine Fisheries Service indicates these fisheries are operating at fishing levels below that required to harvest Maximum Sustainable Yield. (Reference: web site cited earlier). Regulations will phase out bottomfishing in five years from the date of proclamation (due to be enforced in 2011). Spawning potential ratio (SPR) indicates that overall the status of the fishery is good.

http://www.pifsc.noaa.gov/wpacfin/hi/dar/Pages/hi_fish_4.php

Comment [kb109]: Answer doesn't seem to fit question

Comment [kb110]: This is not an accurate portrayal... this is not the best available data... nor does it address the question.

11. What is the status of non-indigenous species and how is it changing?

Eleven species are documented, but not all are established. Only two invasive species are found throughout the monument; the blue-line snapper (taape) and the hydroid *Pennaria*. Distribution of the latter is limited within the monument; the majority of established individuals are in Midway harbor. The primary source of invasive species is the main islands, and management processes are in place. Marine debris is a potential vector, but is not within management control. The terrestrial environment has been affected by invasive and alien species, however status and trend determinations in this condition report are limited to the marine environment.

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Deleted: There are currently no estimates of the impacts that are occurring due to ghost fishing.¶

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12. What is the status of key species and how is it changing?

There is a great dichotomy in the status of species. Apex predators are in near pristine condition, and corals and turtles are steady. However, monk seals, migratory shorebirds and resident seabirds are decreasing significantly. For example, monk seals have suffered a 60% population decline since the 1950s (Antonelis 2004). Monk seals are an important indicator of condition, potentially of severe change in deeper resources about which we have little information.

Comment [kb111]: Misleading – not true for most species

<http://www.botany.hawaii.edu/faculty/duffy/arb/543/06.pdf>

Comment [kb112]: Without scientific studies to prove this, it is not true and cannot be stated.

13. What is the condition or health of key species and how is it changing?

Based on body condition and the occurrence of starvation, many yearling and juvenile monk seals are in poor health and there has been a 60% population decline since the 1950s. The health of a few species of seabirds has been negatively affected primarily due to ingestion of marine debris. However, predatory and reef fishes, marine invertebrates, and most corals are stable and in good condition.

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Comment [kb113]: Is this true? I've heard Beth Flint say quite the contrary.

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Comment [kb114]: Missing in the report is an assessment of the disease status of fish. Since parasite levels are likely indicators of coral reef ecosystem condition, the report should provide some indication of these levels.

Comment [kb115]: This is weak! What are the key species?

14. What are the levels of human activities that may influence living resource quality and how are they changing?

Overall levels of human activities are very low, although marine debris and climate change are major factors that threaten Northwestern Hawaiian Islands habitats and ultimately the health of key species (Baker 2006). Both marine debris and climate change are affected by human activities occurring far outside the monument but the effects are being felt within. Other activities include research and some bottom fishers. Permitted activities such as research comprise the majority of human activities and can be controlled. Illegal activities exist and are difficult to quantify, but surveillance is increasing.

<http://www.int-res.com/articles/esr2006/2/n002p021.pdf>

Living Resources Status & Trends

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.
▲ = Improving ▬ = Not changing ▼ = Getting worse ? = Undetermined trend N/A = Question not applicable					
#	Issue	Rating	Basis for Judgment		
9	Biodiversity	▬	Assessment/monitoring activities to date		
10	Extracted Species	▲	Limited activity; existing fishery to be phased out by June 2011		
11	Invasive Species	?	Few species with isolated distributions; uncertainty of potential impact		
12	Key Species	?	Monk seal and seabird decline; corals and predatory fish populations high and stable		
13	Health of Key Species	?	Monk seal starvation and body condition; debris ingestion by seabirds; predatory fish and most corals in good condition and stable		
14	Human Activities	▬	Limited visitation		

Comment [kb116]: If something is classified as good, can it be improving?

Comment [kb117]: How many key species are doing poorly? How were key species chosen?

Comment [kb118]: This should be improving.

Maritime Archaeological Resources

Due to the strategic location of the Northwestern Hawaiian Islands for commerce and military activities, the area features significant maritime heritage resources. Beginning in 2002, archaeologists with NOAA's Maritime Heritage Program have been conducting the systematic survey of important wreck sites in the Northwestern Hawaiian Islands and sharing their findings with the public through a comprehensive education and outreach program. Of the current 127 potential resource sites, to date 18 preliminary site assessments have been conducted, and five site inventory surveys have been completed. These resources include British and American 19th century whaling shipwrecks, the U.S. Navy side wheel steamer USS *Saginaw*, the WWII submarine rescue vessel USS *Macaw*, and the American bark *Carrollton*. Maritime archaeological survey in the Northwestern Hawaiian Islands emphasizes a non-invasive approach, *in situ* management being the preferred alternative. This approach is most compatible with the goal of minimizing/eliminating negative impacts on the ecosystem. The comprehensive survey to locate and assess all existing maritime heritage sites, as directed by the National Historic Preservation Act, has not been completed.

<http://www.sanctuaries.noaa.gov/maritime/>

The following information provides an assessment by maritime heritage staff from the Pacific Islands regional office of the status and trends pertaining to the current state of the monument's maritime archaeological resources. It is important to remember that, while the Northwestern Hawaiian Islands possess unique examples of heritage resources, the systematic survey of these sites has only recently begun. These surveys are currently conducted by a small team of maritime archaeologists, accompanying biologists and oceanographers on "piggy-back" missions of opportunity. Site archaeological inventory is time-intensive, and

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completion of a survey often requires work over multiple field seasons. This means that estimates of resource status at this point are often based on partial data.

15. What is the integrity of known maritime archaeological resources and how is it changing?

Resource integrity is a crucial measure for heritage sites, one which is carefully defined by the National Register for Historic Places. Measures of integrity include location, design, setting, materials, workmanship, feeling, and association. Integrity does not simply mean the “intactness” of a shipwreck or structure, for the same types of measures apply to scattered sites and artifacts as well, provided the site retains historical, scientific, or educational information. The shallow water heritage resources in the Northwestern Hawaiian Islands have often been broken apart by the high-energy environment, but retain a measure of integrity as pristine archaeological sites. The downward trend is due to the slow and inevitable processes of deterioration over time.

16. Do known maritime archaeological resources pose an environmental hazard and is this threat changing?

From the handful of archaeological resources which have been surveyed to date, there are no known hazardous cargoes on archaeological sites currently threatening the environment. Historical/archaeological sites are considered to be at least 50 years in age, lowering the immediate threat of damage from mechanical break-up. 19th-century shipwreck sites exhibit even less potential impact, coming closer to a state of equilibrium with their immediate environment. World War II-era vessels that may have hazardous cargoes/materials have been lost in the Northwestern Hawaiian Islands, but these have not yet been surveyed or located. Modern wrecks that are not archaeological resources may pose a threat from deterioration, and surveys of these impact sites should be conducted in the future.

17. What are the levels of human activities that may influence maritime archaeological resource quality and how are they changing?

While there do exist anecdotal reports of maritime archaeological resources having been removed illegally from the Northwestern Hawaiian Islands in the past, these instances have not been fully documented or confirmed. In general the remoteness of the Northwestern Hawaiian Islands protects its archaeological sites in comparison to other more accessible locations. Management efforts currently include education and outreach focusing on the nature of archaeological resources and heritage preservation, and this is one of the best long-term strategies for minimizing potential human impacts. Damage and/or removal of archaeological resources remain a concern, and planned future activities (such as tourism at specific locations) indicate the necessity of outreach, monitoring, and enforcement. Archaeological resources are also subject to inadvertent damage in a similar manner to the natural ecosystem, from anchors, marine debris, groundings, etc.

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Maritime Archaeological Resources Status & Trends

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.
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▲ = Improving — = Not changing ▼ = Getting worse
 ? = Undetermined trend N/A = Question not applicable

#	Issue	Rating	Basis for Judgment
15	Integrity	▼	Natural deterioration (physical, biological and chemical)
16	Threat to Environment	—	No known resources with hazardous cargoes
17	Human Activities	▲	Few instances of resource removal or damage

Native Hawaiian Cultural Resources

Native Hawaiian research contributes to an ecosystem-based approach to management of the Northwestern Hawaiian Islands and complements other types of research. Since the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve in 2000, research efforts have produced a substantial amount of cultural information pertaining to the traditions and practices of native Hawaiians in the Northwestern Hawaiian Islands. The monument has taken several steps toward integrating this information into educational and outreach efforts to engage students and the public in learning about and caring for the Northwestern Hawaiian Islands as well as the main Hawaiian Islands.

