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## Description of Hawaiian Names Given to the NWHI

An important aspect of Hawaiian culture is the awareness that in numerous instances traditional place names either were replaced with foreign ones or the Hawaiian names were misspelled to the degree that their meanings were changed. The Hawaiian Lexicon Committee from the University of Hawai`i, Hilo (UH-Hilo) has given names to some places in the Northwestern Hawaiian Islands (see list below). Other groups are currently researching the traditional ancient names for these islands. When the results of that research are available, they will be included on the project web site (see [www.navigatingchange.org](http://www.navigatingchange.org)).

**Mokumanamana (Necker Island)** – The traditional name. A small basaltic islet with numerous heiau (shrines).

**Kānemiloha`i (French Frigate Shoals)** – An atoll of reefs, low sand islets, and the 120-foot-high La Pérouse Pinnacle. This shoal-like place is thought to have been the place where one of Pele's brothers was left as a guard during the voyage to Hawai`i from Kahiki. Its name commemorates Kānemiloha`i.

**Pūhāhonu (Gardner Pinnacles)** – Means “surfacing of a turtle for air.” These two isolated islands and various rock outcroppings seem to appear unexpectedly to voyagers at sea, like a turtle coming up for air, its back and head emerging above the surface. Although turtles are rarely sighted on land in the main islands, often they can be seen resting on crevices and rock ledges at Pūhāhonu.

**Ko`anako`a (Maro Reef)** – Because this atoll is generally covered by breakers, this Hawaiian name translates as “surf that arrives in combers.”

**Kauō (Laysan Island)** – This flat island, bordered by sand and surf and harboring a pond, resembles a bird's egg, cracked open,

with the yolk surrounded by egg white. Kauō can be either the yolk or the egg white, its meaning specified with the modifier melemele (yellow) or ke`oke`o (white). Denoting the contents of an egg, the name Kauō also signifies the thousands of birds that inhabit the island.

**Papa`āpoho (Lisianski Island)** – The literal translation describes the physical appearance of Papa`āpoho, a flat (island) with a depression.

**Holoikauaua (Pearl and Hermes Atoll)** – This atoll is named for the endangered Hawaiian monk seal—described in Hawaiian as a “dog-like animal that swims in the rough”—which frequents local waters and hauls out on the beaches of several of the Northwestern Hawaiian Islands.

**Pihemanu (Midway Atoll)** – Along with many of the Northwestern Hawaiian Islands, Pihemanu is a refuge for birds. Its name means “the loud din of birds.”

**Mokupāpapa (Kure Atoll)** – The northwesternmost island in the Hawaiian archipelago may have been called Mokupāpapa. Moku, “islet,” combined with pāpapa, “low, flat, expansive reef,” means “islet with low-lying reefs.” Recorded in chants, the name Mokupāpapa refers to an island or islands of the names description, located northwest of Ni`ihau.

Source: Adapted from: Kimura, L.L. (1998). Hawaiian Names for the Northwestern Hawaiian Islands. In J.O. Juvik & S.P. Juvik (3rd ed). Atlas of Hawai`i (p. 27). Honolulu, HI: University of Hawaii Press.

# Historical Timeline of the NWHI

- 2005 The Northwestern Hawaiian Island Coral Reef Ecosystem Reserve operations' plan is approved
- 2004 Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NOWRAMP) conducts additional expeditions to the NWHI to continue collecting data about the NWHI
- 2002 NOWRAMP conducts expeditions to the NWHI. Scientists map and assess the shallow reefs for biodiversity, status, and management needs
- 2001 The process to designate the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve as the nation's 14th National Marine sanctuary begins
- 2000 NOWRAMP expedition is launched as a multi-agency and institutional partnership that brings together the best field resources (people, equipment, and funding) of both the resources trustees (State and Federal) and the academic community
  - President Bill Clinton calls for recommendations on the conservation of the NWHI and issues Executive Order 13178, creating the NWHI Coral Reef Ecosystem Reserve, which protects Hawaiian cultural and religious uses
- 1997 Hui Mālama i Na Kūpuna o Hawai'i Nei re-inter the remains of seven ancient Hawaiians at Nihoa and Mokumanamana
- 1996 Full jurisdiction and control of Midway Atoll is transferred from the U.S. Navy to the U.S. Department of Interior, U.S. Fish and Wildlife Service, creating Midway Atoll National Wildlife Refuge
- 1995 – 2000 The Western Pacific Regional Fishery Management Council contractors complete a Review of Coral Reefs around American Flag Pacific Islands, assessing the need and feasibility of establishing a coral reef fishery management plan for the Western Pacific Region
- 1992 LORAN, a marine navigation system station on Kure Atoll, is closed
- 1987 – 1991 The Western Pacific Regional Fishery Management Council establishes the Pelagic Fishery Management Plan (1987); NWHI Ho'omalū Zone bottomfish limited entry program (1989); and Protected Species Zone 50 nautical miles around the NWHI, within which longline fishing is prohibited (1991)
- 1984 A Bishop Museum Expedition finds 25 additional archeological sites on Nihoa and Mokumanamana
- 1980 – 1986 The Western Pacific Regional Fishery Management Council establishes the Precious Coral Fishery Management Plan (FMP) (1980), Crustaceans FMP (1983), and Bottomfish and Seamount Groundfish FMP (1986)
- 1978 Following a Governor's Advisory Committee recommendation, the National Marine Fisheries Service, U.S. Fish and Wildlife Service, State of Hawai'i, and University of Hawai'i begin a five-year cooperative research program to identify NWHI marine resources
- 1965 – 1959 Japanese longliners annually expend up to 2,170 vessel days fishing in the NWHI
- 1946 – 1959 Nine large commercial vessels fish in the waters of the NWHI
- 1942 Preparation for possible hostilities led to the development of a U.S. Navy base at Midway Atoll. The Japanese fleet is defeated at the Battle of Midway June 3-6, 1942

- 1941 On the same day as Pearl Harbor, which starts the U.S. involvement in World War II, Midway is shelled by the Japanese
- 1923 – 1924 The Tanager Expedition records its travels to a number of islands studying plants, animals, and geology. Kenneth Emory and others on this expedition find 115 archeological sites that include ancient habitation, agriculture, and religious sites. While on Laysan, the expedition witnesses the extinction of the Laysan `apapane (native honeycreeper)
- 1917 Public officials deny requests to establish a fishing station and cannery at French Frigate Shoals
- 1909 President Theodore Roosevelt creates the Hawaiian Islands Bird Reservation, a preserve and breeding ground for native birds, which extends from Pearl and Hermes to Nihoa and includes Kure
- 1908 The rights to remove “products of whatever nature from the islands” of Laysan and Lisianski are given to Genkichi Yamanouchi, who exports tons of feathers and bird wings
- 1898 The U.S. annexes “the Hawaiian Islands and their dependencies” through a Resolution of Annexation. Most of the NWHI are incorporated into the U.S.
- 1895 French Frigate Shoals is annexed by the Republic of Hawai`i
- 1894 Mokumanamana is annexed by the Republic of Hawai`i
- 1893 The Hawaiian Kingdom is illegally overthrown by a group of American businessmen
- 1890 The Hawaiian Kingdom allows captains George D. Freeth and Charles N. Spencer to mine guano on Laysan and other NWHI for 20 years, for a royalty of 50 cents per ton
- 1886 Kure is formally annexed to the Hawaiian Kingdom by King Kalākaua
- 1885 Lili`uokalani’s travel party arrives on Nihoa along with a survey group.
- 1872 Captain Dowsett of the whaling ship Kamehameha finds Dowsett Reef, just north of Maro Reef, which was found in 1820 by Captain Allen
- 1859 Captain N.C. Brooks finds the Midway Island while sailing under the Hawaiian flag. He names it Middlebrooks Island (after himself), and claims it for the U.S. under the Guano Act of 1856, a law that authorizes Americans to temporarily occupy unclaimed Pacific islands to obtain guano
- 1857 Kamehameha IV visits Nihoa and annexes this island to the Hawaiian Kingdom
- 1828 Laysan Island is found by Captain Stanikowitch of the Russian ship Moller
- 1823 Captain Benjamin Morrell, Jr. of the schooner Tartar finds Kure Atoll and claims Kure to have an abundance of sea turtles and sea elephants
- 1822 Ka`ahumanu claims Nihoa as part of Hawai`i. Pearl and Hermes Atoll is accidentally found by foreigners when the ships Pearl and Hermes run aground there
- 1820 Gardner Pinnacles and Maro Reef are found by Captain Joseph Allen of the brig Maro
- 1805 Captain Yurii Lisianski runs aground on what becomes known as Lisianski Island
- 1800 Western sailing ships begin to exploit the area for seals, whales, reef fish, turtles, sharks, birds, pearl oysters, and sea cucumbers
- 1789 Nihoa is noted by Western explorers. Captain Douglas was among the first Europeans to see the island and named it Bird Island, referring to the multitude of its inhabitants
- 1786 Captain La Perouse, the first European to sail past Mokumanamana, names it in honor of the French Minister of Finance, Jacques Necker. La Perouse finds the French Frigate Shoals
- 1779 Captain Cook’s men are accompanied by a chief’s canoe headed to Ka`ula Island, off the coast of Ni`ihau

1700 Hawaiians from Kauaʻi and Niʻihau make canoe trips to Mokupāpapa, an island west of Kaʻula, for turtles and seabirds

1200 Pele, the Hawaiian Fire-Goddess, and her family arrive in Nihoa

1000 – 1700 Hawaiian habitation on Nihoa and Mokumanana occurs

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# Fascinating Facts about the NWHI

## General Facts

- The NWHI contain more than 800,000 acres (1,250 square miles) of submerged shoals, coral reefs, and seamounts (that's twice the land surface area of O`ahu).
- The NWHI are home to the healthiest and least-disturbed reefs in the United States. This ecosystem is believed by scientists to be one of the last intact predator-dominated large-scale marine ecosystems in the world.

## Midway

- A thriving colony of approximately 500,000 Bonin petrels was almost destroyed by the accidental introduction of rats to Midway in 1943. By 1979, the petrels had declined to 5,000 pairs and had very little nesting success. By 1998, the rats were eliminated and now the petrels' population is growing.
- Midway Atoll is home to the world's largest Laysan albatross colony and the second-largest black-footed albatross colony.
- In February 2002, Chandler S. Robbins returned to Midway Atoll and recaptured a Laysan albatross that he had banded there on December 10, 1956. This bird must have been at least 5 years old when he first banded it (it would have hatched in or before February, 1951). How old would it have been when he recaptured it on its nest on February 5, 2002? Albatrosses live a long time and can raise chicks at advanced ages.

