

Figure 249. Comparison of fish standing stock at two neighbor island limited-take MPAs. Arrows represent year designated an MPA (from Friedlander in press).

with increased use versus diminished resources.

President Clinton's Executive Order 13089 for Protection of U.S. Coral Reefs (1998), mandating federal agencies make better use of their programs to protect and enhance U.S. reefs, has not yet been effectively put to the test in the MHI. Of particular concern are federal oversight or funding of activities such as offshore aquaculture, bioprospecting, marine ornamental aquaculture, underwater sensor technology, and shoreline or harbor modification.

Current monitoring of fisheries activities in the MHI does not provide information on the recreational and subsistence fisheries that accounts for much of the catch on Hawaiian coral reefs. Future management designs will need to consider the habitat requirements and life histories of the species of interest as well as the extent of fishing pressure in the area and the degree of enforcement.

Overuse of MHI MPAs for the tourist trade¹⁶⁴ and the lack of any true, fully protected reserves¹⁶⁵ is quickly eliminating the opportunity to have even a small area in the MHI that represents a natural coral reef ecosystem. What the MHI needs is a true coral reef ecosystem reserve, where all extraction

activities would be restricted. Given the substantial overlap of user groups in many MHI reef areas, the increasing population, and the perpetual conflict between resource utilization and conservation¹⁶⁶, creation of such a new type of MPA is unlikely in the MHI any time in the near future.

Northwestern Hawaiian Islands (NWHI)

Introduction

The NWHI extend for more than 2,000 km (1,300 mi) to the northwest of the island of Kaua'i. From Nihoa and Necker (roughly 7 and 10 million years old respectively) to Midway and Kure atolls (~28 million years old), the NWHI represent the older, emergent portion of the Archipelago (Fig 250). The majority of the islets and shoals remain uninhabited, although Midway, Kure, and French Frigate Shoals have all been occupied for extended periods by various government agencies over the latter portion of the last century.

With the exception of Midway Atoll, the entire NWHI is part of the State of Hawai'i from the shoreline to 3 nmi from any emerged land. The USFWS manages Midway as a National Wildlife Refuge. Much of the rest of the NWHI¹⁶⁷ is within the Hawaiian Islands National Wildlife Refuge, established by President Theodore Roosevelt in 1909, and administered by the USFWS. The near-shore reefs of the NWHI (with the exception of some species-specific and temporally-limited fisheries depletion) are in very good to excellent condition.

In addition, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was created by Executive Order 13178 on December 4, 2000. This

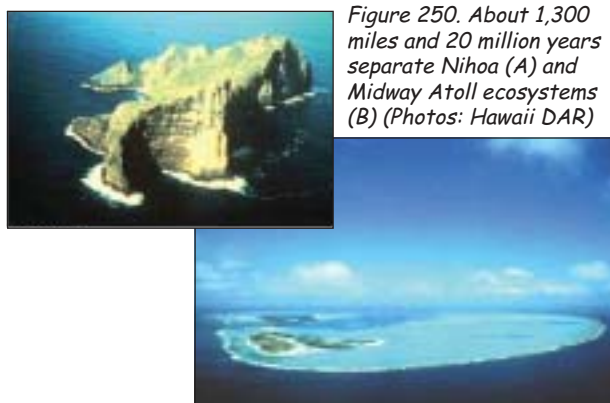


Figure 250. About 1,300 miles and 20 million years separate Nihoa (A) and Midway Atoll ecosystems (B) (Photos: Hawaii DAR)

¹⁶⁶ The State legislature recently passed a regulation requiring extensive review of all new management rules for effects on small business.

¹⁶⁷ Excluding Kure Atoll which is a State of Hawai'i wildlife refuge.



Figure 251. Seven species of *Acropora* corals, closely related to this table coral in French Frigate Shoals, have been identified from the NWHI (Photo: James Maragos).

large reserve area, 1,200 nmi long and 3-50 nmi from shorelines, is to be managed under the Secretary of Commerce, and is now undergoing the process for designation as a National Marine Sanctuary. The Executive Order also established 15 Reserve Preservation Areas within the reserve in which all extractive use is prohibited with limited exceptions.

Condition of Coral Reefs

Algae and Higher Plants – Abbott (1995) estimated the number of algal species in the NWHI to be around 200, with numerous new species and new records having been recently recorded (Maragos and Gulko 2002). Given the large amount of shallow (<30 m) benthic area relative to the MHI, seaweeds presumably comprise the largest component of the benthos and this number could be expected to increase significantly once the entire area is more fully assessed. As an example, prior to the 2000 NOWRAMP expedition, there were only eight species of algae known from French Frigate Shoals, compared to the roughly 130 species collected there as a result of this expedition (P. Vroom pers. comm.).