<http://www.hawaiiireef.noaa.gov/management/mp.html>

Response to Pressures

This section provides a summary of existing and proposed responses to pressures on marine resources of the Northwestern Hawaiian Islands. Existing monument responses and management actions are enacted to implement the final regulations issued by NOAA and USFWS and to protect natural resources of the monument, effective August 25, 2006. Goals and strategies have been developed for each of the action plans outlined in a new draft management plan, scheduled for release in 2007.



The NOAA research vessel Hi'ialakai is homeported in Hawaii to support coral reef ecosystem mapping and habitat activities in the greater Pacific under the NOAA Ocean Service. (Photo: NOAA)

Jurisdictional Authorities of the Monument

The three principal entities (collectively known as the Co-Trustees) with responsibility for managing lands and waters of the monument are the Secretary of Commerce through the National Oceanic and Atmospheric Administration (NOAA), the Secretary of the Interior through the U.S. Fish and Wildlife Service (USFWS), and the State of Hawai'i through the Governor.

Entering the monument is prohibited without prior notification (uninterrupted passage only), except where necessary to respond to emergencies threatening life, property, or the environment, or activities necessary for law enforcement purposes or armed forces actions.

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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 out to 3 miles offshore of each of the Northwestern Hawaiian Islands, except Midway which was excluded by the Hawaii Statehood Act of 1959. The State currently manages the emergent lands and reefs at Kure Atoll as a State Wildlife Sanctuary. USFWS has sole responsibility for management of the areas of the monument that overlay the Midway Atoll National Wildlife Refuge out to 12 miles offshore, the Battle of Midway National Memorial, and the Hawaiian Islands National Wildlife Refuge. NOAA has primary management responsibility of marine areas of the monument. A Memorandum of Agreement signed by all three Trustees on December 8, 2006 created a jurisdictional regime where all parties share in the management, access and permissions to enter the monument, and which will normally require a consensus among all trustees for important decisions affecting the monument. The Co-Trustees have established a goal to provide a seamless and unified management in the spirit of cooperative conservation.

http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

In coordination with the Secretary of Commerce, the Western Pacific Regional Fishery Management Council (WPRFMC) is tasked with stewardship over fishery resources in the Exclusive Economic Zone (generally 3 to 200 miles offshore) surrounding the Northwestern Hawaiian Islands, under the Magnuson Fishery Conservation and Management Act of 1976. The WPRFMC has developed fishery management plans for bottomfish, crustaceans, pelagic fisheries, and precious corals in the Northwestern Hawaiian Islands. Due to the regulations set forth in Proclamation 8031, which established the monument, some of these fisheries are now closed. In 1996, the Sustainable Fisheries Act made NOAA Fisheries in affiliation with the WPRFMC also responsible for protecting essential fish habitat.

http://hawaiireef.noaa.gov/PDFs/Final_ROP.pdf

Special Preservation Areas and Ecological Reserves

Special Preservation Areas (SPAs) are discrete, biologically important areas of the monument. Uses within SPAs are subject to conditions, restrictions, and prohibitions, including but not limited to access restrictions. SPAs are used to avoid concentrations of uses that could result in declines in species populations or habitats, 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 are areas of the monument consisting of contiguous, diverse habitats that 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 areas representing a broad diversity of resources and habitats found within the monument.

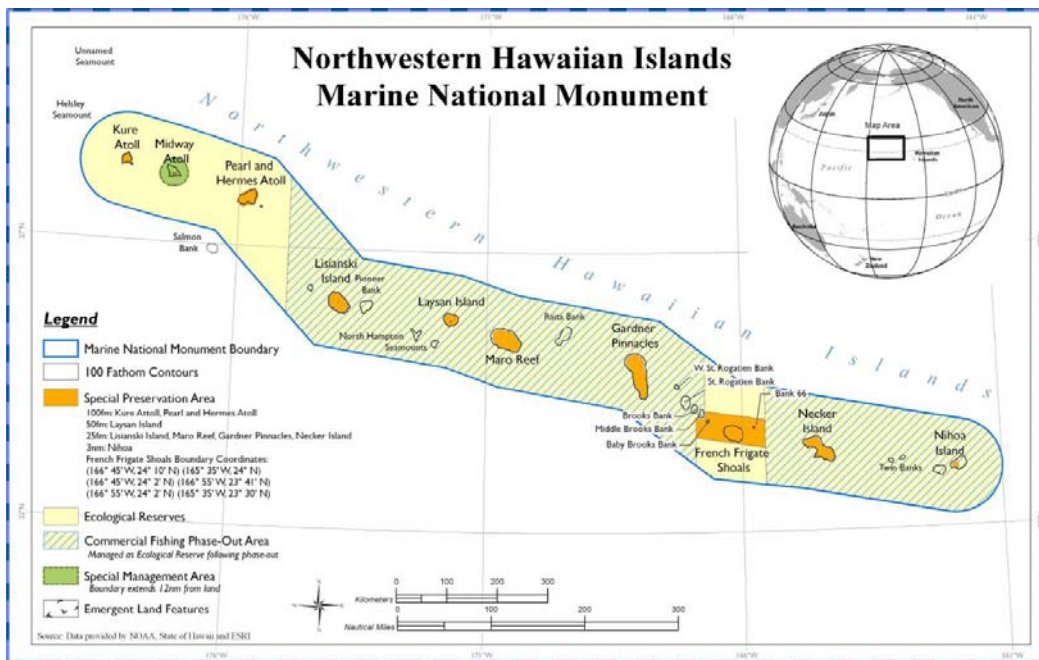
<http://www.whitehouse.gov/news/releases/2006/06/20060615-18.htm>

The Special Preservation Areas (SPA) cover a total area of 6,802 square miles, including the 924 square mile Midway Atoll Special Management Area (SMA). The Ecological Reserves cover a total of 37,762 square miles.

<http://hawaiireef.noaa.gov/about/faq.html>

NOAA and USFWS monument regulations for SPAs and SMAs state that except due to emergencies and law enforcement activities, the following activities are prohibited without a valid permit:

- Discharging or depositing any material or other matter into SPAs or the Midway Atoll SMA except vessel engine cooling water, weather deck runoff, and vessel engine exhaust; and
- Swimming, snorkeling, or closed or open circuit SCUBA diving within any SPA or Midway Atoll SMA.



Map of monument boundaries and special management areas. (Map: Papahānaumokuākea monument)

Marine Pollution

Impacts of marine debris upon the ecological health of the Northwestern Hawaiian Islands have not been fully documented due to the large size and remoteness of the region, as well as the historical and ongoing nature of the problem. Mortality as the result of entanglement in derelict fishing gear, primarily nets, has been documented for several mobile marine species in the Northwestern Hawaiian Islands with impact upon the Hawaiian monk seal being of greatest concern due to its highly endangered status. In November 2006, NOAA's National Marine Fisheries Service developed the Recovery Plan for the Hawaiian Monk Seal with the goal of assuring the long-term viability of the Hawaiian monk seal in the wild, allowing initially for reclassification to threatened status and, ultimately, removal from the List of Endangered and Threatened Wildlife (NMFS 2006).

http://www.nmfs.noaa.gov/pr/pdfs/recovery/draft_hawaiianmonkseal.pdf

On July 13, 2007, the Monument was designated "in principle" as a Particularly Sensitive Sea Area (PSSA) by the International Maritime Organization (IMO), a Specialized Agency of the United Nations. PSSA designation will augment domestic protective measures by alerting international mariners to exercise extreme caution when navigating through the area. Additionally, as part of the PSSA designation process, in July 2007 the IMO's Sub-Committee on Safety of Navigation approved U.S. proposals for the associated protective measures (APMs) of: (1) the expansion and amendment of the six existing recommendatory Areas to be Avoided (ATBAs) in the area, which would enlarge the class of vessels to which they apply and augment the geographic scope of these areas as well as add new ATBAs around Kure and Midway atolls; and (2) the establishment of a ship reporting system for vessels transiting the Monument, which is mandatory for ships entering or departing a U.S. port or place and recommendatory for other ships.