## Laysan Island

- Laysan Island was described as a "denuded desert" in the Bishop Museum's Tanager Expedition report in 1929. Scientists described what the island looked like after rabbits multiplied there and ate the native plants.
- The U.S. Fish and Wildlife Service worked hard to restore and maintain this native ecosystem. Now the island has healthy vegetation again and supports the largest number of native birds in the NWHI.
- On a super salty lake lying in the middle of Laysan Island lives the Laysan duck. This, the most endangered species of duck in the United States and the one with the smallest home range of any duck in the world, was found only on Laysan Island until 2004. At that time 20 were relocated to Midway Atoll National Wildlife Refuge, where today they are doing quite well.

## French Frigate Shoals

- Only a honu (Hawaiian green sea turtle) knows . . . how to swim back to French Frigate Shoals. A honu tracked by scientists swam from French Frigate Shoals at more than one mile an hour, covering a distance of 702 miles during her 23-day migration to Kāne`ohe Bay on O`ahu!
- When turtles are mature adults (around 20 to 25 years old), they return to the same place they were hatched to lay their eggs. An estimated 800 female green sea turtles nested at French Frigate Shoals during 2002. Each female can make three nests holding an average of 100 eggs per nest. How many eggs were laid during 2002?
- Nine out of every 10 turtles seen in the main Hawaiian Islands were hatched within the protected French Frigate Shoals atoll.

## Unbelievable Flights!

- Sooty terns NEVER sit on the water! After leaving their nests, they fly at sea for at least a year before touching land!
- An albatross is an amazingly efficient long-distance flyer. Using its wings like a glider plane, it can fly 62 miles per hour! Albatross have been tracked traveling at least 2,000 miles on a round-trip voyage from Tern Island to the coast of California during a two-week period.



## Monk Seals

- Monk seals have existed for 15 million years with virtually no evolutionary changes. This earns them the title “living fossils.”
- Monk seals are one of only two mammals native to Hawai`i. Do you know what the other native mammal is? (Hawaiian hoary bat)
- Seeing a monk seal pup was once an extremely rare occurrence. Over the last 7 years on Midway Atoll, there has been much less human disturbance to the seals. Recently, a record 15 monk seal pups were born on the atoll.

## Home Sweet Home

- Seventy-two terrestrial arthropods, including species of giant cricket and giant earwig, three plant species, and two land birds (the Nihoa finch and the Nihoa millerbird), are found only on the island of Nihoa and nowhere else in the world.
- Native plant community bragging rights go to Mokumanamana and Gardner Pinnacles. These two islands have native plant communities and no invasive species! This provides excellent habitat for hundreds of thousands of nesting native birds.
- Established in 1909, the Hawaiian Islands National Wildlife Refuge encompasses the islands and reefs stretching 800 miles from Nihoa to Pearl and Hermes Reef.
- Maro Reef has much less than an acre of emergent land but almost 478,000 acres of submerged lands, making it the largest coral reef in the NWHI.
- Lisianski was named for the Russian ship captain who grounded his vessel there in 1805, the first of many recorded shipwrecks there. Three-fourths of the Bonin petrels in Hawai`i nest here along with more than a million sooty terns. Its surrounding undersea world is massive in size covering an area over 100 times the size of the island.
- The above-sea land area of Gardner Pinnacles consists of only 5 rocky acres yet biologists have sighted over 19 species of birds. Nests for 12 of these species can be found on the island’s steep cliffs.



- Black-lipped pearl oysters were once so common at Pearl and Hermes Atoll that an entire button industry was created to produce pearl shell buttons. Due to over harvesting, the species almost disappeared from Hawai`i. The Territory of Hawai`i made it illegal to harvest these oysters in 1929, but the species has never recovered.

# Personal Stories of Nihoa and Necker Islands

By Dennis Kawaharada

In 1822, Ka`ahumanu and a royal party including Kaumuali`i, Liholiho, Keopuokalani, and Kahekili Ke`eaumoku visited Ni`ihau and heard chants and stories about an island called Nihoa to the west of Kaua`i, the direction from which the winter rains came:

‘Ea mai ana ke ao ua o Kona,  
‘Ea mai ana ma Nihoa  
Ma ka mole mai o Lehua  
Ua iho a pulu ke kahakai

The rain clouds of Kona come,  
Approaching from Nihoa,  
From the base of Lehua,  
Pouring down, drenching the coast.

Intrigued, Ka`ahumanu organized an expedition and sailed in two or three boats under Captain William Sumner to visit the island. They landed on the once inhabited but long deserted island 150 miles WNW of Kaua`i, and annexed it to the Hawaiian Kingdom. The waterfront area around Ka`ahumanu Street in Honolulu was named Nihoa in honor of the visit. The island was annexed to the Hawaiian Kingdom again by Kamehameha IV, who landed on the island in 1857. In 1885, Queen Lili`uokalani, with 200 excursionists, visited Nihoa on the steamer `Iwalani, and brought back artifacts—a stone bowl, a stone dish, a coral rubbing stone, and a coral file (Emory 8-11).

Nihoa, jutting up from the sea beyond sight of Kaua`i and Ni`ihau, is the westernmost place in this tradition of Kaua`i geography. It has come to stand for “one who bravely faces misfortune”: “Kū paku ka pali o Nihoa i ka makani.” The cliffs of Nihoa stand strongly against the wind (Pukui, `Ōlelo No`eau #1924). “Nihoa” means “firmly set,” or “toothed, serrated,” possibly a reference to its jagged profile—from one side it looks like a molar, standing isolated at sea. (In Micronesia, an island seen from a departing canoe just before the island disappears from sight is called a “tooth,” and serves as a final landmark to orient the canoe on its voyage.)

Nihoa is one mile long, a quarter of a mile wide, and 900 feet high on its east end. It was

designated as part of a wildlife refuge by Theodore Roosevelt in 1909. It is inhabited by insects; monk seals; two species of land birds, a finch and a millerbird, found nowhere else; and numerous seabirds (terns, boobies, petrels, shearwaters, albatrosses, tropic birds, and frigate birds). Today, access is controlled by the U.S. Fish and Wildlife Service, and landing, except for scientific study and cultural purposes, is prohibited.

Nihoa was once inhabited by the kānaka maoli, sometime between 1000 and 1500 A.D. About 35 house sites, 15 bluff shelters, 15 heiau, and 28 agricultural terraces have been identified on the island (Emory 12; Cleghorn 21-22). Various artifacts have also been collected, including fishhooks, sinkers, cowry shell lures, hammerstones, grindstones, adzes, and coral rubbing stones (Emory 38-50). The evidence seems to indicate permanent or semi-permanent settlement. Living on the island would have been difficult. Surveys have discovered only three seeps of water, all contaminated with guano (Emory 12). Tava and Keale report a tradition of Ni`ihau that a spring called Waiakanohoaka provided good, sweet water (102), but this spring has not been located. The freshwater on the island comes from the estimated 20-30 inches of rain that falls annually from passing squalls (Cleghorn 26).

Archaeologists surmise that the terraces were planted with sweet potatoes, a crop requiring less water than thirsty taro. They estimate that the 12-16 acres under cultivation might have supported about 100 people (Cleghorn 25). Fish, shellfish, crabs, lobsters, turtles, and seals, as well as seabirds and their eggs, are abundant sources of food. Cleghorn speculates that the food and water supply was sufficient for subsistence, but that the lack of firewood would have created a hardship (26). The only tree on the island is the loulou palm. Research expedition members counted 515 palms in 1923. The fan-like leaves were used for plaiting, and the trunks could have been used for building shelters or for firewood. But if the trees were cut down for firewood,

the supply would have eventually been depleted.

Without the numerous kinds of plants found in the forests of the larger islands (e.g., koa, `ōhi`a, hau, hala, olonā, wauke), the settlers could not have provided themselves with canoes, wood containers, nets, fishing line, clothing and blankets, mats, and medicines. The colony was probably supplied with these products from Kaua`i or Ni`ihau. Several gourd fragments have been found; other bowls and containers were carved from stone.

Landing on the island is difficult. High, sheer cliffs prevent landing on the east, north, and west sides. The island slopes down to the south, but the shoreline is rocky and unprotected from the surge of southerly swells. Large vessels anchor offshore, and those who wish to land have to go in on a smaller boat or swim ashore. In ancient times, small canoes could have been carried up onto the rocky coast on calm days. If the canoes used to reach the island were somehow damaged in the rough surf, the settlers would not have been able to repair them with resources from the island. They would have been trapped until other canoes arrived from Ni`ihau or Kaua`i.

Partial skeletons of men, women, and children have been found on the island, and two burial sites located. The journey of spirits to the afterworld (in the west, toward the setting sun) would have been shorter from this western outpost than from the islands to the east. The name of a place on the island where spirits of the dead departed for the afterworld is still remembered: It was called Mau-loku (“Continuous falling”; Pukui et al, *Place Names of Hawai`i*).

How the island was discovered is not known—possibly by fisherman working the seas west of Kaua`i or following seabirds to gather their feathers or eggs. Red feathers were coveted for making sacred objects, and the red-tailed tropicbird is one of the seabirds that nests on Nihoa. Polynesians traveled great distances to obtain such feathers: One Marquesan tradition tells of a 1200-mile voyage, from Hiva Oa to Rarotonga, to obtain the red feathers of a kura bird; and the voyaging chief Hema is said to have sailed back to Kahiki to obtain a girdle of red feathers for his son Kaha`i.

Once discovered, the island became a part of the economy of Ni`ihau, an island relatively limited in resources. The traditions of Ni`ihau say that the people of that island were frequent and perhaps long-term visitors to collect loulu palm wood for spears and a grass called makiukiu, which could be used for cordage and stuffing (Tava and Keale 102).

Another motive for visiting the island is suggested by the chant of Ni`ihau describing the Kona rain clouds coming from Nihoa and soaking the west coasts of Kaua`i and Ni`ihau. Small, low islands like Ni`ihau, and the leeward coasts of high islands like Kaua`i, depend on the heavy rains of annual Kona storms to bring life to their crops. But if the storms stay west or pass to the north without reaching Hawai`i, droughts and, in ancient times, famine could occur. Could the people of Ni`ihau or leeward Kaua`i have sailed west to get closer to the source of these rain clouds, or to the deities who controlled them, in order to pray for rain and make offerings? Water represented life and wealth in ancient Hawai`i, and such a voyage might have been worth the effort and the risk.

One hundred and fifty miles west of Nihoa is an island called Necker. This island is smaller and has even fewer resources than Nihoa. There are no trees and is no soil. Yet the island is covered with some 33 heiau (Emory 59). Several stone images, the largest around 16 inches high, were found by visitors in historical times. The images look like gingerbread men—flat, neckless, with round faces from which eyes, noses, mouths, and ears protrude (Emory 125, *Illustrations XX-XXII*). Who or what these images represent is unknown.