Halophila hawaiiensis has been found at Midway Atoll and Pearl and Hermes Atoll, and may exist elsewhere in the NWHI.

Coral – Previously 22 species of coral were reported from the NWHI (Okamoto and Kawamoto 1980), compared with 52 species reported from the recent NOWRAMP Expedition (Maragos and Gulko 2002). Seven species of the genus *Acropora*¹⁶⁸ have been found in the NWHI, five of these have not been reported in the MHI¹⁶⁹ (Fig 251). French Frigate Shoals, and Maro Reef have the highest

reported biodiversity of coral species (Grigg 1983, Maragos and Gulko 2002).

Coral cover for many areas of the NWHI is low, with the highest percentages at French Frigate Shoals and Maro Reef (Grigg 1983). Recent research reports that coral cover is also high at many of the atolls (Maragos and Gulko 2002) and Neva Shoals (R. Brainard pers. obs.). Towed diver video surveys conducted during the NOWRAMP 2000 Expedition revealed high heterogeneity within and among the different atolls, islands, and banks. Also, growth rates for corals in the northern portion of the chain are reported to be significantly slower than the same species found farther to the south¹⁷⁰ (Grigg 1988), raising concern about recovery rates from human impacts at different locations.

Large Mobile Invertebrates – Surveys conducted in the 1970s (Okamoto and Kawamoto 1980) found only 63 species of macroinvertebrates throughout the NWHI. Rapid ecological assessments conducted during the Fall of 2000 added to this count (Minton *et al.* in prep.). Other surveys conducted within the soft sediment habitats characteristic of many atoll lagoons reported that a variety of polychaete worms and molluscs were the most abundant infauna (Sorden 1984). The NOWRAMP survey of soft sediments identified 5,400 organisms representing 300 taxa from 63 stations (D. Turgeon pers. comm.). Polychaetes comprised 47% of the total assemblage, followed in abundance by malacostracans (29%) and gastropods (7%).

Towed diver surveys during the NOWRAMP 2000 Expedition recorded localized areas with a moderate abundance of *A. planci* along the southern outer reef slope at Pearl and Hermes Atoll and along the eastern outer reef slope at Kure Atoll (R. Brainard

Figure 252. Carnivores abound in the NWHI, like this school of goatfishes in Kure Lagoon (Photo: James Maragos).



¹⁶⁸ *A. cytherea*, *A. cerialis*, *A. gemmifera*, *A. humilis*, *A. nasuta*, *A. paniculata*, and *A. valida*.

¹⁶⁹ A few small colonies of *Acropora cytherea* and *A. paniculata* were reported off the island of Kaua'i but have not been seen in recent years.

pers. comm.). These occurrences were associated with dead or dying *Pocillopora* colonies in areas of low coral cover.

Fish – A total of 266 species of fishes is listed from Midway Atoll of which 258 are reef and shore fishes (Randall *et al.* 1993). Cooler water temperatures, lack of certain high-island habitat types, and lower sampling effort may all contribute to the lower number of species compared to the main Hawaiian Islands. The reef fish community structure in the NWHI is different from other areas in the Hawaiian Archipelago owing to reduced abundance of herbivores (mostly surgeonfishes) and the increased importance of damselfishes and carnivores (mostly jacks, sharks, goatfishes, scorpionfishes, and big-eyes, Fig. 252). Reef fish trophic structure in the NWHI is dominated by carnivores in numerical abundance and biomass (Parrish *et al.* 1985, Fig. 253). The result is that the NWHI are among the few large reef ecosystems on the globe to remain predator-dominated and intact regarding fish assemblages (Friedlander *et al.* in prep.).

Because of the distances involved and the more exposed sea conditions, commercial fishers with large vessels (greater than 20 m) are the primary participants in the NWHI fisheries (Smith 1993). Commercial fishing in the NWHI within a 100 m depth targets mostly bottomfish and lobster, each of which is managed separately by the National Marine Fisheries Service (NMFS) through the actions of an advisory body: the Western Pacific Regional Fisheries Management Council (WPRFMC). Both of these fisheries are limited-entry with less than 20 vessels allowed to operate in either fishery.

