



Hō'omoe wai kāhi ke kāo'o.
Let's all travel together like water flowing in one direction.

» Hawaiian phrase from Mary Kawena Pukui's *Ōlelo No'ēau Hawaiian Proverbs and Poetical Sayings* (Bishop Museum Press, 1983). Front cover photo by Wayne Levin. Back cover photo by Greg McFall/NOAA.

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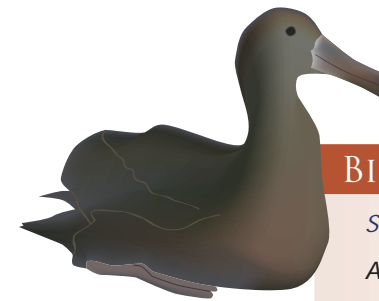
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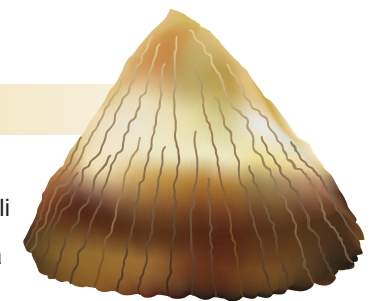


BIRDS

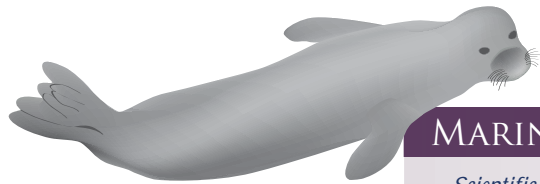
<i>Scientific</i>	<i>Common</i>	<i>Hawaiian</i>
<i>Acrocephalus familiaris kingi</i>	Nihoa Millerbird	ulūlu
<i>Anas laysanensis</i>	Laysan Duck	
<i>Diomedea immutabilis</i>	Laysan albatross	mōlī
<i>Diomedea nigripes</i>	black-footed albatross	ka‘upu
<i>Fregata minor palmerstoni</i>	great frigate bird	‘iwa
<i>Oceanodroma tristram</i>	Tristram’s storm petrel	
<i>Phaethon rubricauda</i>	red-tailed tropicbird	koa’e ‘ula
<i>Pterodroma hypoleuca</i>	Bonin petrel	
<i>Sula dactylatra</i>	masked booby	‘ā
<i>Sula leucogaster</i>	brown booby	‘ā
<i>Sula sula rubripes</i>	red-footed booby	‘ā

INVERTEBRATES/CORALS

<i>Scientific</i>	<i>Common</i>	<i>Hawaiian</i>
<i>Cellana exarata</i>	limpets (black foot)	‘opihi makaiauli
<i>Cellana sandwicensis</i>	limpets (yellow foot)	‘opihi ‘āinalina
<i>Colobocentrotus atratus</i>	shingle urchin	hā‘uke‘uke
<i>Siphonaria normalis</i>	false limpet	
<i>Drupa ricina</i>	snail	makaloa
<i>Echinometra oblonga</i>	urchin	ina
<i>Littoria pincta</i>	snail	pipipi kolea
<i>Isognomon californicum</i>	bivalve	nahawele
<i>Echinolittorina hawaiiensis</i>	snail	pipipi
<i>Nerita picea</i>	snail	pipipi
<i>Acanthaster planci</i>	crown of thorns	
<i>Pocillopora meandrina</i>	cauliflower coral	
<i>Montipora capitata</i>	rice coral	

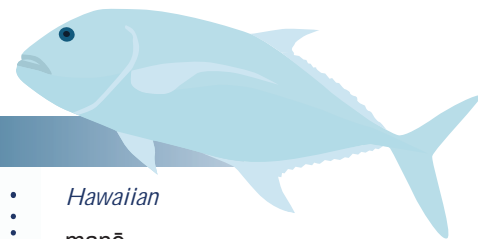


Species Mentioned in the Permitted Activities 2014 Annual Report



MARINE MAMMALS/REPTILES

Scientific	Common	Hawaiian
<i>Monachus schauinslandi</i>	Hawaiian monk seal	ʻĪlioḥoloikauaua
<i>Chelonia mydas</i>	Hawaiian green sea turtle	honu
<i>Eretmochelys imbricata</i>	Hawksbill turtle	ʻea



FISH

Scientific	Common	Hawaiian
<i>Carcharhinus galapagensis</i>	Galapagos shark	manō
<i>Caranx ignobilis</i>	giant trevally	ulua
<i>Sebastapistes fowleri</i>	dwarf scorpionfish	nohu
<i>Sebastapistes coniota</i>	speckled scorpionfish	nohu
<i>Chlorurus perspicillatus</i>	spectacled parrotfish	uhu 'ahu'ula
<i>Evistias acutirostris</i>	striped boarfish	
<i>Genicanthus personatus</i>	Masked Angelfish	
<i>Holanthias fuscipinnis</i>	yellow anthias	
<i>Suezichthys sp.</i>	wrasse	
<i>Epibulus insidiator</i>	sling-jaw wrasse	
<i>Myripristis amaena</i>	brick soldierfish	ʻūʻū
<i>Myripristis berndti</i>	bigscale soldierfish	ʻūʻū
<i>Neoniphon aurolineatus</i>	yellowstripped squirrelfish	ala'ihī