The Hawaiian name for Necker has been lost. But Teva reports that there are four names remembered on Ni`ihau of islands beyond Nihoa: Mokuakamohoali`i, Hanakaieie, Hanakeaumoe, and Ununui (103). Mokuakamohoali`i, “Island of the Shark God Kamohoali`i,” is a possible name for Necker, as the largest geographical feature on this island is a bay called Shark Bay. Kamohoali`i was the king of sharks and brother of the volcano goddess Pele. The Pele migration is said to have come from the west, with Kamohoali`i serving as navigator.

Cleghorn suggests that in addition to going to Necker for gathering resources such as bird feathers and eggs, the visits may have had a ritualistic purpose: The heiau could have belonged to a bird cult, similar to the one on Rapa Nui (Easter Island) (61). But the heiau and statues could also have been used in rain-god worship. As in the Hopi kachina rituals in the American Southwest, the rain deities might have been associated with ancestral spirits who return each year in the form of rain clouds from their homes in the west. (The winter rains of the American Southwest come from the west, as they do in Hawai'i.) In either case, birds and rain clouds are metaphorically connected with each other in Hawaiian chants. Beckwith notes, "The cloud hanging over Ka'ula is a bird which flies before the wind:

The blackbird begged,  
The bird of Ka'ula begged,  
Floating up there above Wa'ahila"  
(The Hawaiian Romance of Laieikawai, p. 323).

Nihoa would have been a stop on the way to or from Necker. Annual visits to Necker during the spring and summer trade wind season could have been made, when food would have been abundant on and around Nihoa and Necker. A Ni'ihau tradition suggests such was the case: "The Ni'ihauans sailed to Nihoa in the spring, returning to Ni'ihau in the fall on the Kona winds" (Tava and Keale 102). The same sailing strategy could have taken them to Necker. After landing on Necker, prayers and offerings could have been presented to the deities. Then the pilgrims could have fished, hunted birds, collected eggs, and built or maintained heiau. When a cold front approached, the canoes could have headed back to Ni'ihau or Kaua'i on the southwesterly winds that preceded the front, or the northerly winds that followed.

Any downwind sail with the prevailing winds is a risky undertaking, because unless the wind shifts, the sail home involves tacking

into the wind, something which the keel-less Polynesian canoes would have great difficulty doing. The risk is weighed against the importance of the potential benefits of going to the downwind destination. For a community dependent on farming, drought could be disastrous. If one of the sources of the life-giving waters of Kāne was westward, was it worthwhile to sail west to present offerings and prayers to a god who brought life-giving waters? For a time in Hawaiian prehistory, the answer was apparently yes; then, perhaps after dry-land taro and sweet potato cultivation in areas with limited rainfall had improved enough so that famine was no longer a seasonal threat, such voyages became unnecessary.

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# Northwest Islands Dotted with Wrecks of Old Vessels

Posted on Monday, June 7, 2004 – Honolulu Advertiser Special

By Jan TenBruggencate - Advertiser Science Writer

LAYSAN ISLAND, French Frigate Shoals –Hō kūle`a's crew, hauling hundreds of pounds of marine debris from Laysan's beaches, repeatedly trudged through soft sand by the rusted bow and flaking machinery of a wrecked steel fishing boat. It is just one of the dozens of crafts that have come to their ends on Hawai`i's leeward islands, which stretch like a vast rock and coral trap 1,200 miles from Kaua`i to Kure Atoll. The wrecks still happen every few years. In recent decades the victims have mainly been fishing boats, but decades and centuries past they were coal carriers, sail-powered whalers, military ships, tankers, pleasure craft, and many more.

Many had survivors, who reported the wrecks. Many more, it is assumed, did not. There is still a lot of surveying to do, but even among those areas that have been swept for lost ships, there are mystery wrecks, said marine archaeologists Hans Van Tilburg, maritime heritage coordinator for the Pacific Islands Regional Office of the National Oceanic and Atmospheric Administration's National Marine Sanctuary Program. It's even possible that Spanish treasure galleons filled with Mexican silver wrecked here. Spanish ships crossed from Acapulco to Manila once or twice a year from about 1565 to 1810, he said.

Van Tilburg was interviewed before Hōkū le`a started its voyage through the islands. One problem in identifying old wrecks is that islands are subject to huge storms, powerful seas, and occasional tsunami, and old wooden ships would have left little evidence behind. "That's a high-energy environment," Van Tilburg said. The rough seas, tricky currents, difficult-to-spot shoals and reefs, and narrow passages are among the reasons why Hōkūle`a's captain, Nainoa Thompson, abandoned non-instrument

navigation once passing the volcanic islands of Nihoa and Mokumanamana and entering a region with an 800-mile stretch of reefs, shoals, and banks. Before approaching any low island he pours over maritime charts and often keeps two global positioning system satellite navigation units running at once—each as a check for the other. "It's too risky, too dangerous" to take lightly, he said.

The canoe sailed up to Lisianski Island yesterday morning, but anchored three miles from shore. Coral heads and reefs, many of which are poorly charted, surround the island. The crew dived on the reef for half an hour, then raised anchor and sailed for Pearl and Hermes Atoll, which it expected to reach this morning. Although he said the coral and marine life are remarkable there, he opted to sail by Maro Reef entirely. Many wrecks would appear to justify his caution.

There are wrecks that could be serious threats to the environment, like the 1957 loss on Maro Reef of the Navy oil tanker Mission San Miguel. It was not carrying a cargo of oil when it went down, but would still have had a lot of residual oil in its tanks, plus its own fuel oil and other fluids. When the Navy tried to salvage it, there was too much oil in the water for divers to work and the salvage was abandoned. And when folks returned to the site later, the ship was gone. "It had been high on the reef, hard aground, and then there was no trace of it anymore. We assume it launched itself into the deep," Van Tilburg said. One fear is that some of its tanks are still whole but deteriorating, and that they will ultimately fail and cause a major oil spill. "The topic worldwide is an important one. The Navy could pump it out if it is shallow enough. It would be nice to confirm its location in case it starts leaking," he said. The captain of the three-masted copra schooner O.M. Kellogg, which wrecked on Maro in 1915 while bound from Samoa to San Francisco, complained a month later in the Honolulu

Advertiser that “I think it is always bad weather at Maro Reef.” And as Hōkūle`a sailed by south of the reef last week, there were dark rain squalls on Maro.

The most important known marine archeological find in the Northwestern Hawaiian Islands is probably the 1870 wreck of the USS Saginaw at Kure Atoll, Van Tilburg said. He and a crew of divers in August 2003 found remains from the Navy ship, including two small iron cannons, iron anchors, metal rudder fittings, and copper pins that once held the major timbers together. The Saginaw had been sent to nearby Midway to blast a channel, so a coal fueling station could be established there. The ship had been built during a period when sail power was giving way to steam. It was a hybrid: a coal-fired, steam-powered side-wheeler that carried masts and sails. All 93 men aboard survived the wreck, and lived on Green Island, a flat sand and coral islet just inside the reef. Five of the crew sailed a small boat for help. They made it 1,200 miles to Kaua`i, but they were extremely weak by then. Four died while landing in the rough surf. The crewmembers who remained on Kure, eating seal and albatross meat and drinking rainwater, all survived.

Van Tilburg said he would love to do more work on the wreck, including trying to find the remains of the survivors’ camp to see what can be learned about how they lived. Shipwreck survivors need to be innovative, because they often have few resources. Survivors of the 1842 wreck of the whale ship Parker at Kure used pieces of copper from their own wreck or the previous wreck of the ship Gledstanes to make cooking utensils. Wrecks were such a common occurrence that the crew of one rescue ship in 1886 planted trees and built two 500-gallon water tanks with a raingutter system to aid future victims on Kure. But vandals from other ships had destroyed the improvements within a year.

Advertiser Science Writer Jan TenBruggencate is sailing as a crewmember aboard the voyaging canoe Hōkūle`a as it sails through the Northwestern Hawaiian Islands. His dispatches are sent back via satellite phone.



Source: <http://the.honoluluadvertiser.com/article/2004/Jun/07/ln/ln10a.html>

Photo by Polynesian Voyaging Society

# Shipwrecks at Pearl and Hermes Atoll

Posted by Dr. Hans Van Tilburg  
Maritime Archeology and History Team Leader  
September 28, 2002

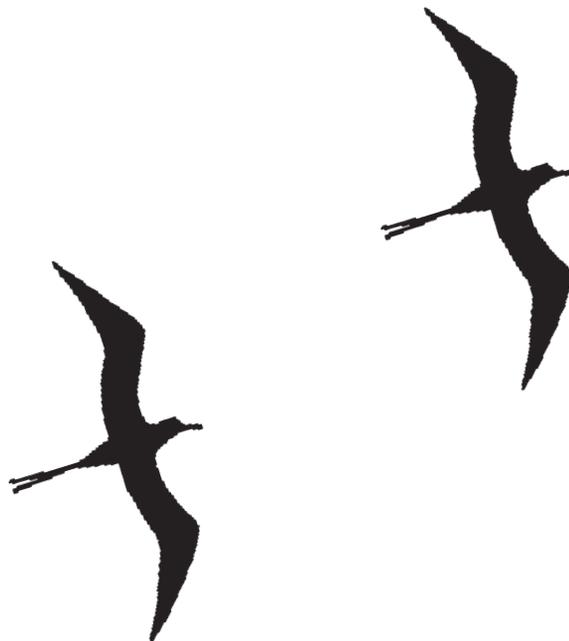
Unfortunately, the USS Saginaw at Kure eluded our efforts. We did a number of diver tow searches in the area indicated by historic references, but saw no traces of the wreck. Sedimentation rates on that side of the atoll are high, and it's possible that after 132 years, the material is buried deep under the sands.