There is currently concern over the declining abundance of lobsters in the NWHI, particularly in light of their potential importance as food for the endangered Hawaiian monk

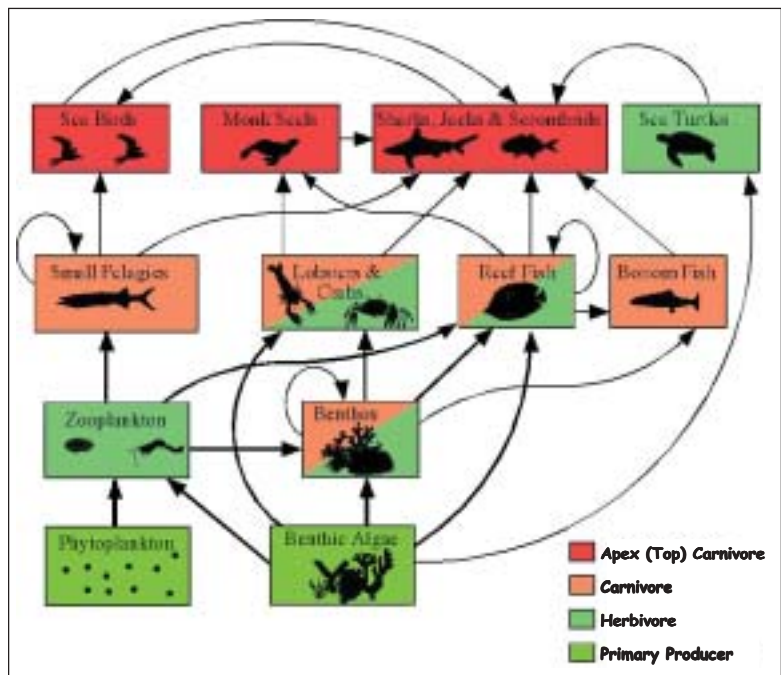


Figure 253. The coral reef food web in French Frigate Shoals, NWHI (Modified after Polovina 1984).

seal¹⁷¹. A lawsuit was filed in federal court in 1999 regarding this issue. Before a ruling was issued, NMFS closed the fishery when it became apparent that some of the assumptions used in the lobster population assessment model were incorrect. Executive Order 13178, which established the NWHI Coral Reef Ecosystem Reserve, capped the lobster take at the 2000 catch level or zero take. Currently the NWHI lobster fishery remains closed.

Recreational and commercial fishing is prohibited within the 10-20 fathom isobath off most islands northwest of Kauai (varying with location) owing to their status as a National Wildlife Refuge managed by the USFWS, and their designation as critical habitat for the Hawaiian monk seal by the NMFS.

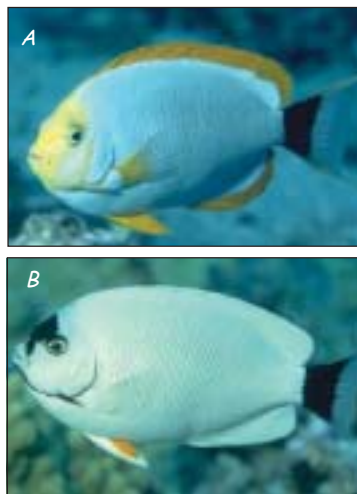


Figure 254. Female (A) and male (B) masked angelfishes (Photos: James McVey).

Mean standing stock of fish biomass on shallow reefs at French Frigate Shoals and Midway Atoll was almost twice as high as those reported from shallow reefs in the Main Hawaiian Islands (DeMartini *et al.* 1996). The difference in biomass among these locations may reflect the heavy fishing pressure on reef fishes in the MHI compared to the NWHI (Grigg

¹⁷⁰ For example, lobe coral (*Porites lobata*) reportedly grows at an average of 11 mm/yr in parts of the MHI while the same species grows at only 0.3 mm/yr at the northern end of the chain.

¹⁷¹ Research has shown that lobster is a constituent of the monk seal diet. Studies on the importance of this component using fatty acid analysis and spew contents are underway by NMFS researchers.

1994, DeMartini *et al.* 1994). Okamoto and Kawamoto (1980) noted many inshore fish species appear to be larger at the northwestern end of the Hawaiian Archipelago. Fishing pressure may account for the low numbers and smaller sizes of certain prized species in the MHI compared to the NWHI where fishing pressure is relatively low (Hobson 1984).

The remoteness of the NWHI makes the cost of collecting marine ornamental species there relatively high. At present, collection of coral reef species from the NWHI for the aquarium trade is limited, although the recent sale of a number of pairs of masked angelfish (*Genicanthus personatus*) has raised concern for protecting such endemic and rare organisms from overexploitation. Species such as the masked angelfish, dragon eel (*Enchelycore pardalis*) and the Hawaiian lionfish (*Pterois sphex*) are considered vulnerable and in need of protection (Fig. 254).



Figure 255. Debris that is a source of contaminants on Tern Island in French Frigate Shoals (Photo: James Maragos).