Ultimately, the monument's desired outcome is the elimination of marine debris and derelict fishing gear from the Northwestern Hawaiian Islands. Complete elimination of marine debris in the near future is virtually impossible due to the financial cost, the size of the area and continual influx of new debris. However, removal of existing debris, detection and prevention of incoming debris, and education to prevent generation of more debris are the achievable strategies to reduce its overall impact. The following management strategies have been identified to reduce the impact of marine debris:

- Remove marine debris by: contributing to the Northwestern Hawaiian Islands marine debris removal effort, and developing and implementing a five-year marine debris removal and prevention plan for the monument.
- Contribute to marine debris prevention efforts by: supporting National Marine Fisheries Service marine debris studies; working with the U.S. State Department to gain international cooperation and involvement for marine debris issues; working with the fishery management councils to address marine debris prevention with U.S. fishing fleets, and; working with partners to continue to develop and implement an outreach strategy for marine debris.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Existing NOAA and USFWS monument regulations that address marine pollution within monument waters are:

- Exploring for, developing, or producing oil, gas, or minerals is prohibited within the monument.
- Except due to emergencies and law enforcement activities, discharging or depositing any material or other matter into the monument, or discharging or depositing any material or other matter outside the monument that subsequently enters the monument and injures any resources of the monument, except fish parts (i.e., chumming material or bait) used in and during authorized fishing operations, or discharges incidental to vessel use such as deck wash, approved marine sanitation device effluent, cooling water, and engine exhaust is prohibited.

http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Diseases, Climate Change and Coral Bleaching

With coral reefs around the world in decline, the Northwestern Hawaiian Islands present a unique opportunity to characterize an intact coral reef ecosystem and to begin to understand the degree of natural variability in an ecosystem relatively free of local anthropogenic influences. Studying these remote ecosystems may also make an important contribution toward understanding the impacts of global climate change on coral reefs.

The monument's goal is to increase understanding of the distributions and functional linkages of marine organisms and their habitats in space and time to improve ecosystem-based management decisions. The following strategies have been identified to support continued characterization and monitoring of Northwestern Hawaiian Islands marine ecosystems:

- Assess and prioritize research and monitoring activities by: developing and implementing a prioritized research and monitoring plan for the monument and update annually, and; coordinating meetings for research updates with researchers.
- Conduct research that supports ecosystem-based management by: continuing to characterize types and spatial distributions of shallow-water marine habitats; working with partners to select, map, and characterize deep-water habitats; conducting a biogeographic assessment of Northwestern Hawaiian Islands living marine resources; implementing additional research priorities identified in the Monument Research and Monitoring Plan, and; facilitating and supporting the development of ecosystem models.
- Conduct monitoring to understand ecosystem change over time by: assessing monitoring program protocols; formalizing a collaborative regional monitoring program for the Northwestern Hawaiian Islands; continuing to monitor at established sites in shallow-water coral reef; establishing a monitoring program for deep-water ecosystems, and; collecting, analyzing and inputting research, monitoring, and bathymetric data into appropriate databases to inform management decisions.
- Communicate results of research and monitoring by: coordinating an annual meeting to present current research being conducted in the Northwestern Hawaiian Islands; prioritizing research, monitoring, and modeling projects for education and outreach; including an educational component in all research expeditions, and; using materials gathered and created during research expeditions to develop or enhance education and output products.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Alien Species

Because it is difficult, if not impossible, to determine whether an alien species will become invasive in a given environment, efforts must be made to prevent all alien species from entering Northwestern Hawaiian Islands ecosystems. Three strategies have been identified for achieving the desired outcomes of preventing alien species introductions and monitoring and controlling existing alien species in the monument:

- Prevent, monitor and control alien species introductions by: developing an interagency Northwestern Hawaiian Islands alien species plan to address prevention, control, and response and develop best management practices; conducting hull inspections and cleaning for NOAA research vessels to prevent the introduction of marine alien species to the Northwestern Hawaiian Islands; developing a hull inspection and cleaning program for vessels operating under permit in SPAs to prevent the introduction of marine alien species to the Northwestern Hawaiian Islands; identifying, characterizing, and monitoring populations of alien species; conducting research on alien species detection and control, and; working with partners in responding to alien species introductions in the Northwestern Hawaiian Islands.
- Engage monument users and the public in preventing the introduction and spread of alien species by: integrating alien species information into an overall outreach program for monument permittees, and integrating alien species information into general monument outreach materials.
- Participate in statewide and Pacific regional alien species efforts by participating in statewide and international initiatives on alien species.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Existing NOAA and USFWS monument regulations that address marine alien species within monument waters are:

- Introducing or otherwise releasing an introduced species from within or into the monument is prohibited.
- Except due to emergencies and law enforcement activities, discharging or depositing any material or other matter into the monument is prohibited (see Marine Pollution for further details).

http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Fishing

Existing NOAA, USFWS, and State of Hawaii regulations that address fishing activities within monument waters are:

- Using or attempting to use poisons, electrical charges, or explosives in the collection or harvest of a monument resource is prohibited.

a. Commercial fishing regulations within the monument are as follows:

Comment [kb119]: Add statement about requirements for hull inspections of all permitted vessels

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- *Lobster fishing.* The Presidential Proclamation has permanently closed the commercial lobster fishery within the monument.
- *Fishing and bottomfish and pelagic species.*
 - Commercial fishing for bottomfish and associated pelagic species may continue within the monument subject to *General requirements* (below), until June 15, 2011, provided that: (i) The fishing is conducted in accordance with a valid commercial bottomfish permit issued by NOAA; and (ii) Such permit was in effect on June 15, 2006, and is subsequently renewed pursuant to NOAA regulations.
 - Total landings for each fishing year may not exceed the following amounts: (i) 350,000 pounds for bottomfish species; and (ii) 180,000 pounds for pelagic species.
 - Commercial fishing for bottomfish and associated pelagic species is prohibited in the monument after June 15, 2011.
- *General requirements.* Any commercial fishing within the monument shall be conducted in accordance with the following restrictions and conditions:
 - A valid permit or facsimile of a valid permit shall be on board the fishing vessel and available for inspection by an authorized officer;
 - No attempt is made to falsify or fail to make, keep, maintain, or submit any logbook or logbook form or other required record or report;
 - Only gear specifically authorized by the relevant permit issued under the Magnuson-Stevens Fishery Conservation and Management Act is allowed to be in the possession of a person conducting commercial fishing under this section;
 - Any person conducting commercial fishing notifies the Secretaries by telephone, facsimile, or electronic mail at least 72 hours before entering the monument and within 12 hours after leaving the monument in accordance with federal regulations;
 - All fishing vessels must carry an activated and functioning VMS unit on board at all times whenever the vessel is in the monument;
 - All fishing vessels must carry an observer when requested to do so by the Secretaries;
 - The activity does not take place within any Ecological Reserve, any Special Preservation Area, or within either National Wildlife Refuge.
- b. Except where necessary to respond to emergencies threatening life, property, or the environment, or activities necessary for law enforcement purposes or armed forces actions, the following activities are prohibited throughout the monument:
 - Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging; or attempting to remove, move, take, harvest, possess, injure, disturb, or damage any living or nonliving monument resource;
 - Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the monument;
 - Attracting any living monument resource.

http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Vessel Hazards and Groundings

Vessel activities can introduce hazards to the marine environment. Some are biological in nature (e.g., the threat of alien species introductions and interactions with protected marine species). Other environmental threats from vessels include waste, effluent, and bilge and ballast water discharge, light and noise pollution, and anchor damage. Two strategies have been identified for achieving the desired outcome of preventing and reducing impacts of vessels operating in and transiting through Northwestern Hawaiian Islands:

- Address known vessel hazards and impacts by: developing protocols and practices for safe vessel operations with jurisdictional partners; informing monument users about hazards, regulations, permit requirements, and compliance regarding vessel operations; investigating domestic and international shipping designations, and; working with NOAA and the U.S. Coast Guard to update nautical charts and Notice to Mariners.

- Conduct research on vessel hazards and impacts by conducting a vessel threat assessment, and conducting studies on vessel hazards and impacts.