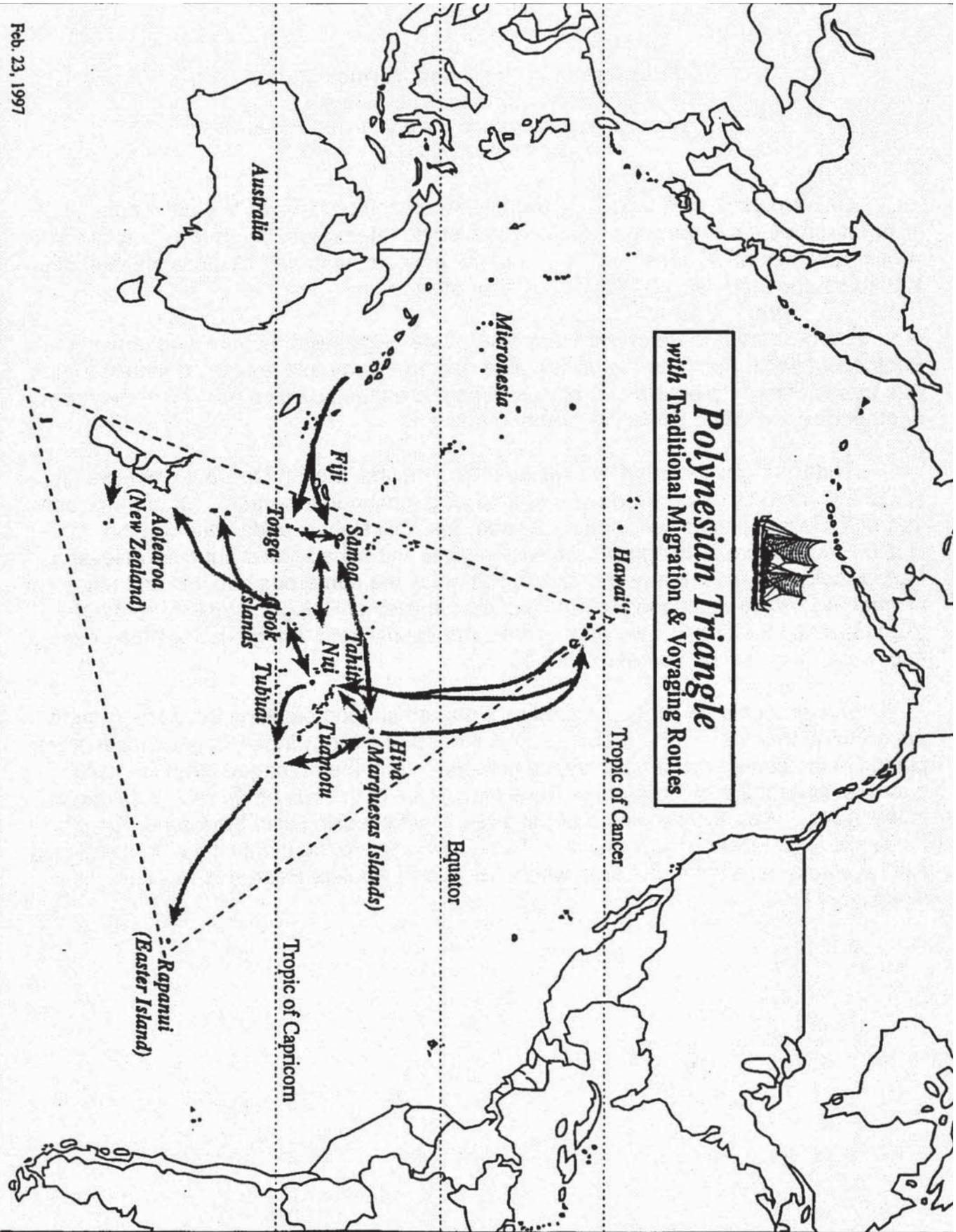
On our return to Pearl and Hermes Atoll we began with a shore side survey of Southeast Island. Again, traces of cut giant bamboo, some pieces over 6 meters long, with traces of cross pieces and lashings. Where are these coming from? Are they rafts or other devices? Who still builds bamboo rafts?

Today's dives included two wreck sites. The first, the SS Quartette, wrecked in 1952. The remains of the Korea-bound ship long remained emergent, but are now only four or five small pieces occasionally awash. The real sight is underwater on the shallow reef, where a topography of twisted steel and ruins spread out over at least a football field size area. Many varieties of fish enjoy the numerous habitats and refuges of what used to be, according to Mark Rauzon in *Isles of Refuge*, a Liberty ship from World War II. Liberty ships were, of course, the supply train "bridge" across the oceans, and many found second careers after 1945.

Our second dive spot appeared as a square-shaped block on the horizon far to the north on the edge of the reef crest. It is the top of a six-cylinder marine diesel power plant. On the coral spires below lay the propeller shaft, the damaged propeller itself, and twisted debris and machinery. There is no trace of the hull or the rest of the wreck in the vicinity. We have no record of this vessel, but checking with the Coast Guard on our return might clear up this mystery. Tomorrow, back to the most intriguing needles in the haystack . . . a return to the area where the British whalers Pearl and Hermes wrecked in 1822.

Source: <http://www.hawaiianatolls.org/research/NOWRAMP2002/journals/pahwrecks.p>

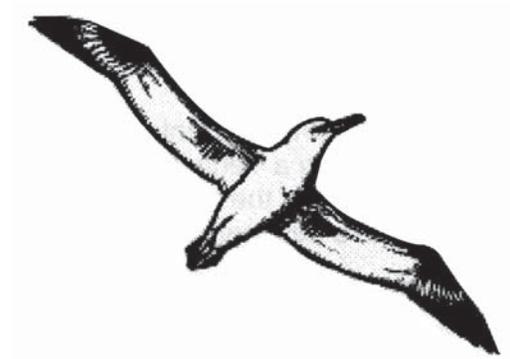




(2003). *Teacher Information Packet. Navigating Change. An Exhibit on the Northwestern Hawaiian Islands at the Hawai'i Maritime Center. Honolulu, HI: Bishop Museum & NASA.*

# Sea and Land Birds Nesting in the NWHI

Black noddy (Oio)  
Black-footed albatross  
Blue noddy  
Bonin petrel  
Brown booby (ʻĀ)  
Brown noddy (Noio koha)  
Bulwer's petrel (ʻOu)  
Christmas shearwater  
Dark-rumped petrel (ʻUa`u)  
Gray-backed tern (Pākalakala)  
Great frigatebird (ʻIwa)  
Laysan albatross (Mōli)  
Laysan duck  
Laysan finch  
Little tern  
Masked booby  
Newell's shearwater (ʻA`o)  
Nihoa finch  
Nihoa millerbird  
Red-footed booby (ʻĀ)  
Red-tailed tropicbird (Koa`e`ula)  
Short-tailed albatross  
Sooty Tern (ʻEwa`ewa)  
Tristram storm petrel  
Wedge-tailed shearwater (ʻUa`u kani)  
White or Fairy Tern (Manu o Kū)  
White-tailed tropicbird (Koa`e kea)



# Marine Organisms of the NWHI

## Shallow Reef Organisms

Antler coral (Ko`a)  
Arc-eye hawkfish (Pili ko`a)  
Banded coral shrimp (`Ōpae kai)  
Black sea cucumber (Loli)  
Black triggerfish  
(Humuhumu`ele`ele)  
Bird wrasse (Hinalea`i`iwi)  
Blue coral (Ko`a)  
Cauliflower coral (Ko`a)  
Christmas wrasse (`Āwela)  
Cleaner shrimp (`Ōpae)  
Coralline algae (Manamana`ula)  
Hawaiian cleaner wrasse  
Hawaiian hogfish (`A`awa)  
Hawaiian whitespotted toby  
Hermit crab (Unauna)  
Limpets (`Opihi)  
Linckia seastar  
Manybar goatfish (Moana)  
Nerite snail (Kūpe`e)  
Orange tube coral (Ko`a)  
Ornate butterflyfish (Kīkākāpu)  
Oval chromis  
Periwinkle snail (Pūpū kōlea)  
Reticulated brittlestar (Pe`a)  
Rock-boring urchin (`Ina Uli)  
Saddle wrasse (Hinalea lauwili)  
Sea lettuce (Limu palahala)  
Slate pencil urchin  
(Ha`uke`uke`ula`ula)  
Slipper lobster (Ulā papapa)  
Spotted boxfish (Moa)  
Tiger cowry (Leho)  
Triton's trumpet (Pū)  
Yellowfin goatfish (Weke)  
Yellow margin moray eel  
(Pūhi paka)  
Yellowtail coris (Hinālea `Aki lolo)

## Mid Reef Organisms

Bluefin trevally (`Ōmilu)  
Convict tang (Manini)  
Fire dartfish  
Giant trevally (Ulua aukea)  
Goldring surgeonfish (Kole)  
Gray reef shark (Manō)  
Hawaiian anthias  
Hawaiian dascyllus (Alo`ilo`i)  
Hawaiian sergeant (Mamo)  
Hawaiian squirrelfish (`Ala`ihi)  
Leatherback (Lai)  
Lobe Coral (Ko`a)  
Longnose butterflyfish  
(Lauwiliwili nukunuku`oi`oi)  
Long-spined urchin (Wana)  
Milletseed butterflyfish  
(Lauwiliwili)  
Moorish idol (Kihikihi)  
Octopus (He`e maui)  
Orangeband surgeonfish  
(Na`ena`e)  
Orangespine unicornfish  
(Umaumalei)  
Peacock razorfish (Laenihi)  
Pennant butterflyfish  
Potter's angelfish (`Ānela`i`a)  
Raccoon butterflyfish (Kīkākāpu)  
Reef triggerfish  
(Humuhumunukunukuāpua`a)  
Spotted eagle ray (Lupe)  
Spotted pufferfish (`O`opu hue)  
Trumpetfish (Nūnū)  
Whitemargin unicornfish  
(Kala kea)  
Whitetip reef shark  
(Manō lālākea)  
Yellow tang (Lau`i`pala)

## Open Ocean Organisms

Amberjack (Kāhala)  
Dolphinfish (Mahimahi)  
Hawaiian stingray (Hihimanu)  
Humpback whale (Koholā)  
Mackerel scad (`Ōpelu)  
Marlin  
Ono  
Oceanic whitetip shark (Manō)  
Portuguese man-o-war  
(Pa`imalau)  
Short-winged flying fish (Mā  
lolo)  
Smalltail stingray  
Tiger shark (Manō)  
Yellowfin tuna (`Ahi)

Source: \_\_\_\_\_. (2003). Education Kit: Navigating Change Northwestern Hawaiian Islands. Hawai`i: PREL, NOAA, State of Hawai`i Department of Education, U.S. Fish and Wildlife Service, Department of Land and Natural Resources & Bishop Museum