Marine Reptiles and Mammals – Ninety percent of the Hawaiian green sea turtles return as adults from all over the archipelago to nest on the tiny islets that make-up French Frigate Shoals Atoll in the NWHI. No turtles with fibropapillomatosis have yet been observed in the NWHI.

The endangered Hawaiian monk seal depends upon the islands and waters of the NWHI for breeding and sustenance; with a population of only 1,400 animals, this coral reef-associated seal remains one of the most critically endangered marine mammals in the United States.

Water Quality – Eutrophication is not thought to be a problem in the NWHI due to lack of human habitation and distance from populated areas. Sew-

age discharges into the lagoon at Midway during the peak population periods from of the last century may have contributed nutrients and stimulated phytoplankton and algal growth in the lagoon.

Oil Spills and Toxic Chemicals – Recent oil spills in the NWHI are almost entirely due to groundings of fishing vessels on the isolated atolls. Des Rochers (1992) identified these vessels as a primary threat to reef resources as many carry greater than 37,900 liters (10,000 gallons) and there is a history of groundings in the NWHI. The October 1998 grounding of a 24-m longline fishing vessel at Kure Atoll released over half of its 41,640 liters of diesel onto the shallow reef environment.

Lead and PCBs were recently detected in waters surrounding seawalls on Tern Island at French Frigate Shoals (Fig. 255). Studies by USFWS suggest that these materials may have already entered the aquatic ecosystem food chain at Tern Island. PCBs have been measured in monk seal blood and blubber (Tummons 2000). High PCB levels have also been observed at Midway (L. Woodward pers. comm.). Kure, a State-administered atoll, was occupied for decades by USCG for a LORAN station and has not yet been fully evaluated for contaminants. High concentrations of contaminants were detected in a small area at Laysan Island by USFWS specialists. The contaminants are scheduled to soon be removed by USFWS.

Results from the NOWRAMP 2000 Expedition's preliminary survey of near-shore soft sediments off the NWHI islands and atolls identified high levels of toxic contaminants in a few sites from Midway and Kure atolls (Turgeon *et al.* in Maragos and Gulko 2002, Fig. 256). At four of 38 sites, levels of

Figure 257. An endangered Hawaiian monk seal entangled in nets in the NWHI (Photo: NOAA Marine Fisheries Service).



¹⁷² Over 23 endangered Hawaiian monk seals have recently been found entangled in nets in the NWHI (National Marine Fisheries Service).

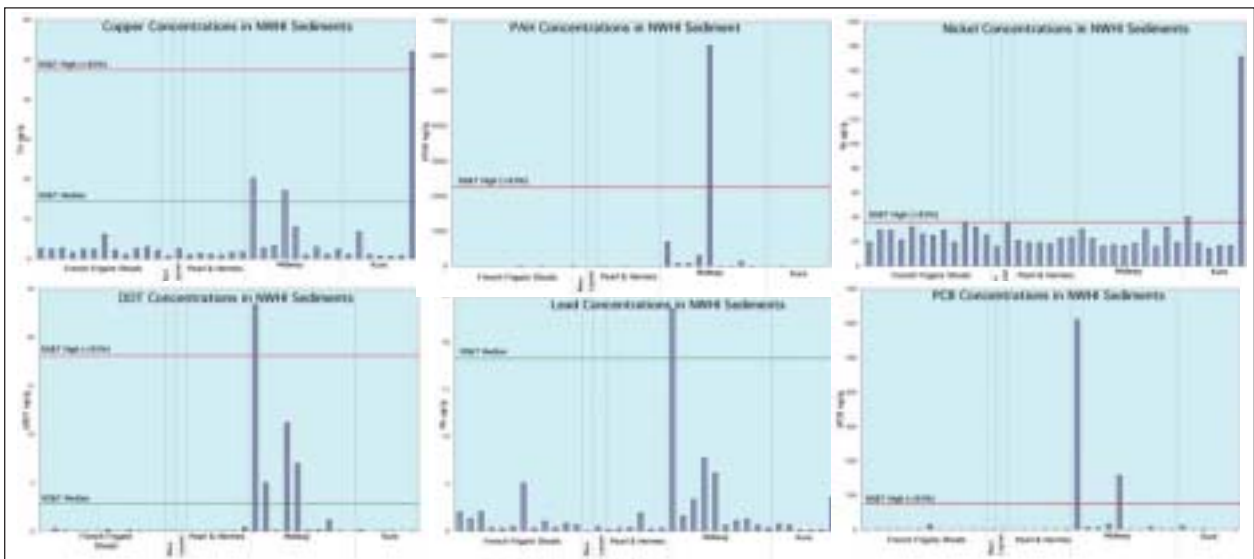


Figure 256. Sediment contamination (PAHs, PCBs, DDT, lead, copper, and nickel) was in the upper 85th percentile nationally at four near-shore sites off Kure and Midway (Source: Turgeon et al. in Maragos and Gulko 2002).

