



Patrick Ching 2006

## E Pūlama I Nā Moku Manamana No Ka Mua Aku! – Cherish The Northwestern Hawaiian Islands For Future Generations!

Native species clockwise from upper left corner: female 'iwa (great frigatebird) harassing koa'e 'ula (red-tailed tropicbird) for fish; manu o Kū (white tern); 'ewa'ewa (sooty tern); flock of 'iwa in distant thermal updraft; two male 'iwa in naupaka kahakai; 'ā (red-footed booby) chick and adult in naupaka kahakai; honu (green sea turtle); mōli (Laysan albatross); Laysan duck eating native brine flies; 'ūlili (wandering tattler); pōhuehue (beach morning glory); Laysan finch chasing native earwig; Nihoa millerbird in kāwelu (native bunchgrass); 'Īlioholoikauaaua (Hawaiian monk seal); native Agrotis moth; 'ōmilu (bluefin trevally); hihimanu (spotted eagle rays); and black-footed albatross in front of niuhi (tiger shark).

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Working today for the nature of tomorrow!

CCH is the Hawai'i affiliate of the National Wildlife Federation.

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# E Pūlama I Nā Moku Manamana No Ka Mua Aku!

## *Cherish The Northwestern Hawaiian Islands For Future Generations!*

The Northwestern Hawaiian Islands (NWHI) coral reef ecosystem is the most remote – and possibly least impacted – in the world. As of June 2006, these islands also formed the world's largest marine protected area. Inhabited by native marine and terrestrial species, a number of which are endemic (unique) to these islands, the reefs and islets cover an area so vast that scientists have yet to survey it comprehensively. The NWHI include atolls, small basalt and raised coral islands, and a number of submerged reefs and banks – all of which mark the location of former volcanoes. From southeast to northwest, the NWHI are Nihoa Island, Necker Island (Mokumanamana), French Frigate Shoals (Kānemiloḥa'i), Gardner Pinnacles (Pūhāhonu), Maro Reef (Ko'anako'a), Laysan Island (Kauō), Lisianski Island (Papa'āpoho), Pearl and Hermes Atoll (Holoikauaua), Midway Atoll (Pihemanu), and Kure Atoll (Mokupāpapa). Unique in every respect, the NWHI provide a glimpse of Hawai'i's past, as well as its future.

## Geology & Formation

Each of the Hawaiian Islands, including the NWHI, was formed in the same location where the Big Island of Hawai'i continues to grow today. The Hawaiian Islands were formed by two processes: localized mid-oceanic volcanism and plate tectonics. Such mid-oceanic volcanism is caused by a "hotspot" well beneath the earth's crust, which allows fluid magma (molten rock) to make its way up to the seafloor. The Hawaiian hotspot appears to have been active, in about the same location, for at least 75 to 80 million years.

Hotspots create island chains rather than large single islands as a result of the movement of oceanic plates (part of the earth's crust and upper mantle layer beneath the crust). The Pacific plate is moving to the northwest several inches per year, carrying with it the islands formed over the Hawaiian hotspot. The oldest islands are at the northwestern end of the chain, while the youngest, the Big Island of Hawai'i and the underwater volcano Lō'ihi, are now positioned over the hotspot and are volcanically active.

Once the moving Pacific plate has carried the volcano off the Hawaiian hotspot, eruptions become less frequent, and subsidence (sinking) and erosion quickly dominate. While the islands subside and erode, corals and calcareous algae build fringing (and in some cases barrier) reefs. Under favorable conditions, coral growth can encircle an island. Once the last remnant of the volcano has eroded away, the remaining reef and any coral islets are collectively termed an atoll. (Volcanic remnants still above sea level include Nihoa and Necker, La Pérouse Pinnacle of French Frigate Shoals, and Gardner Pinnacles.)

Reef growth slows as the islands move north out of the tropics and into cooler waters. When coral growth is unable to keep pace with subsidence and erosion, the atoll disappears below the surface and becomes a

seamount. The oldest volcanoes created by the Hawaiian hotspot are well over 60 million years old and have eroded to become the Emperor Seamounts, which are now all below sea level.