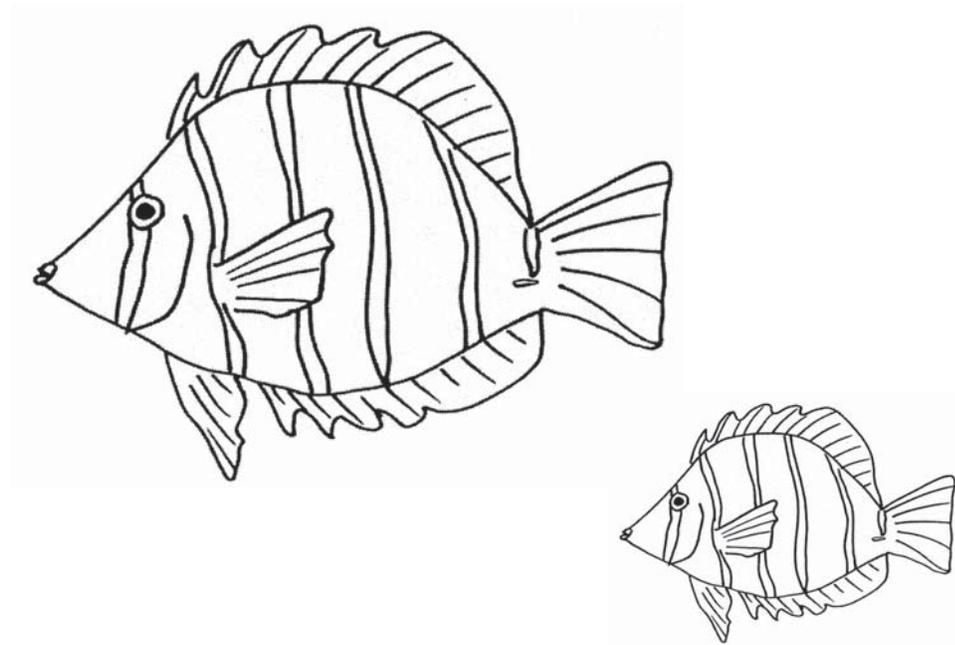
# Pop-up Reef

## Materials Needed

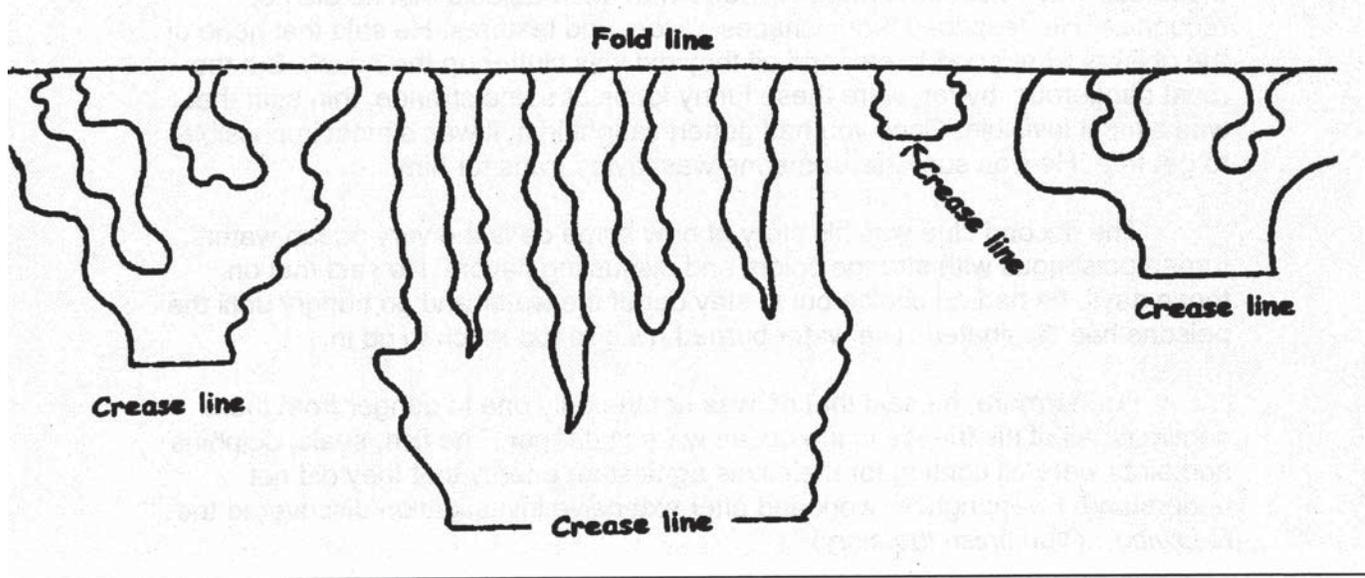
- Reef pattern
- Construction paper—2 sheets of different colors
- Scissors
- Glue
- Colored construction paper to create reef critters

## Directions

- Place the reef pattern on top of a piece of construction paper.
- Fold both on the center dotted line fold that goes across the paper.
- Cut through both pages on the solid lines.
- Open the construction paper reef up and pop the cut-out reef sections forward. Crease on the dotted lines. Keep working on it . . . it will become a 3-dimensional reef.
- Glue the flat unpopped parts of the reef to another piece of construction paper.
- Create reef critters and algae and add them to the popped-out reef.



Source: (2003). Education Kit. Navigating Change: Northwestern Hawaiian Islands. Hawaii: PREL, State of Hawaii Department of Education, Department of Land and Natural Resources, NOAA, U.S. Fish and Wildlife Service, and Bishop Museum.



Your job is to solve the problems of Claud the Crab. Read the story below. Write your own story about what you, the Detective, were able to find out and how the problem got solved.

It was a hot muggy day and I was sitting sleepily at my desk when in rushed the largest crab I had ever seen. He introduced himself quickly as Claud the Crab, and told me he desperately needed to hire a private detective. Of course, my first question was what crime was it that he needed investigated. He started talking very fast and clicking his claws together in obvious panic. When I could finally get him calmed down enough that I could understand him, I started to get the picture.

The crime was attempted murder. This poor crab's home was being destroyed, and he was in grave danger of being killed! Yet he did not have any idea of what was going on or why someone would want to kill him. Claud was sure that he had no personal enemies, and certainly none capable of the magnitude of destruction he was describing.

Then he gave me the first clue. He said that every day, the beaches and the ocean waters became more crowded with dead objects that he did not recognize. He described the many shapes, colors, and textures he saw. He said that none of the objects were good to eat, and all they did was clutter up the beach. But the most dangerous, by far, were these funny loops of strange, thin stuff that was almost invisible. Once you had gotten caught in it, it was almost impossible to get free. He was sure that someone was laying traps for him!

The second clue was his story of how some days the very ocean waters turned poisonous with strange colors and disgusting flavors. He said that on those days, he had no choice but to stay out of the water and go hungry until the poisons had dissipated. The water burned his gills too much to go in.

Furthermore, he said that he was not the only one in danger from these criminals. All of his friends in the ocean were in danger. The fish, seals, dolphins, and birds were all fighting for their lives against an enemy they did not understand—or even see! I went right to work and after extensive investigation discovered the following. . . . (You finish the story.)

Source: \_\_\_\_\_. (2003). Education Kit: Navigating Change Northwestern Hawaiian Islands. Hawai'i: PREL, NOAA, State of Hawai'i Department of Education, U.S. Fish and Wildlife Service, Department of Land and Natural Resources & Bishop Museum.

## Questions

1. What impacts can coastal communities have on reefs?
2. How does marine debris affect animal life?
3. How do introduced species affect the native animals in the ocean?
4. How do fishing vessels that have gone ashore affect the reef?

As people visit the coral reef for recreation or commercial purposes, they change the reef. Many major cities are located on coasts near coral reefs, or along rivers that empty into the ocean. Many things that people put in the water can have an effect on the reef.

Communities near the ocean must be careful about what goes into the storm drains that carry runoff from streets and parking lots. Pesticides and fertilizers used on farms and lawns can also end up washing into the ocean. Municipal or residential sewage systems that release wastewater too close to shore cause an overabundance of algae to grow. Coastal communities and construction that replace vegetation with bare soil and concrete also increase the runoff of freshwater and sediment into coastal waters. Reef-building corals have a low tolerance for unnatural runoff and sediment deposits.

Marine debris is another form of pollution. In the last few decades more and more things we use have been made out of plastic. If these objects wind up in the water they drift around, sometimes for years, until they end up on a shore or snagged on the reef. Some of the items are merely unsightly. Others are dangerous to marine life. Sections of old net can continue to entangle marine life long after they're discarded or lost. Items like cigarette lighters and small plastic toys are mistaken for food items by albatross and then fed to their young chicks who cannot digest or pass them. Many albatross chicks die from this each year.

People harvest fish from the reef for food and for the aquarium trade. These are activities that many of us have enjoyed, but they must be done with care. Overharvesting of grazers like parrotfish, surgeonfish, and sea urchins can result in an overabundance of algae. Anchoring in coral is a source of damage often seen along our coasts. Divers and snorkelers need to be careful that they don't kick or grab onto fragile corals.

In the past few decades, an increasing number of exotic (introduced) marine species have arrived in Hawai'i. In the 1950s several species of snappers and groupers were brought here and released on the reefs. Two of these (the blue-lined snapper and argus grouper) are now abundant and competing with native fish. Non-native aquarium fish and invertebrates have also been released by people. These pose a danger to the reef. If you have aquarium fish that you don't want anymore, you should return them to a pet shop.

Some introduced species arrive here by accident in the ballast water of ocean-going ships. Several species of algae, mollusks, and fish have arrived this way and are now common, especially in areas like harbors where ships flush their ballast-water tanks.

In recent years, at least two large fishing vessels have run aground on the reefs of the Northwestern Hawaiian Islands. In addition to the direct damage caused by crashing into the coral, there was the danger that fuel oil from ships would escape into the water. Fortunately this did not happen, but in the past, several small oil slicks of unknown origin have come ashore in the main Hawaiian Islands.

Source: \_\_\_\_\_. (2003). Education Kit: Navigating Change Northwestern Hawaiian Islands. Hawai'i: PREL, NOAA, State of Hawai'i Department of Education, U.S. Fish and Wildlife Service, Department of Land and Natural Resources & Bishop Museum.

# Marine Debris Proves to Be Real Threat to Voyage

Posted on Tuesday, June 8, 2004 – Honolulu Advertiser Special  
By Jan TenBruggencate – Advertiser Science Writer

PEARL AND HERMES ATOLL, Northwestern Hawaiian Islands – The voyaging canoe Hōkūle`a sailed to an anchorage for a brief stop here yesterday morning, but during the middle of the previous night it had not been clear the canoe would make it.

A little after 11 p.m., the crew of the escort boat Kama Hele reported “a problem with the engine.” The problem: It had stopped abruptly. Engineer Steve Garrett at first suspected a transmission problem. Someone finally jumped into the water and diagnosed the problem: A twisted mess of drifting ropes had wrapped around the single propeller—another threat of marine debris. Near midnight, with no moon and with the dark, deep ocean below, crewmen Kiyoshi Amimoto and Tim Gilliom went over the side with lights and knives. Hōkūle`a took down its sails and drifted in wait two miles ahead. The two cut through rope after rope, stopping occasionally to scan the waters around them with lights for predators. They got the prop free, and by midnight both Kama Hele and Hōkūle`a were again under way. Hōkūle`a’s crew applauded Amimoto and Gilliom when the two boats anchored at Pearl and Hermes.