<http://www.hawaiiireef.noaa.gov/management/mp.html>

NOAA and USFWS monument regulations stipulate that except due to emergencies and law enforcement activities, deserting a vessel aground, at anchor, or adrift is prohibited within the monument.

http://hawaiiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Tourism and Recreation

Ocean-based ecotourism and recreation in their various forms can provide significant educational opportunities, build constituencies, and provide assistance to natural resource managers. However, they can also lead to wildlife disturbance, habitat degradation, and pollution. It is a goal of the monument to prevent, avoid, or minimize negative human impacts associated with ocean-based ecotourism and recreation by allowing access only for those activities that do not threaten the natural character or biological integrity of the Northwestern Hawaiian Islands ecosystem or Native Hawaiian cultural or maritime heritage resources. The strategy and associated activities that has been identified by the monument to achieve this goal is:

Comment [kb120]: Update this section to be consistent with the MMP.

- Develop a process to assess and manage recreation and ocean-based ecotourism activities by: working with the Interagency Coordinating Committee to identify locations that may be suitable for ocean-based ecotourism; tracking and assessing recreational activities, and; developing outreach materials specific to recreational uses and integrating them into a permitting outreach program.

<http://www.hawaiiireef.noaa.gov/management/mp.html>

Existing NOAA and USFWS monument regulations that address tourism and recreation within monument waters are:

- Anchoring on or having a vessel anchored on any living or dead coral with an anchor, anchor chain, or anchor rope is prohibited within the monument.
- Except due to emergencies and law enforcement activities, removing, moving, taking, harvesting, possessing, injuring, disturbing, damaging, or attempting to remove, move, take, harvest, possess, injure, disturb, or damage any living or nonliving resource; drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; constructing, placing, or abandoning any structure, material, or other matter on the submerged lands; touching coral, living or dead; possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the monument, and; attracting any living resource is prohibited within the monument.

http://hawaiiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

Protected Species

There are three federal acts, as well as multiple state statutes, that protect specific species in the Northwestern Hawaiian Islands. The federal acts are the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Migratory Bird Treaty Act (MBTA). The ESA of 1973 provides for the conservation of species at risk of extinction throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The MMPA of 1972 established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States. The MBTA of 1918 implements various treaties and conventions between the United States and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds.

<http://www.nmfs.noaa.gov/pr/laws/mmpa.htm>

<http://www.nmfs.noaa.gov/pr/laws/esa.htm>

<http://www.fws.gov/laws/lawsdiqest/migtrea.html>

Although endangered and threatened species are not the direct responsibility of the monument, coordination with agencies responsible for their welfare and recovery is necessary to ensure that activities taking place in the monument, and monument management, are effective in protecting and enhancing populations of those species. To support efforts to enhance protected species in the Northwestern Hawaiian Islands, the monument has identified two strategies for achieving this goal:

- Coordinate with partners on protected species needs by communicating regularly with jurisdictional agencies on protected species issues, and assisting in the development and implementation of a protected species threat reduction assessment for the Northwestern Hawaiian Islands.
- Support and facilitate research on protected species by identifying research needs and supporting research to enhance populations of protected species, and incorporating new data on candidate and protected species into the Northwestern Hawaiian Islands biogeographic assessment database.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Maritime Archaeological Resources

Proposed strategies and associated activities in the monument action plan are designed to increase our understanding of maritime heritage resources and foster effective and protective management in the monument. These strategies are as follows:

- *Document and inventory maritime heritage resources.* Preserving and appreciating maritime heritage resources begins with documentary research and field inventory surveys. These activities are similar to those associated with ecosystem research. Both involve consolidation of past information, diving operations, and mapping or remote sensing surveys. Maritime heritage field surveys are therefore compatible with multidisciplinary research missions.
- *Incorporate maritime heritage into public education and outreach.* Raising public awareness of the maritime heritage field is essential to better valuing and protecting the resource. Protection comes through understanding the nature of maritime heritage resources, as well as familiarity with established preservation efforts. Education and outreach for maritime resources emphasize “bringing the place to the people, not the people to the place” in a responsible manner.
- *Coordinate monument agency efforts to protect maritime heritage resources.* Because of NOAA’s previous maritime heritage work in the region, efforts to inventory, evaluate, interpret, and preserve maritime heritage resources in the Northwestern Hawaiian Islands will be coordinated from the Pacific Islands regional office by NOAA maritime heritage staff and conducted in close collaboration and coordination between NOAA, DLNR and FWS. Each program or agency provides expertise in the joint preservation of these non-renewable resources.

<http://www.hawaiireef.noaa.gov/management/mp.html>

Existing NOAA and USFWS Monument Regulations

The monument is currently supported in its day-to-day maritime heritage activities by the Pacific Islands NMSP regional office. Except where necessary to respond to emergencies threatening life, property, or the environment, or activities necessary for law enforcement purposes or armed forces actions, the following activities are prohibited throughout the monument:

- Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging; or attempting to remove, move, take, harvest, possess, injure, disturb, or damage any living or nonliving monument resource.

http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf

State and Federal Preservation Laws

A number of established laws govern the protection and management of maritime heritage resources. The Abandoned Shipwreck Act of 1987 charges each state with the preservation management for “certain abandoned shipwrecks, which have been deserted and to which the owner has relinquished ownership rights with no retention.” In the State of Hawai‘i the preservation and protection of historic properties on state submerged lands falls under HRS Chapter 6E, which established the State Historic Preservation Program. For both NOAA and FWS, preservation mandates for maritime heritage resources derive directly from elements of the Federal Archaeology Program, including the National Historic Preservation Act of 1966 (NHPA). Section 110 of the NHPA states that each federal agency shall establish a preservation program for the protection of historic properties. Other relevant preservation guidelines include the Antiquities Act of 1906, Archaeological Resources Protection Act of 1979, National Environmental Policy Act of 1982, the Preserve America Executive Order (EO 13287 2003), and the Sunken Military Craft Act of 2004. These laws codify the protection of heritage sites from illegal salvage and looting. NOAA’s Maritime Heritage Program and the monument’s Maritime Heritage Action Plan are specifically designed to address these preservation mandates and both inventory and protect these special resources for the benefit of the public.

http://www.hawaii.gov/dlnr/hpd/hrs_6_e.htm

<http://www.cr.nps.gov/local-law/nhpa1966.htm>

<http://www.nps.gov/phso/archeology/ABSA.htm>

<http://www.history.navy.mil/branches/org12-12a.htm>
<http://www.cr.nps.gov/history/hisnps/nps/history/antiq.htm>

Native Hawaiian Cultural Resources

Native Hawaiian practices exercised for subsistence and other cultural purposes are based on a value system that is consistent with resource protection and preservation, and serve as long-term conservation measures. The monument has identified a strategy and associated activities to support Native Hawaiian subsistence, cultural and religious practices in the Northwestern Hawaiian Islands:

- Review Native Hawaiian practices permit applications and track and monitor permitted activities.
- Support Native Hawaiian practices by: supporting Native Hawaiian cultural research and education; developing outreach for those planning expeditions for Native Hawaiian practices, and; seeking assistance from permittees to share lessons learned from their experiences.

<http://www.hawaiiireef.noaa.gov/management/mp.html>

Understanding the Northwestern Hawaiian Islands from a Native Hawaiian perspective benefits the monument in many ways. Native Hawaiian research contributes to an ecosystem-based approach to management and complements other types of research. Education and outreach to the Native Hawaiian community can elicit greater involvement by Native Hawaiians in monument management. Utilizing cultural information in education and outreach will engage the broader public in learning about and caring for the Northwestern Hawaiian Islands. The monument has identified two strategies to increase understanding of Native Hawaiian histories and cultural practices related to the Northwestern Hawaiian Islands:

- Support Native Hawaiian cultural and historical research by: identifying cultural research needs and priorities; supporting Native Hawaiian cultural research of the Northwestern Hawaiian Islands; identifying ways of integrating Native Hawaiian traditional ecological knowledge and management concepts into monument management, and; seeking protective status, as appropriate, to protect cultural sites.
- Provide cultural outreach and educational opportunities to the Native Hawaiian community and the general public by: integrating Native Hawaiian values and cultural information into a general outreach and education program; developing a culturally based strategy for education and outreach to the Native Hawaiian community; integrating Native Hawaiian values and cultural information into a monument permittee education and outreach program, and; facilitating cultural education opportunities in the field for students, teachers and cultural specialists.