PCBs, PAHs, DDT, Dieldrin, Chlordane, nickel, and copper were above the 85th percentile of concentrations measured in the coastal United States by the NOAA Status and Trends Program.

Environmental Pressures on Coral Reefs

Human Stresses – Terrestrial sources of sedimentation are now practically non-existent in the NWHI due to the lack of human development and the lack of erodable land mass. The only major coastal construction in recent times occurred at Midway Atoll when it was a Naval Air Station (Maragos 1993) and involved airstrips, seawalls, roadways, large buildings, and construction of a deep draft harbor. Localized coastal construction has occurred on islets at Kure Atoll and French Frigate Shoals in the past. Tern Island at French Frigate Shoals was partially built of dredge spoils from the surrounding reef habitats. The seawall at Tern Island is scheduled for rebuilding in 2002.

Alien Species – Knowledge about the number and types of alien species and their range in the NWHI is very limited at this time. The NOWRAMP 2000 Expedition indicated that alien species do not appear to be widespread in the NWHI (Maragos and Gulko 2002). The majority of alien species have been reported at Midway, which has served as a gateway for many fouling species on the submerged hulls of ships for a period of over 60 years.

Destructive Fishing Practices – There are no confirmed reports of destructive fishing practices such as cyanide or dynamite fishing. Although the

lobster fishery was thought to primarily operate over sand and algal bed habitats, surface-deployment of lobster traps may have caused damage to benthic coral reef habitat when the fishery was open.

Marine Debris – Marine debris, primarily thought to arise from derelict gear from North Pacific fisheries, is impacting a wide range of marine life found throughout the NWHI. The gear includes drift nets, trawls, traps, and lines. Impacts include dislodging and breaking coral colonies, and entangling and killing seabirds, monk seals¹⁷², sea turtles, and fish (Fig. 257). Drifting marine debris may also serve as a vector for alien species introductions. In 1996 and 1997, NMFS conducted the first surveys for derelict fishing gear in the NWHI. In 1998, 1999, and 2000, NMFS led a multi-agency partnership involving the USCG, USFWS, DLNR, UH, the Sea Grant College Program, the Hawai‘i Wildlife Society and the Center for Marine Conservation to remove marine debris from French Frigate Shoals, Lisianski, Pearl

Table 23. Chronology of reported vessel groundings and disposition in the NWHI (from DesRoches 1992, Green 1976, Clark and Gulko 1999, B. Kananaka pers comm.).

Year	Vessel Type	Location	Removal
1969	Fishing	Laysan	No
Late 1970s	Fishing	Kure	No
1980	Cargo	FFS	Yes
1981	Fishing	FFS	No
1989	Cargo	Pearl & Hermes	No
pre-1992	Fishing	Kure	No
1998	Fishing	Kure	No
2000	Fishing	Pearl & Hermes	Yes

and Hermes, Kure, and Midway. The combined efforts removed over 60 tons of marine debris. It is estimated that about 1,000 tons of marine debris still remain on the islands and reefs of the NWHI (M. Donohue pers. comm.).

Ship Groundings – Ship groundings that occur in the NWHI raise special concerns due to the remote location, the pristine nature of the habitat, the exceptionally high numbers of marine endangered or protected animals present, and the effects on coral reef habitats that may be slow to recover. In addition, ship groundings in the NWHI provide added concerns due to the extreme costs involved in assessing the damage, controlling spills, removing the vessel and follow-up mitigation (Table 23).

Recently, it has been recognized that ferrous metal from grounded vessels promote the establishment of cyanobacteria (that has displaced calcareous algae and corals atop reef flats) in remote, oceanic areas such as Rose Atoll in American Samoa. Observations during the NOWRAMP 2000 expedition suggest that this may be occurring to a limited extent at Kure and Pearl and Hermes atolls.

In the last two years there have been three groundings of federally permitted fishing vessels atop coral reefs in State waters. One vessel ran aground at Kure Atoll, another grounded on Kaua‘i while in transit to the NWHI, and the most recent event involved a longliner that ran aground at Pearl and Hermes Atoll. Reef structural damage from such groundings can be exacerbated if ships are not removed. For example, when a fishing vessel, the *Paradise Queen*, grounded on Kure Atoll in 1988, fuel spilled and lobster traps, lines, and other loose gear threatened federally-protected green sea turtles, sea birds, and the endangered Hawaiian monk seal (Fig. 258). Secondary damage from the breakup of this vessel by seasonal storm waves created a series of ‘bulldozers’ that are working their way shorewards, creating more physical damage to parts of the reef unharmed by the initial grounding (Gulko and Clark 1999). The vessel was never removed and the responsible parties have not paid any penalty.