Shortly after dawn, the canoe had its biggest day of fishing to date. Four handlines were trolling behind the vessel. Suddenly one hit, then another, and as they were being hauled in, a third, and then a fourth. The crew hauled in two kawakawa and two small `ahi. One of the lines was fed back out to aid in untangling it, and another fish hit, got loose, hit again, got loose again and then hit hard a third time. It was another small `ahi. The crew had fish chowder and teriyaki fried fish on Sunday night with that day’s catch, made by sailing master Bruce Blankenfeld. Yesterday, Russell Amimoto and Tava Taupa made a heaping platter of sashimi and fried fish at lunch, and the crew was arguing over whether to have `ahi spaghetti or more sashimi for dinner. The sashimi was served on cabbage. The canoe’s cabbages were still usable, but only after several layers of blackened and rotten leaves are removed from the outside, and black spots cut out of the inside.

The only fruits left are shriveled lemons and limes. Onions are OK. Potatoes are soft and turning green. Squashes and sweet potatoes still look good, but haven’t been tried. The canoe has done well with eggs. The voyage is into its third week without refrigeration, and each egg is float tested—if it sinks it’s deemed OK. If it floats, it’s assumed to be bad. As of yesterday, all eggs had been good. “Last voyage, they lasted 27 days,” said watch captain Russell Amimoto, the younger brother of Kiyoshi Amimoto, who helped clear the escort boat’s propeller.

The ship’s doctor, Cherie Shehata, has been busy with one or more medical issues daily. Captain Nainoa Thompson appears to be doing well after injuring his ribs a week ago off French Frigate Shoals, although he had some soreness after snorkeling yesterday. Shehata has also stitched a gashed finger, taped a possible broken toe, worked on a jellyfish sting, dealt with seasickness, and responded to leg rashes and abrasions. She’s a triple treat who also works the sails and steers, and in recent mornings has cooked crew breakfasts.

Pearl and Hermes is the second-largest atoll in the Hawaiian archipelago. These low coral islands are difficult to spot, even though we were using satellite navigation techniques and knew where Pearl and Hermes Atoll was. Three miles from it we could see no sign of it. At about two miles, from the deck of Hōkūle`a, an occasional spot of white on the horizon suggested surf breaking on the reef and at 1.6 miles we could pick out a narrow line of cream-colored sand, distinct from the bright white of the surf. It was Southeast Island, the largest of the sandbars here. We’d been looking for the green clouds we’d seen at French

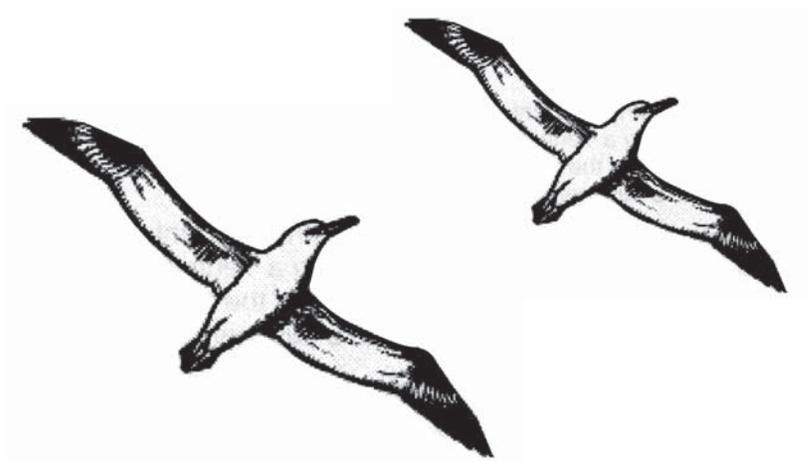
Frigate Shoals—white clouds that turn chartreuse from the reflection of the shallow lagoon water. We didn't see them on our approach, because there weren't any low clouds at all over the lagoon—although we spotted the green wonders later.

Next, we could pick out the hump of swells, rising up before they broke on the fringing reef, and then we could see a line of pale bluish green on top of white breakers. It was the inside of the lagoon. Sooty terns came screeching by, and we spotted a turtle swimming. The water under the boat was getting paler as it shallowed. About a third of a mile out, we could pick out the steady roar of the breakers. The sand island we were approaching grew thicker with closeness, and what at first looked like greenery on its 10-foot highest point turned out to be a cluster of green tents occupied by a NOAA Fisheries seal-monitoring team. There isn't much land vegetation on Pearl and Hermes.

A few hundred yards off the reef, we could pick up detail. We could see the pale blue patches of sandy bottom on the outside of the reef, the pale green shallower sandy patches inside, and the darker green areas inside where coral and algae reefs were. Beyond that, there was the darker blue water of the deeper areas inside the lagoon.

After our brief diving stop, we sailed on for Kure Atoll, the end of the Hawaiian Archipelago. We hoped to walk on Green Island there and dive its reefs before sailing to Midway, where this crew will leave the canoe and a new crew is waiting to take Hōkūle`a back home.

Advertiser Science Writer Jan TenBruggencate is serving as a crewmember on Hōkūle`a as it sails through the 1,200 miles of the Northwestern Hawaiian Islands. His dispatches are sent back via satellite telephone.



Source: <http://the.honoluluadvertiser.com/article/2004/Jun/08/In/In15a.html>

## Good Seeds

Pearl and Hermes Atoll

– September 29, 2002

Posted by Kaliko Amona, Graduate Intern  
NWHI Coral Reef Ecosystem Reserve

At so many of the islands we've visited during this expedition, our teams have been extremely cautious with our clothes, shoes, and equipment, not wanting to introduce any alien plants or animals to these pristine environments. Today we were just as careful, wearing only new clothing that had been sealed and frozen for 48 hours before we left Honolulu, but there was one difference. At Pearl and Hermes Atoll, our goal was to bring seeds, the good kind, from one island to another.

At North Island, our group split up into teams to work on the day's first order of business—counting birds. Watching first for their burrows, then for nohu (*Tribulus cistoides*) barbs, Ethan and I carefully walked the island looking for noio (brown noddy) and `iwa (great frigate bird) chicks and eggs. Most of the young noio we found were hidden in the shade of *Eragrostis variabilis* grass, quietly waiting for a parent to arrive with their daily meal. Beneath the roots of this grass we peeked into burrows where wedge-tailed shearwaters did the same.

After the bird count, we collected seeds from the *Eragrostis* to plant at Southeastern Island. Native to Pearl and Hermes Atoll, this bunch grass-like plant provides excellent habitat for many of the seabirds that live here. The native plants at Southeastern Island have not fared as well as those on North Island, with *Verbesina* (golden crown-beard) and other alien plants taking over some parts of the island. *Verbesina* is the same alien plant that we fought during our stay on Green Island at Kure Atoll. *Verbesina* appears to be an allelopathic plant—it may release chemicals that prevent other plants from growing around it, so it easily out-competes many native plants. As part of its annual cycle, the *Verbesina* dies back, leaving barren areas with very

little vegetation. These barren areas provide unstable soil for burrowing birds and their burrows may easily collapse if the soil becomes wet. To help the birds, and the entire ecosystem, we scattered native *Eragrostis* seeds over an area that the terrestrial crew had cleared of pest plants earlier in the week.

In all, we sowed about a gallon and a half of the tiny *Eragrostis* seeds. A year ago, Alex Wegmann of the U.S. Fish and Wildlife Service scattered a little less than this amount and twelve plants have come up since. Our efforts today are a small step toward restoring Southeastern Island. It will take much more work, but the U.S. Fish and Wildlife Service's work at Laysan Island provides evidence that such restoration is possible. Over several years, field crews there have transformed the island environment from one that was degraded by human exploitation to an ecosystem where native plants and animals thrive.

### Footnotes:

During our search we came upon a koa'e`ula (red-tailed tropic bird) chick sitting under the shade of *Eragrostis*. Although we were focusing on noio and `iwa for the count, we made a note of this one and continued on. Only after returning to the rest of the group did we find out what a special find we had made. Beth Flint, our escort from the U.S. Fish and Wildlife Service, told Ethan and me that this was the only red-tailed tropic bird chick reported during their surveys during the past several days. By now, most koa'e`ula have fledged and are out on their own.

We also gathered seeds from the native *Solanum nelsoni* plants we came across on North Island and sowed them on Southeast Island. The large black fruits are filled with small, chili pepper-like seeds.

### References:

Beth Flint and Alex Wegmann, U.S. Fish and Wildlife Service

## Efforts to Mālama the NWHI

The incredible life that still flourishes in the NWHI is a product of not only the area's remote location, but also of visionary management that began almost 100 years ago, when early protections were put in place. Before the region became a wildlife refuge, Laysan Island, for example, was mined for eggs, bird feathers, and guano, leading to the death of hundreds of thousands of Laysan albatross. Today, the island's habitat and its bird population are being restored. These efforts continue as many more of the island ecosystems impacted by human occupation and introduction of alien species are restored to their natural state. Protections afforded to land and shallow waters have been extended to deeper waters surrounding the islands in recognition of the connections between land and sea, and particularly to protect endangered species and some of the last truly wild coral reefs on the planet.

Scientists, on annual research cruises to the region, continue to discover new marine species. They also collect data on the incredible complexity of these ecosystems that are still operating in natural balance, an opportunity that is becoming increasingly rare in our human-modified world. The information they collect, and the conclusions they draw from it, is helping to determine the best way to protect this unique ocean region for generations to come, and sheds some light on how we can restore our island ecosystems back home.

Ongoing research in the Hawaiian Islands National Wildlife Refuge (HINWR), Midway Atoll National Wildlife Refuge (MANWR), Kure Atoll State Wildlife Sanctuary (KASWS) (Mālama) and Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NWHICRER)

Ongoing monitoring of terrestrial plants and birds

Long-term monitoring continues of 4 endemic endangered landbird species, 20 seabird species, 5 shorebird species, and 106 plant species that occur in HINWR, KAWS, and MANWR. Monitoring intervals range from year-round measurements made at permanently staffed stations (French Frigate Shoals, Laysan, and Midway Atoll) to irregular visits at some of the remote sites (Gardner Pinnacles and Mokumanamana) and include measurements of population size, reproductive performance, and breeding chronology. Seabird data are submitted to the Pacific Seabird Monitoring Database and represent the largest and longest set of time series of tropical seabird population data in the world.