<http://www.hawaiiireef.noaa.gov/management/mp.html>

Concluding Remarks

This initial report on resource status and trends for the Papahānaumokuākea Marine National Monument indicates the need for management actions that address potential impacts of key habitats, degrading conditions of some living resources (Hawaiian Monk seals, resident seabirds and migratory shorebirds), a general need to increase knowledge of regional biodiversity, and enhanced research and discovery of marine archaeological resources. Although the Northwestern Hawaiian Islands are often referred to as remote and relatively pristine, only seven of the seventeen categories received the highest rating of good. The factors contributing to these slightly diminished rankings suggest areas of focus for management actions, including marine debris, the health of threatened and endangered species, and research on the impacts of climate change. Only three categories were rated as fair (the lowest ranking assigned to any of the categories for the Northwestern Hawaiian Islands), suggesting that the overall condition of these ecosystems is good relative to the more heavily impacted reefs of the main Hawaiian Islands.

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Although the monument currently limits permitted human activity, Midway Atoll will be opening to visitors in the near future. The Midway Atoll Interim Visitor Services Plan will guide visitor activities until such time as the broader monument management plan that meets the applicable requirements of a refuge comprehensive conservation plan and visitor services plan is completed in 2008. The monument plan will incorporate broader monument opportunities to assist in management and conservation activities within the Northwestern Hawaiian Islands and throughout the main Hawaiian Islands that benefit the monument.

<http://www.fws.gov/midway/VSP/IVSP.pdf>

Archeological resources in the monument are an important link to the history of this area. Loss of these resources by natural processes ~~would be difficult to mitigate.~~ In order to preserve the artifacts and history, it is therefore important to identify, locate and document these resources.

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An important focus of the monument will be to continue to recognize and perpetuate the unique relationship of native Hawaiians to the land, sea and their cultural traditions. The monument can facilitate this relationship by serving as a catalyst for strengthening the bond between the Hawaiian people and the lands and waters of the Northwestern Hawaiian Islands. Incorporating traditional values and ecological knowledge into the natural resource management of the Northwestern Hawaiian Islands will be an important part of all management initiatives in this region.

Acknowledgements

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<<<<The below Web sites are currently links throughout the report. We need to decide which need to be actual citations and which should only appear in the "Additional Resources" section:>>>>

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National Marine Sanctuaries Web site, Maritime Heritage: <http://www.sanctuaries.noaa.gov/maritime/>

National Park Service Web site, Abandoned Shipwreck Act: <http://www.nps.gov/phso/archeology/ABSA.htm>

National Park Service Web site, Antiquities Act of 1906: <http://www.cr.nps.gov/history/hisnps/npshistory/antiq.htm>

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Naval Historic Center Web site, Sunken Military Craft Act: <http://www.history.navy.mil/branches/org12-12a.htm>

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<http://www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/hawaiianmonkseal.htm>

NOAA National Marine Fisheries Office of Protected Resources Web site, Green Turtle:
<http://www.nmfs.noaa.gov/pr/species/turtles/green.htm>

NOAA National Marine Fisheries Service, Pacific Islands Fisheries Science Center Web site, Marine Debris:
<http://www.pifsc.noaa.gov/cred/mdr.php>

NOAA National Marine Fisheries Web site, Marine Mammal Protection Act of 1972:
<http://www.nmfs.noaa.gov/pr/laws/mmpa.htm>

NOAA's Coral Reef Information System Web site, Cultural history of the NWHI early settlers:
http://www.coris.noaa.gov/about/eco_essays/nwhi/history.html

Northwestern Hawaiian Islands Marine National Monuments. A Citizen's Guide:
http://hawaiiireef.noaa.gov/PDFs/Citizens_Guide_Web.pdf

Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Final Reserve Operations Plan. March 2005.
http://hawaiiireef.noaa.gov/PDFs/Final_ROP.pdf

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<http://www.hawaiianatolls.org/about/ffs.php>

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Papahānaumokuākea Marine National Monument Web site, Management Plan:
<http://www.hawaiiireef.noaa.gov/management/mp.html>

Papahānaumokuākea Marine National Monument Web site, Maritime Heritage: <http://www.hawaiiireef.noaa.gov/maritime/>

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Turtle:http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf

Reducing Potential Impact of Invasive Marine Species in the Northwestern Hawaiian Islands Marine National Monument.
http://cramp.wcc.hawaii.edu/Downloads/TR_Godwin_et_al%20Invasives_Final%20Draft.pdf

State of Hawaii Aquatic Invasive Species Management Plan: http://www.state.hi.us/dlnr/dar/pubs/ais_mgmt_plan_final.pdf

State of the Coastal Environment. The Extent and Condition of U.S. Coral Reefs:
http://oceanservice.noaa.gov/websites/retiredsites/sotc_pdf/CRF.PDF

The Role of Oceanographic Conditions and reef morphology in the 2002 coral bleaching event in the northwestern Hawaiian Islands: http://www.pifsc.noaa.gov/library/pubs/HoekeARB543_Final.pdf

The U.S. Geological Survey Web site, The long trail of the Hawaiian hotspot: <http://pubs.usgs.gov/gip/dynamic/Hawaiian.html>

The White House Web site, Establishment of the Northwestern Hawaiian Islands Marine National Monument:
<http://www.whitehouse.gov/news/releases/2006/06/20060615-18.html>

Additional Resources

Bishop Museum Web site: <http://www.bishopmuseum.org/>

Hawai'i Coral Reef Initiative Research Program Web site: <http://www.hawaii.edu/ssri/hcri/files/>

Hawai'i Institute of Marine Biology Web site: <http://www.hawaii.edu/HIMB/>

Marine Conservation Biology Institute Web site: <http://www.mcbi.org/>

Marine Protected Areas of the United States Web site: <http://www.mpa.gov/>

NOAA Coral Reef Conservation Program Web site Web site: <http://www.coralreef.noaa.gov/>

NOAA National Marine Fisheries Office of Protected Resources Web site, Endangered Species Act:
<http://www.nmfs.noaa.gov/pr/laws/esa/>

NOAA National Marine Fisheries Office of Protected Resources Web site, Marine Mammal Protection Act of 1972:
<http://www.nmfs.noaa.gov/pr/laws/mmpa/>

NOAA National Marine Sanctuary Program Web site: <http://www.sanctuaries.nos.noaa.gov/welcome.html>

NOAA Ocean Explorer Web site: <http://www.oceanexplorer.noaa.gov/welcome.html>

NOAA's Coral Reef Information System (CoRIS) Web site, Cultural History of the NWHI:
http://www.coris.noaa.gov/about/eco_essays/nwhi/history.html

NOAA's Coral Reef Information System (CoRIS) Web site: <http://www.coris.noaa.gov/>

NOAA's National Marine Fisheries Service Web site: <http://www.nmfs.noaa.gov/>

NOAA's National Marine Sanctuary Program Web site: <http://sanctuaries.noaa.gov/>

NOAA's National Marine Sanctuary Program Web site, Maritime Heritage: <http://www.sanctuaries.noaa.gov/maritime/>

NOAA's Pacific Islands Fisheries Science Center Web site, Marine Debris Removal: <http://www.pifsc.noaa.gov/cred/mdr.php>

Papahānaumokuākea Marine National Monument Web site: <http://hawaiiireef.noaa.gov/>

Papahānaumokuākea Marine National Monument Web site, About the Area: <http://hawaiiireef.noaa.gov/about/welcome.html>

Papahānaumokuākea Marine National Monument Web site, French Frigate Shoals: <http://www.hawaiianatolls.org/about/ffs.php>

Papahānaumokuākea Marine National Monument Web site, Frequently Asked Questions:
<http://hawaiiireef.noaa.gov/about/faq.html>

Papahānaumokuākea National Marine Monument Web site, Maritime Heritage: <http://www.hawaiiireef.noaa.gov/maritime/>

State of Hawai'i's Department of Land and Natural Resources Web site: <http://www.hawaii.gov/dlnr/>

U.S. Fish & Wildlife Service Web site: <http://www.fws.gov/>

Western Pacific Fishery Management Council Web site: <http://www.wpcouncil.org/>

Woods Hole Oceanographic Institution Web site: <http://www.whoi.edu/>

Appendix A: Rating Scheme for System-Wide Monitoring Questions

The purpose of this appendix is to clarify the 17 questions and possible responses used to report the condition of sanctuary resources in "Condition Reports" for all national marine sanctuaries. Individual staff and partners utilized this guidance, as well as their own informed and detailed understanding of the site to make judgments about the status and trends of sanctuary resources.