## Native Hawaiian Culture

*Pae like ka moku i lālani, hui aku hui mai me Hōlani*  
The Hawaiian Islands lay in sequence, adjoined to Hōlani  
*Ka Mele a Kamahu'alele*

According to Hawaiian oral traditions, the Hawaiian Islands – including the NWHI – are related, all part of a large 'ohana (family). *Mo'olelo* (narrative), *oli* (chant), and *mele* (chant with dance) identify as many as 23 islands beyond Kaua'i and Ni'ihau. These islands are often mentioned in association with Hawaiian gods and chiefs. Pele and her family stop at Mokumanamana (Necker) on their way to the main Hawaiian Islands. Pele's brother, Kānemiloḥa'i, is left on Mokupāpapa (Kure) as a guard. Kānemiloḥa'i is also a traditional name for French Frigate Shoals. Mokuakāmohoali'i is possibly another traditional name for Necker. It may refer to Pele's eldest brother, Kāmohoali'i, king of the sharks, and to what is now called Shark Bay to the north of the island. Hōlanikū is another ancient name for Kure. It is mentioned in *Ka Mele A Kamahu'alele* – the chant of Kamahu'alele, the famous priest of the great navigating chief, Mo'ikeha. Hōlanikū is closest to Hōlani, a mythical region to the west of the Hawaiian archipelago bounded by Hōlanikū (Hōlani in the east) and Hōlanimoe (Hōlani in the west).

From archaeological evidence we know that Nihoa and Necker were both frequented by Native Hawaiians beginning about A.D.1000, with evidence of visitation or habitation over hundreds of years. At least 88 cultural

sites are found on Nihoa and 52 on Necker. Resources on Nihoa were probably capable of supporting a small resident population, or possibly as many as 100–150 seasonal visitors. The inhabitants of Nihoa built agricultural terraces that cover 15% of the island, as well as residences, religious shrines, and water diversions. Artifacts from Nihoa include fishhooks, sinkers, cowry shell lures, hammerstones, grindstones, and adzes. According to oral traditions, the people of Ni'ihau went to Nihoa to collect loulou palm wood and grass.

Long-term habitation on Necker would have been difficult, due to the lack of water and soil on the island, but early visitors or inhabitants quarried rock to build more than 30 shrines, as well as terraces, walls, and platforms. They also fashioned *ki'i pōhaku*, unique stone statues of small moon-faced human figures. Ancestral iwi (bones) removed from Necker in the 1920s were reburied in 1997 by a Native Hawaiian organization.

It is unlikely that the low-lying sand and coral islands northwest of Necker were permanently inhabited by Native Hawaiians because of the strong winds and storm waves, and lack of freshwater. But voyages between the main Hawaiian Islands and the NWHI were feasible, as has been demonstrated in recent times by the voyaging canoe, *Hōkūle'a*.

## On the Land

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The islands, rocks, and sandbars of the NWHI are small (covering only 3,500 acres) and have little fresh water. No more rain falls on the islands than above the adjacent open ocean (25–30 inches per year). In addition to being battered by ocean waves and storm winds, the islands also have been subjected to destructive human activities, including guano mining, military use (as bases and as targets), fishing and whaling, seal hunting, feather collecting, and intentional and accidental invasive species introductions.

Despite these challenges, plants are found on all but the smallest or most ephemeral of the islands, including about 55 native ferns and seed-producing plant species, eight of which are endemic to the NWHI. *Kāwelu*, a native bunchgrass, is found in coastal areas on all the main Hawaiian Islands, but forms a dominant vegetation type only in the NWHI, and particularly on Laysan (where extensive restoration has occurred) and Lisianski. The Laysan finch nests primarily in *kāwelu* tussocks, and *kāwelu* seeds are a major food source. Other birds also rely on the grass, including the Nihoa millerbird, which weaves its nests from *kāwelu* blades. Indigenous, salt-adapted and ocean-dispersed plants include *pōhuehue* and *naupaka kahakai*. Among the 10 rare and endangered plant species on the NWHI are loulou palms, 'ohai, and *pua pilo*.

Native land birds include the Nihoa finch, Nihoa millerbird, Laysan duck, and Laysan finch; all are endan-

gered species. These birds face a dual threat to their survival: their native habitats are tiny, and their populations are very small. Three NWHI bird species have become extinct in historic times: the Laysan rail, Laysan millerbird, and Laysan honeycreeper. Non—breeding populations of shorebirds, including 'ūlili and kioea, make regular visits to many of the islands during their annual migrations.

Native terrestrial invertebrates play an important role in the NWHI ecosystem by pollinating plants, acting as scavengers, and providing food for birds. These invertebrates include moths, true bugs, crickets, grasshoppers, and earwigs. Earwigs can typically be found under rocks and logs, and play an important role as scavengers, aiding in decomposition. Brine flies are an important food source for the endangered Laysan duck, and brine fly larvae are eaten by Laysan finches and other birds.