Tourism – The only tourism activity currently in the NWHI occurs at Midway Atoll under the supervision of the USFWS. The USFWS has limited the number of visitors and workers that can be on the atoll at any one time. Activities include



Figure 258. The fishing vessel, *Paradise Queen*, grounded on a coral reef at Kure Atoll, NWHI, in 1998; note the endangered Hawaiian monk seal resting in the foreground (Photo: M. Cripps).

fishing, boating, diving, snorkeling, and coastal activities. Concerns have been raised over the impact of the catch-and-release fishery at Midway. Large jacks have been infrequently encountered on fish surveys at Midway (relative to French Frigate Shoals) since recent surveys began in 1993, and especially since the catch-and-release fishery began in 1996 (NMFS Honolulu Lab in prep.). Concerns exist over potential commercial SCUBA-based ‘live aboard’ boats and cruise ships working their way up the NWHI chain.

Climate Change and Coral Bleaching – Declines in seabirds, monk seals, reef fishes, and phytoplankton in the NWHI from the early 1980s to early 1990s (Polovina *et al.* 1994) are thought to have resulted from regional decreases in oceanic productivity (Polovina *et al.* 1995).

There was little monitoring for bleaching events in the NWHI during the 1997-1998 ENSO bleaching event; remnant evidence of such events was not detected during the NOWRAMP 2000 expedition.

Current Conservation Management

Mapping – The shallow-water (to a depth of approximately 30 m) coral reef ecosystems of the NWHI will be mapped using image analyses of commercially-available, high-resolution satellite imagery. Imagery has been purchased for 10 NWHI locales. Unvalidated draft maps have been generated for three of these – Kure Atoll, Midway Atoll, and Laysan Island. Similar maps are expected to be generated for the remaining seven areas by July 2002. At that time, an extensive effort will be initiated to validate all maps of the NWHI shallow-

water coral reef ecosystems. It is anticipated that final maps will be available by January 2003.

Assessment and Monitoring – NOAA, USFWS, Hawai‘i DLNR, the Bishop Museum, the Oceanic Institute, the University of Hawai‘i, the University of California at Santa Cruz (UCSC), and private sector companies launched the NOW-RAMP initiative in 2000 to map and assess the status of coral reef shallow-water habitats in the NWHI (Fig. 259). An additional expedition in 2001, sponsored primarily by the NOAA Honolulu Fisheries Laboratory with additional participation by USFWS and UCSC, provided the opportunity to collect additional information and establish data monitoring buoys on reefs at French Frigate Shoals, Maro Reef, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll, and also included limited diver observations on Raita Bank (Maragos and Gulko 2002).

An early baseline assessment of shallow reef fish populations was conducted at French Frigate Shoals and Midway Atoll during 1980-1983 by USFWS fisheries biologists. Honolulu Laboratory biologists completed new baseline assessments at French Frigate Shoals and Midway in 1992 and 1993, respectively (DeMartini *et al.* 1996) and conducted annual monitoring surveys at both sites during 1995-2000 (DeMartini *et al.* 2002).

Since the early 1980s, NOAA Honolulu Fisheries Laboratory scientists have monitored endangered Hawaiian monk seals and sea turtles off French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes, Midway, and Kure. Since 1992 NMFS has conducted annual reef fish surveys at French Frigate Shoals and Midway Atoll. Since 1990, these scientists have also mapped NWHI underwater benthic habitats using towed divers, video cameras, and submersible vehicles.

MPAs – The NWHI contain a number of examples of species-specific, limited-take MPAs. The majority of the NWHI is classified as Critical Habitat for the endangered Hawaiian monk seal. By federal regulation, a 50-mile protected species zone exists around the NWHI islands and atolls restricting longline fishing, and seasonal area closure zones were in effect for the take of NWHI lobster until the entire fishery was recently closed down.

On May 26, 2000, President Clinton directed the Secretaries of Commerce and the Interior, in cooperation with the State of Hawai‘i, and in consultation with the Western Pacific Regional Fisheries Management Council (WPRFMC), to develop recommendations for a new coordinated management regime to increase protection for the unique coral reef resources of the NWHI. As a result, discussions have ensued over their trusteeship and jurisdictional authority. The State of Hawaii holds trusteeship of all reef resources out to three nautical miles from any emerged point of land in the NWHI¹⁷³. The USFWS administers a National Wildlife Refuge throughout the NWHI (with the exception of Kure Atoll), the boundaries of which are currently being solidified and may vary in certain portions of the refuge. NOAA currently has jurisdictional authority over most reef resources outside of three nautical miles primarily through NMFS with the WPRFMC serving in an advisory role. The result of this effort was Executive Order 13178, which on December 4, 2000 established the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve.