The questions derive from the National Marine Sanctuary Program mission, and a system-wide monitoring framework (National Marine Sanctuary Program, 2004) developed to ensure the timely flow of data and information to those responsible for managing and protecting resources in the ocean and coastal zone, and to those that use, depend on, and study the ecosystems encompassed by the sanctuaries. They are being used to guide staff and partners at each of the 14 sites in the sanctuary system in the development of this first periodic sanctuary condition report. The questions are meant to set the limits of judgments so that responses can be confined to certain reporting categories that will later be compared among all sites, and combined.

Following a brief discussion about each question, statements are presented that were used to judge the status and assign a corresponding color code. These statements are customized for each question. In addition, the following options are available for all questions: "N/A" - the question does not apply; and "Undet." - resource status is undetermined.

Symbols used to indicate trends are the same for all questions: "▲" - conditions appear to be improving; "—" - conditions do not appear to be changing; "▼" - conditions appear to be declining; and "?" - trend is undetermined.

Question 1 (Water/Stressors): Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality and how are they changing?

This is meant to capture shifts in condition arising from certain changing physical processes and anthropogenic inputs. Factors resulting in regionally accelerated rates of change in water temperature, salinity, dissolved oxygen, or water clarity, could all be judged to reduce water quality. Localized changes in circulation or sedimentation resulting, for example, from coastal construction or dredge spoil disposal, can affect light penetration, salinity regimes, oxygen levels, productivity, waste transport, and other factors that influence habitat and living resource quality. Human inputs, generally in the form of contaminants from point or non-point sources, including fertilizers, pesticides, hydrocarbons, heavy metals, and sewage, are common causes of environmental degradation, often in combination rather than alone. Certain biotoxins, such as domoic acid, may be of particular interest to specific sanctuaries. When present in the water column, any of these contaminants can affect marine life by direct contact or ingestion, or through bioaccumulation via the food chain.

[Note: Over time, accumulation in sediments can sequester and concentrate contaminants. Their effects may manifest only when the sediments are resuspended during storm or other energetic events. In such cases, reports of status should be made under Question 7 – Habitat contaminants.]

Good	Conditions do not appear to have the potential to negatively affect living resources or habitat quality.
Good/Fair	Selected conditions may preclude full development of living resource assemblages and habitats, but are not likely to cause substantial or persistent declines.
Fair	Selected conditions may inhibit the development of assemblages, and may cause measurable but not severe declines in living resources and habitats.
Fair/Poor	Selected conditions have caused or are likely to cause severe declines in some but not all living resources and habitats.
Poor	Selected conditions have caused or are likely to cause severe declines in most if not all, living resources and habitats.

Question 2 (Water/Eutrophic Condition): What is the eutrophic condition of sanctuary waters and how is it changing?

Nutrient enrichment often leads to planktonic and/or benthic algae blooms. Some affect benthic communities directly through space competition. Overgrowth and other competitive interactions (e.g., accumulation of algal-sediment mats) often lead to shifts in dominance in the benthic assemblage. Disease incidence and frequency can also be affected by algae competition and the resulting chemistry along competitive boundaries. Blooms can also affect water column conditions, including light penetration and plankton availability, which can alter pelagic food webs. Harmful algal blooms often affect resources, as biotoxins are released into the water and air, and oxygen can be depleted.

Good	Conditions do not appear to have the potential to negatively affect living resources or habitat quality.
Good/Fair	Selected conditions may preclude full development of living resource assemblages and habitats, but are not likely to cause substantial or persistent declines.
Fair	Selected conditions may inhibit the development of assemblages, and may cause measurable but not severe declines in living resources and habitats.
Fair/Poor	Selected conditions have caused or are likely to cause severe declines in some but not all living resources and habitats.
Poor	Selected conditions have caused or are likely to cause severe declines in most if not all living resources and habitats.

Question 3 (Water/Human Health): Do sanctuary waters pose risks to human health and how are they changing?

Human health concerns are generally aroused by evidence of contamination (usually bacterial or chemical) in bathing waters or fish intended for consumption. They also emerge when harmful algal blooms are reported or when cases of respiratory distress or other disorders attributable to harmful algal blooms increase dramatically. Any of these conditions should be considered in the course of judging the risk to humans posed by waters in a marine sanctuary.

Some sites may have access to specific information on beach and shellfish conditions. In particular, beaches may be closed when criteria for safe water body contact are exceeded, or shellfish harvesting may be prohibited when contaminant loads or infection rates exceed certain levels. These conditions can be evaluated in the context of the descriptions below.

Good	Conditions do not appear to have the potential to negatively affect human health.
Good/Fair	Selected conditions that have the potential to affect human health may exist but human impacts have not been reported.
Fair	Selected conditions have resulted in isolated human impacts, but evidence does not justify widespread or persistent concern.
Fair/Poor	Selected conditions have caused or are likely to cause severe impacts, but cases to date have not suggested a pervasive problem.
Poor	Selected conditions warrant widespread concern and action, as large-scale, persistent, and/or repeated severe impacts are likely or have occurred.

Question 4 (Water/Human Activities): What are the levels of human activities that may influence water quality and how are they changing?

Among the human activities in or near sanctuaries that affect water quality are those involving direct discharges (transiting vessels, visiting vessels, onshore and offshore industrial facilities, public wastewater facilities), those that contribute contaminants to stream, river, and water control discharges (agriculture, runoff from impermeable surfaces through storm drains, conversion of land use), and those releasing airborne chemicals that subsequently deposit via particulates at sea (vessels, land-based traffic, power plants, manufacturing facilities, refineries). In addition, dredging and trawling can cause resuspension of contaminants in sediments.

Good	Few or no activities occur that are likely to negatively affect water quality.
Good/Fair	Some potentially harmful activities exist, but they do not appear to have had a negative effect on water quality.

Fair	Selected activities have resulted in measurable resource impacts, but evidence suggests effects are localized, not widespread.
Fair/Poor	Selected activities have caused or are likely to cause severe impacts, and cases to date suggest a pervasive problem.
Poor	Selected activities warrant widespread concern and action, as large-scale, persistent, and/or repeated severe impacts have occurred or are likely to occur.

Question 5 (Habitat/Abundance/Distribution): What are the abundance and distribution of major habitat types and how are they changing?

Habitat loss is of paramount concern when it comes to protecting marine and terrestrial ecosystems. Of greatest concern to sanctuaries are changes caused, either directly or indirectly, by human activities. The loss of shoreline is recognized as a problem indirectly caused by human activities. Habitats with submerged aquatic vegetation are often altered by changes in water conditions in estuaries, bays, and nearshore waters. Intertidal zones can be affected for long periods by spills or by chronic pollutant exposure. Beaches and haul-out areas can be littered with dangerous marine debris, as can the water column or benthic habitats. Sandy subtidal areas and hardbottoms are frequently disturbed or destroyed by trawling. Even rocky areas several hundred meters deep are increasingly affected by certain types of trawls, bottom longlines, and fish traps. Groundings, anchors, and divers damage submerged reefs. Cables and pipelines disturb corridors across numerous habitat types and can be destructive if they become mobile. Shellfish dredging removes, alters, and fragments habitats.

The result of these activities is the gradual reduction of the extent and quality of marine habitats. Losses can often be quantified through visual surveys and to some extent using high-resolution mapping. This question asks about the quality of habitats compared to those that would be expected without human impacts. The status depends on comparison to a baseline that existed in the past - one toward which restoration efforts might aim.

Good	Habitats are in pristine or near-pristine condition and are unlikely to preclude full community development.
Good/Fair	Selected habitat loss or alteration has taken place, precluding full development of living resource assemblages, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.
Fair	Selected habitat loss or alteration may inhibit the development of assemblages, and may cause measurable but not severe declines in living resources or water quality.
Fair/Poor	Selected habitat loss or alteration has caused or is likely to cause severe declines in some but not all living resources or water quality.
Poor	Selected habitat loss or alteration has caused or is likely to cause severe declines in most if not all living resources or water quality.

Question 6 (Habitat/Structure): What is the condition of biologically-structured habitats and how is it changing?

Many organisms depend on the integrity of their habitats and that integrity is largely determined by the condition of particular living organisms. Coral reefs may be the best known examples of such biologically-structured habitats. Not only is the substrate itself biogenic, but the diverse assemblages residing within and on the reefs depend on and interact with each other in tightly linked food webs. They also depend on each other for the recycling of wastes, hygiene, and the maintenance of water quality, among other requirements.