## From the Sea

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The area of coral reefs and associated habitat in the NWHI is vast, accounting for most of the reef area in the United States. Collectively the reefs, banks, and waters of the NWHI form what may be the least-impacted large reef ecosystem in the world. Reefs in the NWHI remain dominated by high-level predators, including niuhi (tiger and other large, man-eating sharks) and jacks. Fishing has decimated “apex” or top predators and altered the natural predator-prey relationship in most other reef environments. But the lack of reef fishing in the NWHI has allowed the apex predators to thrive at natural levels. The contrast between the NWHI and the main Hawaiian Islands is stark: apex predators make up over half the fish biomass (the amount of living matter, measured by weight) in the NWHI, but account for just 3% of the fish biomass on reefs around the main islands.

The isolation of the NWHI has restricted the variety of coral species that occur there, but the proportion of endemic species is high (one-fourth of the reef flora and fauna are endemic to Hawai'i). The NWHI reef ecosystem also supports species characteristic of both tropical and sub-tropical environments.

The importance of this unique coral reef ecosystem is heightened by the fact that the NWHI serve as essential habitat for endangered and threatened species. The endangered 'īlioholoikauaua (Hawaiian monk seal) population numbers less than 1,400 individuals, and depends almost entirely on the isolated islands and reefs for breeding and foraging. Critical habitat for the monk seal in the NWHI has been designated by the National Marine Fisheries Service. Most of the sub—adult and adult threatened honu (green sea turtles) found in Hawai'i nest on the NWHI, and the islands and associated waters support one of the largest and most important seabird assemblages in the world.

## Seabirds

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Seabirds are an important part of both marine and terrestrial ecosystems in the NWHI. Seabirds are by far the dominant bird species in the NWHI, with their total number estimated at 14 million. Seabirds feed on a wide variety of marine organisms, including fish, squid, and crustaceans, and collectively consume over 500,000 tons of food per year.

Twenty-two species of seabird nest in the NWHI, among them the mōlī (Laysan albatross), black-footed albatross, Bonin petrel, ua‘u kani (wedge-tailed shearwater), koa‘e ‘ula (red-tailed tropicbird), ‘ā (red-footed booby), and ‘iwa (great frigatebird). Midway Atoll supports the world’s largest Laysan albatross colony and second largest colony of black-footed albatrosses. Terns and noddies on the NWHI, numbering some nine million birds, include manu o Kū (white tern) and an estimated one million nesting pairs of ‘ewa‘ewa (sooty terns). About half of Hawai‘i’s nesting species of seabird are year-round residents.

Some seabirds — notably the “tuna birds,” a group that includes several species of shearwaters and terns — forage in large flocks over feeding schools of aku (skipjack tunas) and other large predators that drive smaller prey to the surface. Rarely feeding in the absence of these predators, tuna birds depend both on them and the small fish and squid on which they feed. Fishermen have long benefited from the association between these seabirds and the large pelagic predators, seeking out hovering and diving bird flocks to guide them to schools of fish.

## Invasive Species

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Non-native small mammals were introduced and later completely removed from the NWHI. These include the roof rat and the Polynesian rat, which formerly occurred on Kure, where it was introduced either pre-contact or from a shipwreck in the 19<sup>th</sup> century. Rats prey on seabird adults, chicks, and eggs. The house mouse is still found on Midway. European rabbits were introduced to Laysan, Pearl and Hermes, and Lisianski and then eliminated in the 1920s, but not before they had consumed virtually all the vegetation on both Laysan and Lisianski.

More than 250 non-native plant species also have been introduced on the NWHI, with most (237) occurring on Midway, which has been heavily modified by humans for a century. Plants, such as golden crownbeard, are serious threats because they inhibit native plant growth, decrease potential nesting habitat for seabirds, and hinder fledging of seabird chicks. Golden crownbeard also hosts a scale that promotes another serious invasive pest – the big-headed ant. Ants attack chicks, attaching themselves to their feet, eyes, and bills.

Ants have overrun the terrestrial ecosystem on Kure, demonstrating that invasive species remain a serious threat to the NWHI today despite the strict controls enforced by managing agencies. Dozens of non-native insects and spiders have been accidentally introduced to the NWHI.