The new NWHI Coral Reef Ecosystem Reserve contains provisions for a number of functional no-take areas distributed across the entire NWHI (with the exception of Midway) in federal waters and ranging from 25 to 100 fathoms in depth. Other regulations to be included within these areas include restrictions on anchoring, discharge and non-extractive uses.

Figure 259. This scientist is making a video record of one of the many reefs surveyed during the 2000 NOWRAMP assessment (Photo: James Maragos).



¹⁷³ Midway, though geographically located within the NWHI, is the only portion of the Hawaiian Archipelago that is not part of the State of Hawai‘i. It is administered independently by the USFWS as a National Wildlife Refuge.

Gaps in Current Monitoring

Multiple agency jurisdictional authority over reef resources raises questions about effective stewardship of the NWHI's coral reefs, which is arguably the last major set of reef ecosystems left in the world that have not been heavily affected by human intrusion. The recent establishment of the NWHI Coral Reef Ecosystem Reserve should help sort out some of these conflicts and provide for a protective umbrella within Federal waters under which the various agencies can partner to effectively manage these unique resources. Currently State waters are not covered within this reserve and comparable effective State management structure or resources are lacking. This is of critical importance as many reef scientists feel that the majority of high biodiversity coral reef habitat in the NWHI is located within State waters. Current lack of regulations controlling extractive activities within NWHI waters pose a particular problem; the proposed State of Hawai'i FMA for the NWHI may not fully close this gaping loophole to protecting this fragile and unique wilderness area.

Difficulties in patrolling and enforcing regulations throughout the 1,600 km (1,000 miles) length of the NWHI poses a problem in encouraging compliance from the various types of vessels (fishing, research, and eco-tourism) currently in the area and the large number of vessels expected to enter the area in the future. Creation of an automated Vessel Monitoring System (VMS), with a transmitting unit required on all vessels operating in the NWHI, and which automatically notifies both the ship in question and the appropriate enforcement and resource trustees of approach to protected or off-limits¹⁷⁴ areas would go a long way towards effectively solving this problem given the large distances and the extremely limited resources available to the USCG and the resource trustees. Efforts are currently underway to fund installation of VMS on various types of vessels, though how the vessels will be monitored and which agencies will have access to the data still needs to be worked out.

Management of the NWHI has been shared among agencies with differing missions. Reliance on the WPRFMC to advise NMFS on management of NWHI fisheries resources at levels that do not impact the sustainability of the fished species, nor

prevent reef ecosystem damage, may have been of limited success. Federal court litigation has occurred during the last two years relating to NMFS compliance with federal fisheries management and endangered species laws in the NWHI. The proposed draft WPRFMC Coral Reef Ecosystem Fisheries Management Plan (FMP) proposes to manage the coral reef ecosystems of the NWHI at an ecosystem level, yet excludes all other existing FMPs from the majority of listed management measures. Since many of the coral reef species are already listed under other existing FMPs (crustaceans, groupers, snappers, sharks) the ecosystem approach is still subordinate to single-species decision-making. Mechanisms (such as automated VMS, active zoning, mitigative bonding) that have been successful in other managed coral reef areas of the Pacific have not been incorporated fully into the existing or proposed WPRFMC's FMPs for the NWHI.

The Hawaiian Archipelago

The last two sections of this report pertain to the entire Hawaiian Archipelago.

Government Policies, Laws, and Legislation

The majority of the shallow water coral reefs are under the jurisdictional authority of the State of Hawai'i (primarily DLNR). Direct military control over areas of the NWHI has been phased out over the last 30 years; Midway was turned over to the USFWS, and the USCG abandoned LORAN stations at Kure and Tern Island (French Frigate Shoals) in the 1970s to 1980s.

In 1998, President Clinton signed Executive Order 13089 for Coral Reef Protection which mandated "All Federal agencies whose actions may affect U.S. coral reef ecosystems shall: a) identify their actions that may affect U. S. coral reef ecosystems; b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and, to the extent permitted by law, c) ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems."

This Executive Order also focused the resources of the various agencies of the federal government to assist the State and Territorial resource trustees in making serious inroads into protection of the

¹⁷⁴ Depending on the type of activity that the vessel is engaged in.