Kelp beds may not be biogenic habitats to the extent of coral reefs, but kelp provides essential habitat for assemblages that would not reside or function together without it. There are other communities of organisms that are also similarly co-dependent, such as hard-bottom communities, which may be structured by bivalves, octocorals, coralline algae, or other groups that generate essential habitat for other species. Intertidal assemblages structured by mussels, barnacles, and algae are another example, seagrass beds another. This question is intended to address these types of places, where organisms form structures (habitats) on which other organisms depend.

Good	Habitats are in pristine or near-pristine condition and are unlikely to preclude full community development.
Good/Fair	Selected habitat loss or alteration has taken place, precluding full development of living resources, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.

- Fair** Selected habitat loss or alteration may inhibit the development of living resources, and may cause measurable but not severe declines in living resources or water quality.
- Fair/Poor** Selected habitat loss or alteration has caused or is likely to cause severe declines in some but not all living resources or water quality.
- Poor** Selected habitat loss or alteration has caused or is likely to cause severe declines in most if not all living resources or water quality.

Question 7 (Habitat/Contaminants): What are the contaminant concentrations in sanctuary habitats and how are they changing?

This question addresses the need to understand the risk posed by contaminants within benthic formations, such as soft sediments, hard bottoms, or biogenic organisms. In the first two cases, the contaminants can become available when released via disturbance. They can also pass upwards through the food chain after being ingested by bottom dwelling prey species. The contaminants of concern generally include pesticides, hydrocarbons, and heavy metals, but the specific concerns of individual sanctuaries may differ substantially.

- Good** Contaminants do not appear to have the potential to negatively affect living resources or water quality.
- Good/Fair** Selected contaminants may preclude full development of living resource assemblages, but are not likely to cause substantial or persistent degradation.
- Fair** Selected contaminants may inhibit the development of assemblages, and may cause measurable but not severe declines in living resources or water quality.
- Fair/Poor** Selected contaminants have caused or are likely to cause severe declines in some but not all living resources or water quality.
- Poor** Selected contaminants have caused or are likely to cause severe declines in most if not all living resources or water quality.

Question 8 (Habitat/Human Activities): What are the levels of human activities that may influence habitat quality and how are they changing?

Human activities that degrade habitat quality do so by affecting structural (geological), biological, oceanographic, acoustic, or chemical characteristics. Structural impacts include removal or mechanical alteration, including various fishing techniques (trawls, traps, dredges, longlines, and even hook-and-line in some habitats), dredging channels and harbors and dumping spoil, vessel groundings, anchoring, laying pipelines and cables, installing offshore structures, discharging drill cuttings, dragging tow cables, and placing artificial reefs. Removal or alteration of critical biological components of habitats can occur along with several of the above activities, most notably trawling, groundings, and cable drags. Marine debris, particularly in large quantities (e.g., lost gill nets and other types of fishing gear), can affect both biological and structural habitat components. Changes in water circulation often occur when channels are dredged, fill is added, coastal areas are reinforced, or other construction takes place. These activities affect habitat by changing food delivery, waste removal, water quality (e.g., salinity, clarity and sedimentation), recruitment patterns, and a host of other factors. Acoustic impacts can occur to water column habitats and organisms from acute and chronic sources of anthropogenic noise (e.g., shipping, boating, construction). Chemical alterations most commonly occur following spills and can have both acute and chronic impacts.

- Good** Few or no activities occur that are likely to negatively affect habitat quality.
- Good/Fair** Some potentially harmful activities exist, but they do not appear to have had a negative effect on habitat quality.
- Fair** Selected activities have resulted in measurable habitat impacts, but evidence suggests effects are localized, not widespread.
- Fair/Poor** Selected activities have caused or are likely to cause severe impacts, and cases to date suggest a pervasive problem.
- Poor** Selected activities warrant widespread concern and action, as large-scale, persistent, and/or repeated severe impacts have occurred or are likely to occur.

Question 9 (Living Resources/Biodiversity): What is the status of biodiversity and how is it changing?

This is intended to elicit thought and assessment of the condition of living resources based on expected biodiversity levels and the interactions between species. Intact ecosystems require that all parts not only exist, but that they function together, resulting in natural symbioses, competition, and predator-prey relationships. Community integrity, resistance and resilience all depend on these relationships. Abundance, relative abundance, trophic structure, richness, H' diversity, evenness, and other measures are often used to assess these attributes.

Good	Biodiversity appears to reflect pristine or near-pristine conditions and promotes ecosystem integrity (full community development and function).
Good/Fair	Selected biodiversity loss has taken place, precluding full community development and function, but it is unlikely to cause substantial or persistent degradation of ecosystem integrity.
Fair	Selected biodiversity loss may inhibit full community development and function, and may cause measurable but not severe degradation of ecosystem integrity.
Fair/Poor	Selected biodiversity loss has caused or is likely to cause severe declines in some but not all ecosystem components and reduce ecosystem integrity.
Poor	Selected biodiversity loss has caused or is likely to cause severe declines in ecosystem integrity.

Question 10 (Living Resources/Extracted Species): What is the status of environmentally sustainable fishing and how is it changing?

Commercial and recreational harvesting are highly selective activities, for which fishers and collectors target a limited number of species, and often remove high proportions of populations. In addition to removing significant amounts of biomass from the ecosystem, reducing its availability to other consumers, these activities tend to disrupt specific and often critical food web links. When too much extraction occurs (i.e. ecologically unsustainable harvesting), trophic cascades ensue, resulting in changes in the abundance of non-targeted species as well. It also reduces the ability of the targeted species to replenish populations at a rate that supports continued ecosystem integrity.

It is essential to understand whether removals are occurring at ecologically sustainable levels. Knowing extraction levels and determining the impacts of removal are both ways that help gain this understanding. Measures for target species of abundance, catch amounts or rates (e.g., catch per unit effort), trophic structure, and changes in non-target species abundance are all generally used to assess these conditions.

Other issues related to this question include whether fishers are using gear that is compatible with the habitats being fished and whether that gear minimizes by-catch and incidental take of marine mammals. For example, bottom-tending gear often destroys or alters both benthic structure and non-targeted animal and plant communities. "Ghost fishing" occurs when lost traps continue to capture organisms. Lost or active nets, as well as lines used to mark and tend traps and other fishing gear, can entangle marine mammals. Any of these could be considered indications of environmentally unsustainable fishing techniques.

Good	Extraction does not appear to affect ecosystem integrity (full community development and function).
Good/Fair	Extraction takes place, precluding full community development and function, but it is unlikely to cause substantial or persistent degradation of ecosystem integrity.
Fair	Extraction may inhibit full community development and function, and may cause measurable but not severe degradation of ecosystem integrity.
Fair/Poor	Extraction has caused or is likely to cause severe declines in some but not all ecosystem components and reduce ecosystem integrity.
Poor	Extraction has caused or is likely to cause severe declines in ecosystem integrity.

Question 11 (Living Resources/Invasive Species): What is the status of non-indigenous species and how is it changing?

Non-indigenous species are generally considered problematic, and candidates for rapid response, if found, soon after invasion. For those that become established, their impacts can sometimes be assessed by quantifying changes in the

affected native species. This question allows sanctuaries to report on the threat posed by non-indigenous species. In some cases, the presence of a species alone constitutes a significant threat (certain invasive algae). In other cases, impacts have been measured, and may or may not significantly affect ecosystem integrity.

Good	Non-indigenous species are not suspected or do not appear to affect ecosystem integrity (full community development and function).
Good/Fair	Non-indigenous species exist, precluding full community development and function, but are unlikely to cause substantial or persistent degradation of ecosystem integrity.
Fair	Non-indigenous species may inhibit full community development and function, and may cause measurable but not severe degradation of ecosystem integrity.
Fair/Poor	Non-indigenous species have caused or are likely to cause severe declines in some but not all ecosystem components and reduce ecosystem integrity.
Poor	Non-indigenous species have caused or are likely to cause severe declines in ecosystem integrity.

Question 12 (Living Resources/Key Species): What is the status of key species and how is it changing?