Laysan ecosystem restoration

Various experimental horticulture procedures are underway for Laysan's ecosystem restoration project. Studies of out planting protocol and propagation techniques are ongoing at the field site. Researchers and biologists live in a remote island camp using eco-friendly solar-generated heat, power, water-filtration system, and compost toilets.

Green sea turtle monitoring by U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)

Long-term monitoring of the trends in the green sea turtle (*Chelonia mydas*) nesting colony is ongoing at French Frigate Shoals in collaboration with the National Marine Fisheries Service, Honolulu Laboratory. Population monitoring began in 1973.

National Marine Fisheries Service monk seal recovery efforts

Field camps are currently located at French Frigate Shoals, Laysan, Lisianski, Pearl

and Hermes Reef, Midway, and Kure. Monk seal research activities have been occurring in the NWHI for many years. Studies have included activities such as collection of samples for fatty acid analysis, documenting entanglements, mobbing, tagging weaned pups, intra-atoll movement of weaned pups, instrumentation of seals with portable camera units, marking seals for population studies, diet supplementation for pups, shark tagging to study movement behavior and removal of sharks along with extensive observations of shark behavior.

**Restoration by U.S. Coast Guard (USCG)**  
The USCG has partially removed the contaminated (PCBs and lead) from the landfill located on Tern Island. The landfill was created during the period the USCG operated a LORAN station at Tern. Recent breaches in the seawall have allowed erosion of the landfill into the atoll's lagoon, contaminating sediment, fish, and other biota.

**Spinner dolphin research**  
Midway Atoll provides a critical habitat for approximately 320 resident dolphins to rest and socialize during the daylight hours. A cooperative research effort between the U.S. Fish and Wildlife Service and the Oceanic Society described the socio-ecology of *Stenella longirostris*, the lagoon's resident spinner dolphins.

**Midway contaminant studies**  
An evaluation of the impact of lead and other contaminants on the immune response in Laysan albatross chicks began in 2000. Other research includes evaluation of contaminated nest soil and its contribution to chick/adult hormonal status (e.g., thyroid), and chick fledgling success in black-footed albatross.

**Midway restoration**  
Before the Navy left Midway, it devoted millions of dollars and significant effort into undoing some of the human imprints

on the islands. Working hand-in-hand with the Fish and Wildlife Service, the Navy and its contractors demolished more than 100 deteriorated buildings, removed scores of under- and aboveground fuel storage tanks, and cleaned up the environmental contaminants left by years of military operations. The Navy also removed a tug and barge thought to be the source of high levels of PCB fish contamination. Monk seals had used this barge as a haul out.

#### Bird aircraft interaction

A study to gather more information on the flight patterns used by seabirds crossing Midway's runway started in November 2001. It was based on the 2000 pilot-season project that monitored seabird flights in relation to wind speed and direction, time of day, landscape features, and species. The goal is to develop a means of communicating bird traffic levels to incoming and outgoing aircraft pilots.

#### Research Programs with the NWHI Coral Reef Ecosystem Reserve

The Reserve leads and supports scientific and cultural research in the NWHI that helps to provide long-term protection for the area's marine resources and cultural heritage. The Reserve's coral reef research program focuses on basic habitat characterization, mapping, and on ecosystem function. Reef surveys have recorded the diversity and abundance of fishes, algae, corals and other reef invertebrates throughout the archipelago, and ongoing monitoring programs keep track of their health. NOAA sponsored mapping expeditions have used multibeam sonar to map previously uncharted features on the ocean bottom, as well as collect more detailed and accurate data on shallow water features. Through radio tagging of large predatory fish such as sharks and jacks, and through genetic studies of fishes the Reserve is trying to discover how all these reef systems are connected, and

how best to manage them to preserve ecosystem function.

Historical and cultural resources such as shipwrecks have also been documented on shallow reefs by Reserve archaeologists, and the Reserve has supported several Native Hawaiian cultural expeditions to the islands. Research in deeper offshore waters has utilized multibeam sonar and submersibles to document rarely seen biological resources and topographical features within Reserve waters. The results from these research efforts are used to determine the best methods for managing the largest coral reef ecosystem in the United States, and to provide lasting protection for its resources.

#### NOAA led Multi-Agency Marine Debris Cleanup Program

A NOAA led multi-agency marine debris cleanup program has been operating in the NWHI since 1997, and as of 2005 has removed nearly 500 tons of marine debris from the shallow waters and reefs. Each year, NOAA NMFS Coral Reef Ecosystem Division coordinates a several month long cleanup expedition to the islands that removes derelict fishing nets, and other large debris that pose a severe entanglement hazard to marine life such as monk seals, sea turtles, and large fish. The nets also act as giant bulldozers when they are pushed into shallow waters by waves and currents. Once in shallow water they crush corals, and destroy the reef structure. Each year it is estimated that 30 to 60 tons

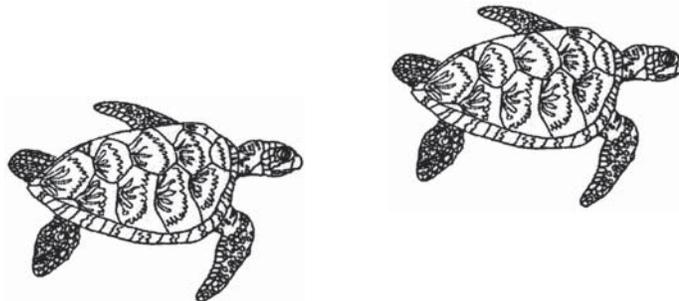
of new debris arrive in the NWHI, mostly in the form of derelict fishing nets from North Pacific fisheries. New programs to identify and collect nets at sea before they cause damage in shallow waters, and prevention programs to stop the debris from getting into the ocean in the first place are being implemented to address this huge problem.

#### Vessel Hull Inspection Program

The NWHI Coral Reef Ecosystem Reserve, along with other agency partners active in the NWHI, has instituted a hull inspection program for vessels entering the NWHI. This program attempts to prevent the introduction of non-native or invasive organisms into the NWHI from fouling on ship hulls, or from ballast water containing these organisms. As of 2005 the program was in its first full year of operation and had already identified and removed several organisms attached to ship hulls that may have been introduced into the NWHI. Introduction of alien and invasive species to the NWHI by human mechanisms is a primary management concern for all agencies attempting to protect this special place.

Source: United States Fish & Wildlife Service. (2002, March). Research in the NWHI National Wildlife Refuges and Kure Atoll Wildlife Sanctuary. Honolulu, HI: Author.

NWHI Coral Reef Ecosystem Reserve text from Andy Collins



# NWHI Legal Status and Protection

The early protections afforded the region resulted from public outcry against exploitation of the area's rich natural resources, and the protections being discussed today are in response to world-wide losses of coral reefs, the need to protect species on the brink of extinction, and a rising awareness that our vast oceans are suffering from human impacts and are not "bottomless." A multitude of state and federal agencies manage and help protect the area known as the Northwestern Hawaiian Islands. From Nihoa Island to Kure Atoll, this area, excluding Midway Atoll, lies within the State of Hawai'i.

In 1857 Kamehameha IV visited Nihoa and annexed this island as well as the rest of the NWHI to the Hawaiian Kingdom. Most of the NWHI were incorporated into the United States of America as part of the Territory of Hawaii on July 7, 1898.

The earliest legally authorized federal protection occurred in 1903 when President Theodore Roosevelt put Midway under Navy Department control in Executive Order 199-A to protect Midway's seabirds from Japanese poachers and squatters. Later, in 1909, he set aside all the "other" islets, atolls, and reefs extending 1200 miles northwest of the main Hawaiian Islands from Nihoa to Kure to protect seabirds from slaughter for the millinery trade. This earlier known "Hawaiian Islands Bird Reservation" is now called Hawaiian Islands National Wildlife Refuge and is administered by the U.S. Fish and Wildlife Refuge. With the exception of Midway and Kure Atolls, this Refuge includes the islets, atolls, and reefs lying northwest of the main Hawaiian Islands.

Kure Atoll became the only state-managed land in the NWHI in 1978 when it was established as a State Seabird Sanctuary managed by the State of Hawai'i, Department of Land and Natural Resources.

In 1996, Midway Atoll became its own separate and unique National Wildlife Refuge, now managed by the U.S. Fish and Wildlife Service as Midway Atoll National Wildlife Refuge.

The State of Hawai'i claims jurisdiction over the waters within 3 nautical miles of land. Under an administrative agreement, the U.S. Fish and Wildlife Service co-manages with the State of Hawai'i Department of Land and Natural Resources more than 610,000 thousand acres of submerged shoals, coral reefs, and seamounts surrounding the atolls and islets. Fishing is currently prohibited within these co-administered Refuge boundaries. The Department of Land and Natural Resources Division of Aquatic Resources is in the process of establishing fishery management areas within State waters surrounding the NWHI. Fisheries regulations in Federal waters from 3 to 200 nautical miles are enforced by the U.S. Coast Guard and National Marine Fisheries Service (NMFS).

The Western Pacific Regional Fishery Management Council proposed regulations that were accepted by National Marine Fisheries Service establishing a Protected Species Zone for endangered Hawaiian monk seals that extends for 50 nautical miles around each Refuge island and includes a 100-nautical-mile wide corridor connecting the Refuge islands. Pelagic longline fishing is prohibited within this zone, but commercial bottomfishing, recreational, and subsistence fishing are allowed except where restricted by Reserve Preservation Areas established under Executive Order 13196.

In December 2000, the NWHI Coral Reef Ecosystem Reserve (Reserve) was created by Executive Order 13178, as modified by Executive Order 13196, to conserve and protect the coral reef ecosystem and related natural and cultural resources of the area.

At approximately 84 million acres, it is the largest conservation area in the U.S. and the second-largest in the world.

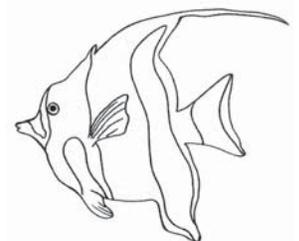
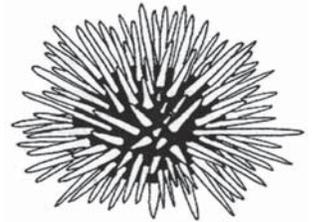
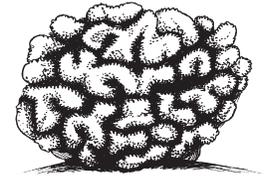
The Reserve is 1200 nautical miles long and 100 nautical miles wide and extends along the entire NWHI, excluding land areas, State of Hawai`i waters, and Midway Atoll NWR. The Reserve is managed under the Department of Commerce, National Oceanic and Atmospheric Administration National Marine Sanctuary Program. As directed by the executive orders that created it, the Reserve is going through a national marine sanctuary designation process and may become the nation's 14th National Marine Sanctuary. These initiatives provide the public with an unprecedented opportunity to participate in determining the health and future of this ocean wilderness. It is the hope of the Navigating Change initiative to inspire Hawai`i's people to take action.