Figure 260. Popular throughout the Pacific, lobsters in the MHI are considered overfished while the NWHI lobster fishery remains closed due to concerns for sustainability of the population (Photo: Hawai'i DAR).

country's coral reef resources. To facilitate this, the President created the U. S. Coral Reef Task Force made-up of cabinet-level appointees to oversee the implementation of the Executive Order.

The State of Hawai'i has a number of existing laws and regulations concerning uses and impacts on corals and coral reefs. Sand, rubble, live rock, and coral are protected from harvest or destruction in State waters. Many Hawaiian stony corals are also prohibited from being sold. Certain Administrative Rules provide for protection of marine water quality, and creation of MPAs. The State Constitution can specifically be applied to protection of coral reef habitats. Portions of Section 1 state that "the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, air, mineral and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State." Section 9 of the same document states that "each person has the right to a clean and healthful environment, as defined by laws relating to environmental quality, including control of pollution and conservation, protection and enhancement of natural resources."

In the Spring of 2000, the Hawai'i Legislature passed a law banning the harvest of shark fins from State waters or landing of shark fins in the State regardless of the waters in which the sharks were caught. The result is a lessening of the fishing pressure on sharks, including species that play a role in reef ecosystems in Hawai'i.

Public Education and Outreach for Coral Reef Protection – The DLNR, as the primary resource trustee for most nearshore coral reefs throughout the Hawaiian Archipelago, has started to produce *State-of-the-Reefs* Reports for distribution to the public, policy-makers, and government agencies.

DLNR also distributes a variety of pamphlets on coral reef MPAs, fishing regulations, laws and regulations and basic natural history information.

Under a grant from NOAA, the State is implementing a variety of public education and outreach projects designed to facilitate coral reef management. These projects include community-based monitoring initiatives, a coral reef awareness raising campaign, and community-based marine debris removal coordination. Installation of day-use mooring buoys at Molokini MLC and an assessment of marine tourism use in State MPAs are also being funded under this grant.

The State of Hawai'i Coastal Zone Management Program has also supported both research and educational activities related to Hawaiian coral reefs. A new booklet will be widely distributed through the local marine tourism industry to better educate visitors and help guide them in limiting their impacts on the natural resources.

Conclusions and Recommendations

Coral reefs have always been an important component of human existence in Hawai'i, as they provide habitat and other resources for fish and invertebrates that are popular for human consumption (Fig. 260). The nearshore reefs once provided the majority of the protein for the Hawaiian people, and today consumptive uses of reef resources include subsistence, commercial, and recreational activities. Despite their importance, coral reefs in Hawai'i suffer from degradation related to continued human population growth, urbanization and development. Ocean outfalls, urbanization, and massive coastal recreational development (e.g., hotels, golf courses) are presently focal points for coral reef degradation in Hawai'i (Jokiel and Cox 1996). New technologies for extraction, offshore aquaculture, and bioprospecting raise concerns about the ability of management agencies to keep up with new impacts to coral reef resources. Economic and business pressures to allow such

impacts may have severe consequences for Hawai'i where coral reefs represent a thin band of habitat directly next to the shore, yet are extremely important to the marine tourism industry which serves as a major lynchpin in the overall Hawaiian economy.

There are strong indications of overfishing for the majority of food fish and invertebrates in the MHI. Similar concerns are starting to be expressed in regards to the impact of the marine ornamental trade. These problems are compounded by the realization that the status of fisheries resources in the MHI are considerably under-reported, making proper management of these resources difficult at this time.

The coral reefs of the Hawaiian Archipelago represent not only the majority of U.S. reef area, but also a set of unique ecosystems of unusually high endemism and diversity of reef types, along with a uniquely predator-dominated fish assemblage within the NWHI. Given this, issues such as alien species introduction and marine ornamental collection¹⁷⁵, are of stronger concern here than in many other coral reef areas.

Hawai'i has a wide variety of types of MPAs which protect coral reef habitat to some extent, yet very little of MHI reefs are 'No-take MPAs' where extraction of any type is not allowed. With only 0.3% of the MHI coral reef habitat protected as 'No-take MPAs,' it's going to be extremely challenging to meet the USCRTF's established goal of setting aside a minimum of 20% of the representative coral reef habitat as 'No-take MPA' by the year 2010. Even those few areas that are currently 'No-take MPAs' in the MHI are exposed to heavy human usage for recreation and marine tourism potentially undermining their effectiveness in representing 'natural' coral reef ecosystems.

While new efforts and joint partnerships have been initiated by the resource trustee agencies, academia, nongovernmental organizations and the various communities themselves, more support (financial and political) for the existing and proposed efforts is needed in order to effectively sustain the exceptionally wide variety and area of coral reef habitat and resources found in the Hawaiian Archipelago.

¹⁷⁵ Especially focused on rare or endangered species.