Certain species can be defined as “key” within a marine sanctuary. Some might be keystone species, that is, species on which the persistence of a large number of other species in the ecosystem depends - the pillar of community stability. Their functional contribution to ecosystem function is disproportionate to their numerical abundance or biomass and their impact is therefore important at the community or ecosystem level. Their removal initiates changes in ecosystem structure and sometimes the disappearance of or dramatic increase in the abundance of dependent species. Keystone species may include certain habitat modifiers, predators, herbivores, and those involved in critical symbiotic relationships (e.g. cleaning or co-habiting species).

Other key species may include those that are indicators of ecosystem condition or change (e.g., particularly sensitive species), those targeted for special protection efforts, or charismatic species that are identified with certain areas or ecosystems. These may or may not meet the definition of keystone, but do require assessments of status and trends.

Good	Key and keystone species appear to reflect pristine or near-pristine conditions and may promote ecosystem integrity (full community development and function).
Good/Fair	Selected key or keystone species are at reduced levels, perhaps precluding full community development and function, but substantial or persistent declines are not expected.
Fair	The reduced abundance of selected keystone species may inhibit full community development and function, and may cause measurable but not severe degradation of ecosystem integrity; or selected key species are at reduced levels, but recovery is possible.
Fair/Poor	The reduced abundance of selected keystone species has caused or is likely to cause severe declines in some but not all ecosystem components, and reduce ecosystem integrity; or selected key species are at substantially reduced levels, and prospects for recovery are uncertain.
Poor	The reduced abundance of selected keystone species has caused or is likely to cause severe declines in ecosystem integrity; or selected key species are at severely reduced levels, and recovery is unlikely.

Question 13 (Living Resources/Health of Key Species): What is the condition or health of key species and how is it changing?

For those species considered essential to ecosystem integrity, measures of their condition can be important to determining the likelihood that they will persist and continue to provide vital ecosystem functions. Measures of condition may include growth rates, fecundity, recruitment, age-specific survival, tissue contaminant levels, pathologies (disease incidence tumors, deformities), the presence and abundance of critical symbionts, or parasite loads. Similar measures of condition may also be appropriate for other key species (indicator, protected, or charismatic species). In contrast to the question about keystone species (#12 above), the impact of changes in the abundance or condition of key species is more likely to be observed at the population or individual level, and less likely to result in ecosystem or community effects.

Good	The condition of key resources appears to reflect pristine or near-pristine conditions.
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Good/Fair	The condition of selected key resources is not optimal, perhaps precluding full ecological function, but substantial or persistent declines are not expected.
Fair	The diminished condition of selected key resources may cause a measurable but not severe reduction in ecological function, but recovery is possible.
Fair/Poor	The comparatively poor condition of selected key resources makes prospects for recovery uncertain.
Poor	The poor condition of selected key resources makes recovery unlikely.

Question 14 (Living Resources/Human Activities): What are the levels of human activities that may influence living resource quality and how are they changing?

Human activities that degrade living resource quality do so by causing a loss or reduction of one or more species, by disrupting critical life stages, by impairing various physiological processes, or by promoting the introduction of non-indigenous species or pathogens. (Note: Activities that impact habitat and water quality may also affect living resources. These activities are dealt with in Questions 4 and 8, and many are repeated here as they also have direct effect on living resources).

Fishing and collecting are the primary means of removing resources. Bottom trawling, seine-fishing, and the collection of ornamental species for the aquarium trade are all common examples, some being more selective than others. Chronic mortality can be caused by marine debris derived from commercial or recreational vessel traffic, lost fishing gear, and excess visitation, resulting in the gradual loss of some species.

Critical life stages can be affected in various ways. Mortality to adult stages is often caused by trawling and other fishing techniques, cable drags, dumping spoil or drill cuttings, vessel groundings, or persistent anchoring. Contamination of areas by acute or chronic spills, discharges by vessels, or municipal and industrial facilities can make them unsuitable for recruitment; the same activities can make nursery habitats unsuitable. Although coastal armoring and construction can increase the availability of surfaces suitable for the recruitment and growth of hard bottom species, the activity may disrupt recruitment patterns for other species (e.g., intertidal soft bottom animals) and habitat may be lost.

Spills, discharges, and contaminants released from sediments (e.g., by dredging and dumping) can all cause physiological impairment and tissue contamination. Such activities can affect all life stages by reducing fecundity, increasing larval, juvenile, and adult mortality, reducing disease resistance, and increasing susceptibility to predation. Bioaccumulation allows some contaminants to move upward through the food chain, disproportionately affecting certain species.

Activities that promote introductions include bilge discharges and ballast water exchange, commercial shipping and vessel transportation. Releases of aquarium fish can also lead to species introductions.

Good	Few or no activities occur that are likely to negatively affect living resource quality.
Good/Fair	Some potentially harmful activities exist, but they do not appear to have had a negative effect on living resource quality.
Fair	Selected activities have resulted in measurable living resource impacts, but evidence suggests effects are localized, not widespread.
Fair/Poor	Selected activities have caused or are likely to cause severe impacts, and cases to date suggest a pervasive problem.
Poor	Selected activities warrant widespread concern and action, as large-scale, persistent, and/or repeated severe impacts have occurred or are likely to occur.

Question 15 (Maritime Archaeological Resources/Integrity): What is the integrity of known maritime archaeological resources and how is it changing?

The condition of archaeological resources in a marine sanctuary significantly affects their value for science and education, as well as the resource's eligibility for listing in the National Register of Historic Places. Assessments of archaeological sites include evaluation of the apparent levels of site integrity, which are based on levels of previous human disturbance and the level of natural deterioration. The historical, scientific and educational values of sites are also evaluated, and are substantially determined and affected by site condition.

Good	Known archaeological resources appear to reflect little or no unexpected disturbance.
Good/Fair	Selected archaeological resources exhibit indications of disturbance, but there appears to have been little or no reduction in historical, scientific, or educational value.
Fair	The diminished condition of selected archaeological resources has reduced, to some extent, their historical, scientific, or educational value, and may affect the eligibility of some sites for listing in the National Register of Historic Places.
Fair/Poor	The diminished condition of selected archaeological resources has substantially reduced their historical, scientific, or educational value, and is likely to affect their eligibility for listing in the National Register of Historic Places.
Poor	The degraded condition of known archaeological resources in general makes them ineffective in terms of historical, scientific, or educational value, and precludes their listing in the National Register of Historic Places.

Question 16 (Maritime Archaeological Resources/Threat to Environment): Do known maritime archaeological resources pose an environmental hazard and is this threat changing?

The sinking of a ship potentially introduces hazardous materials into the marine environment. This danger is true for historic shipwrecks as well. The issue is complicated by the fact that shipwrecks older than 50 years may be considered historical resources and must, by federal mandate, be protected. Many historic shipwrecks, particularly early to mid-20th century, still have the potential to retain oil and fuel in tanks and bunkers. As shipwrecks age and deteriorate, the potential for release of these materials into the environment increases.

Good	Known maritime archaeological resources pose few or no environmental threats.
Good/Fair	Selected maritime archaeological resources may pose isolated or limited environmental threats, but substantial or persistent impacts are not expected.
Fair	Selected maritime archaeological resources may cause measurable, but not severe, impacts to certain sanctuary resources or areas, but recovery is possible.
Fair/Poor	Selected maritime archaeological resources pose substantial threats to certain sanctuary resources or areas, and prospects for recovery are uncertain.
Poor	Selected maritime archaeological resources pose serious threats to sanctuary resources, and recovery is unlikely.

Question 17 (Maritime Archaeological Resources/Human Activities): What are the levels of human activities that may influence maritime archaeological resource quality and how are they changing?

Some human maritime activities threaten the physical integrity of submerged archaeological resources. Archaeological site integrity is compromised when elements are moved, removed, or otherwise damaged. Threats come from looting by divers, inadvertent damage by scuba diving visitors, improperly conducted archaeology that does not fully document site disturbance, anchoring, groundings, and commercial and recreational fishing activities, among others.

Good	Few or no activities occur that are likely to negatively affect maritime archaeological resource integrity.
Good/Fair	Some potentially relevant activities exist, but they do not appear to have had a negative effect on maritime archaeological resource integrity.
Fair	Selected activities have resulted in measurable impacts to maritime archaeological resources, but evidence suggests effects are localized, not widespread.
Fair/Poor	Selected activities have caused or are likely to cause severe impacts, and cases to date suggest a pervasive problem.
Poor	Selected activities warrant widespread concern and action, as large-scale, persistent, and/or repeated severe impacts have occurred or are likely to occur.