# Species in NWHI Listed as Endangered or Threatened

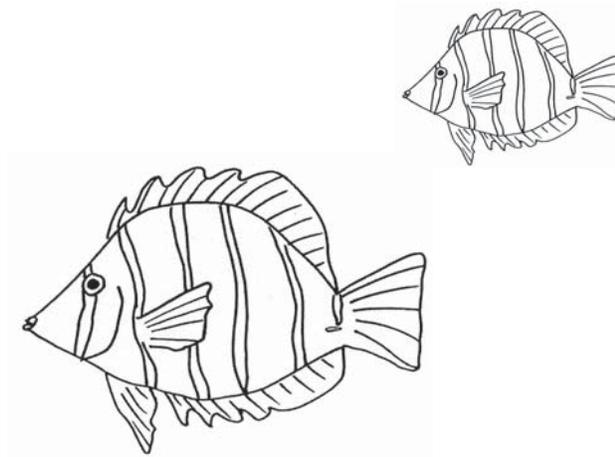
Special Status Species:	Status under the Endangered Species Act
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Hawaiian monk seal	Endangered
Humpback whale	Endangered
Nihoa millerbird	Endangered
Nihoa finch	Endangered
Laysan finch	Endangered
Laysan duck	Endangered
<i>Cenchrus agraminoides</i> var. <i>laysanensis</i> (plant)	Endangered (may actually be extinct)
<i>Mariscus pennatifolius</i> ssp. <i>bryanii</i> (plant)	Endangered
Loulu, <i>Pritchardia remota</i> (plant)	Endangered
<i>Schiedea verticillata</i> (plant)	Endangered
<i>Amaranthus brownii</i> (plant)	Endangered

# Thirteen Things You Can Do to Help Protect Hawai`i's Coral Reefs

1. Support reef-friendly businesses
  - Ask what your dive shop, fishing store, and tour operators are doing to help prevent damage to Hawai`i's coral reefs.
  - Encourage businesses to sponsor and donate a share of their profits to reef management and education activities.
2. Please don't pollute
  - Let others know that plastics in the water can damage and kill fish, marine mammals, turtles, and seabirds.
  - Spread the word that the pollution released on our islands eventually winds its way into the ocean where it harms our reefs.
3. Learn more about our reefs
  - Volunteer at an environmental organization/agency and become a member of a local aquarium, zoo, or environmental center.
  - Help with reef and beach clean-ups.
  - Learn more so you can help others understand the fragility, value, and wonder of Hawai`i's coral reefs.
4. Report dumping, poaching, or other illegal activities
  - Since environmental enforcement officials cannot be everywhere, you can take down as much detailed information about the illegal activity as possible and contact the appropriate authorities. **DO NOT** directly confront possible violators.
5. Never anchor directly on the reef
  - Make use of the State's Day-use Mooring System where available.
  - Anchor in sand away from reefs whenever possible.
6. Take steps to decrease overfishing
  - Observe fishing regulations and only harvest what you need.
  - Tell others that we all need to kōkua (help) so there will be fish for your own children or grandchildren to catch in the future.
7. If you SCUBA dive or snorkel, don't touch
  - Take a moment to think about your actions in the water.
  - Remember that your fins, hands, and diving equipment can be lethal weapons that damage the delicate, tiny animals that build the reef.
8. Get involved in the legislative process
  - Contact your elected officials and encourage them to support legislation what will protect Hawai`i's reefs.
  - Let others know that we need to change the fact that Hawai`i has the fourth longest coastline in the U.S. but ranks 48th in overall funding for fish and wildlife protection, and last in overall state spending on environmental protection!
9. Be an informed consumer and responsible aquarium hobbyist
  - Consider carefully the impact of purchasing preserved coral or aquarium fish. By law, coral for aquaria have to come from outside the State of Hawai`i. Still, their removal causes negative impacts on the reefs of the country they're from.



- Never release exotic aquarium species into Hawaiian waters. Hawai`i is a very unique place containing marine organisms found nowhere else in the world. Introduction of non-native marine life can severely affect the ability of our native species to survive.
10. Be a wastewater crusader
    - Help prevent marine water pollution by cutting down on the amount of chemical pesticides and fertilizers you use.
    - Conserve fresh water.
  11. Support the creation and maintenance of marine parks and preserves
    - Let others know that most of Hawai`i's marine resources are over-fished, and that by setting aside protected habitat we will enhance nearby areas, thereby allowing renewed fishing and gathering opportunities.
  12. Promote responsible development
    - Spread the word that as we develop more and more of our undeveloped coastal—and inland—areas, we place greater pressure on the natural ecosystems to adapt. Most of our native island species depend on our precious few undeveloped natural habitats and have nowhere else to go.
  13. Practice resource stewardship
    - Learn and follow the rules and regulations about fishing, gathering, and use of our marine resources.
    - Spread the word that many marine species are unique to Hawai`i, and that our reefs need our help.



NOTE: Many of these ideas were adopted from the NOAA Coral Reef Home Page ([www.coralreef.noaa.gov](http://www.coralreef.noaa.gov)) and the DLNR Partnership for Resource Protection brochure, the IYOR informational brochure, and the ICUN Coral Reefs of the World lists of Impacts on Reefs

# Glossary of Terms

## A

acre – land area equivalent to 43,560 sq. feet; there are 640 acres in one square mile

ahupua`a – traditional Hawaiian land division usually extending from mountain summits to the outer edge of the reef

āina – land, earth; “that which feeds”

algae – simple plants that live in water

alternatives – one of two or more choices

apex predators – animals at the top of the food chain

archipelago – a chain or cluster of islands surrounded by open sea

atoll – a ring-shaped coral reef or string of coral islands, usually enclosing a shallow lagoon

## B

basalt – hard and dark volcanic rock formed by the cooling of lava at or near the Earth’s surface

baseline – information collected about an ecosystem at a known point in time that creates a “picture” for measuring change in the future

biodegradable – capable of being broken down by natural processes

biodiversity – the abundance of native species in an area

biomass – total weight of living things in a defined area

bolus – fat, cigar-shaped mass of materials that is regurgitated by some types of seabirds and contains materials that were indigestible (e.g. plastics, squid beaks)

## C

capping – stage in the evolution of a typical Hawaiian volcano during which rocks build a steeply sloping cap on the main shield of the volcano. Eruptions are less frequent but more explosive than in other volcano types. The summit caldera may be buried.

carnivores – animals that feed on other animals

community – an assemblage of plants and animals living within a defined area

conclusions – general statements about findings

consumers – animals that get their energy by feeding on plants or other animals

## D, E

decomposers – organisms that help to break down plant and animal matter into nutrients that producers need to grow; scavengers

ecosystem – the interacting system of living organisms and their environment

emergent – above the surface of the water

endangered – plant or animal species in danger of going extinct

endemic – restricted to an area (e.g., a species found only in one area on Earth)

erosion – wearing away of the land by the action of water, wind, or ice

extinction – the total disappearance of a species

F, G

fertilizers – substances (natural or chemical) that supply nutrients to the soil

food chain – a sequence of organisms, each of which uses the next lower member of the sequence as a food source

foraging ground – place from which an animal gets its food

fringing reef – coral reef that grows in shallow water and slopes sharply toward the sea floor

guano – manure composed chiefly of the excrement of sea birds; valued as a fertilizer

guyot – a flat-topped submerged seamount

H

habitat – the place or environment in which a plant or animal naturally lives and grows

hazardous – potentially harmful

herbivores – animals that feed on plants

ho`okele – navigator

ho`okupu – tribute, tax, ceremonial gift-giving as a sign of honor and respect

human disturbance – in this context, human activities that result in harming plants or animals

hypothesis – educated guess

I, J, K

indigestible – digestible with difficulty or impossible to digest

interdependence – in this context, the mutual dependence of plants and animals

invertebrate – an animal without a backbone

kapu – taboo, prohibition; forbidden; sacred

kōkua – to help, assist

kuleana – right, privilege, concern, responsibility

kupuna – elder; grandparent, ancestor, relative or close friend of grandparent's generation

kupūna – plural of kupuna

L, M

$L_{50}$  – the length (L) of a fish species at the time when approximately 50% are reproductively mature (only half will be able to spawn at that size)

latitude – imaginary circles around the Earth, parallel to the equator

laulima – to work together

limpet – mollusk with a conical shell that clings to rocks and corals; `opihi

longitude – imaginary circles on the surface of the Earth passing through the North and South poles at right angles to the equator

low-level carnivore – animal, smaller than apex predators, that feeds on organisms lower in the food chain

mālama – to take care of

mālama `āina – to take care of the land (including the sea)

marine debris – human-made solid material that is dumped or washed into the marine environment

marine protected area – an area in which marine resources receive special protections

## N

National Marine Sanctuary – a system of underwater parks managed by NOAA's Office of National Marine Sanctuaries intended to protect and preserve biological, cultural, and historical resources

National Wildlife Refuge – a federal designation given to a protected area managed by the U.S. Fish and Wildlife Service for the primary purpose of providing necessary habitat for wildlife

navigate – to steer a course

non-biodegradable – not capable of being broken down by the actions of microorganisms

NOWRAMP – Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (the NOWRAMP expedition surveyed the NWHI marine ecosystems)

nutrients – any substance that promotes growth in living organisms

## O, P

omnivores – animals that feed on both plants and other animals

pesticides – substances used to control pests

photosynthesis – the process of using energy from the sun to make starches and sugars from carbon dioxide and water

phytoplankton – single-celled or multi-celled plants

procedures – sequence of actions used in an experiment

producers – organisms that use energy from the sun to produce their own food

predator – an animal that hunts and kills other animals for its food

prey – an animal hunted or caught for food

purpose – goal

## R - Z

reproductive maturity – age or size at which an organism is able to reproduce

reproductive size – the size of an organism when it is sexually mature

results – what happened

secondary activity – (also referred to as “rejuvenation”) renewed volcanic activity that sometimes occurs after the bulk of an island is formed and the volcano has experienced considerable erosion

shield-building – formation of a gently sloping volcano in the shape of a flattened dome and built almost exclusively of lava flows

shifting baseline – using information recorded at a different time as a baseline by which to measure change

submerged – beneath the surface of the water

sustainable use – use of a resource in a way that allows future generations to meet their needs

wayfinding – the art of navigating without instruments, using clues in the environment

zooxanthellae – microscopic, single-celled algae that live inside the tissues of corals and some other animals

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