Invasive marine species on the NWHI include barnacles, bryozoans (tiny reef animals that are among the first to colonize newly exposed surfaces), and fish. The barnacles and bryozoans were probably accidentally introduced by fouling on the hulls of ships. The fish were all intentional introductions to the main Hawaiian Islands that successfully migrated to the NWHI. The spread of the invasive snowflake coral from the main islands to the NWHI is also a serious threat. The accidental introduction of additional alien plants or animals would have unforeseen and devastating consequences.

## Global Warming

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Although long thought to be protected from coral bleaching due to their northerly location in relatively cool waters, the first documented bleaching episode in the NWHI occurred in 1996, and was repeated in 2002 and 2004. Bleaching is a process in which corals are exposed to warmer-than-normal temperatures and lose the colorful algae that feed them. The bleaching was associated with elevated sea surface temperatures, caused by a prolonged period of light winds and less-than-normal mixing of the upper ocean by wind and waves. As temperatures rise, coral bleaching will continue. Sea level rise associated with global warming (due to thermal expansion of the oceans and melting of glaciers and ice caps) also threatens to inundate low-lying islands. Vulnerable species that depend on these islands for nesting, including monk seals, green sea turtles, and seabirds, will lose essential habitat. Global warming may also increase the intensity of storms, which tend to favor invasive plants over native ones.

## Overfishing & Marine Debris

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Experience with a variety of fisheries in the Hawaiian Islands – including those targeting live rock and coral, ula (spiny lobster), and bottomfish such as hāpu‘upu‘u (an endemic grouper) – has shown the difficulty of managing harvest levels in a manner that prevents collapse of the fishery. Concerns regarding overexploitation have resulted in past closure or restriction of each of these fisheries. With the recent designation of the Northwestern Hawaiian Islands Marine National Monument, only limited commercial bottomfishing may be continued by existing permittees, and it must be phased out within 5 years. Pirate, or illegal fishing, is also a threat. All vessels transiting through the NWHI should be identified and fitted with vessel monitoring systems.

In addition to the impact of fishing activities, abandoned gear – most of it from fisheries far from the NWHI – poses a threat as well. Between 1996 and 2005, 542 tons of derelict fishing gear and other marine debris were removed from the reefs of the NWHI; this does not include additional debris cleared from the beaches and islands. Fishing nets and other marine debris can damage reefs and entangle monk seals, sea turtles, and seabirds. Small plastic items, such as bottle caps, disposable lighters, plastic bags, and broken-up pieces of larger items, are ingested by seabirds. Some birds eventually die of starvation even though their stomachs are full of plastic. The need to remove marine debris is ongoing: some 50 tons are estimated to accumulate every year.

## Protection & Management

In the 1800s and early 1900s, the NWHI were exploited by seal hunters, whalers, feather hunters, pearl divers, and guano miners. The NWHI first received protection in 1909, when the Hawaiian Islands Bird Reservation was established in response to the killing of hundreds of thousands of seabirds by Japanese feather hunters. The Reservation later became the Hawaiian Islands National Wildlife Refuge, which protects eight of the ten NWHI islands, as well as adjacent nearshore reefs. The two other atolls – Midway and Kure – are also protected, the former as the Midway Atoll National Wildlife Refuge (established in 1988), and Kure as a State Wildlife Refuge.

In 2000, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was established to protect additional reefs lying beyond the boundaries of the refuges and state waters (which extend three nautical miles from the reefs). The Reserve was managed by the National Oceanic and Atmospheric Administration (NOAA). In 2005, the State of Hawai'i banned all extractive uses in state waters around the NWHI, including commercial and recreational fishing.

In June 2006, the lands and waters of the NWHI were designated a Marine National Monument. Roughly 140,000 square miles, the Monument is the largest marine protected area in the world. Patterned after protections developed while the area was under consideration for designation as a National Marine Sanctuary, the Monument provides immediate and permanent protection and conservation of the NWHI's resources. The Monument will be given a Hawaiian name and cooperatively managed by NOAA, the U.S. Fish and Wildlife Service, and the State of Hawai'i.

The proclamation establishing the Monument prohibits activities likely to result in dramatic, large-scale impacts, by banning the unauthorized passage of ships, unauthorized recreational or commercial activities, resource extraction, and dumping of waste. The NWHI

also need comprehensive protection from invasive species introductions, which can be prevented only through careful screening of all people, equipment, and craft traveling to the NWHI. Public awareness of the fragility of the NWHI, together with policies that limit non-essential human visits and require strict quarantine practices, will help protect this special place for future generations.

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