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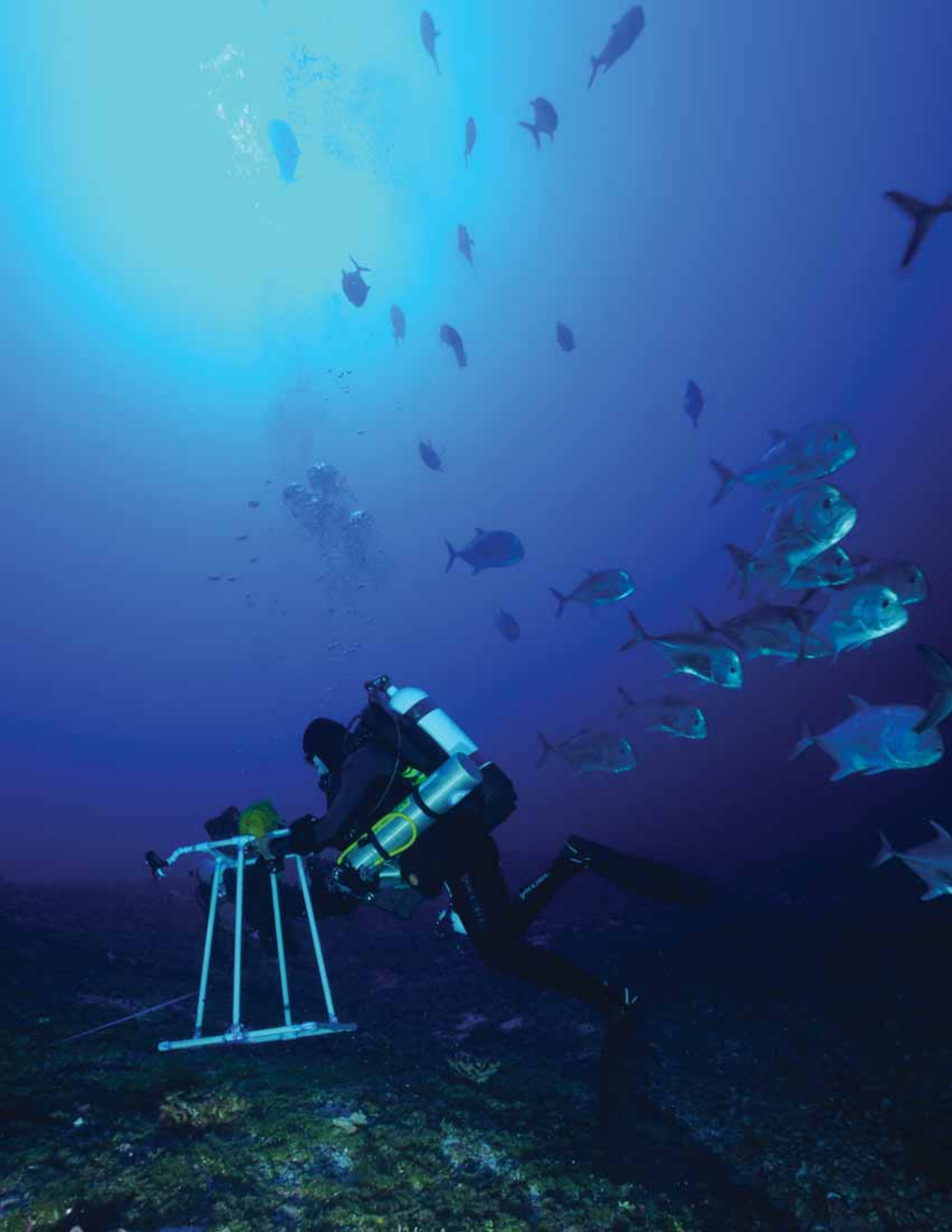
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» RECREATION

While recreation activities are permitted only in PMNM within Midway Atoll Special Management Area as per federal regulations for Papahānaumokuākea Marine National Monument (50 CFR Part 404), no recreation permits were issued in 2014. Access for general visitation purposes was previously allowed at Midway Atoll National Wildlife Refuge; however, due to reductions in refuge staff and operational capacity, historical and eco-tour access is currently not offered. The U.S. Fish and Wildlife is considering visitation options in the future if operational support becomes available.

For more information, visit www.fws.gov/refuge/Midway_Atoll/.

BELOW USFWS volunteer albatross counters moving in grid formation to accurately record locations of active Laysan and black-footed albatross nests at Midway Atoll National Wildlife Refuge. Photo by Dan Clark/USFWS



RIGHT Kālewa Correa captures 3D spatial imagery with the Google Street View Trekker and a hand-held GPS on East Island at French Frigate Shoals. Photo by Ty Benally/USFWS



» SPECIAL OCEAN USE

Of the six Special Ocean Use (SOU) permit applications that were received and processed in 2014, one was issued (see Table 11 below) and five were withdrawn.

» **Table 11. Affiliations of Special Ocean Use permittees and permitted projects in 2014.**

SPECIAL OCEAN USE PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED SPECIAL OCEAN USE PROJECTS
Māna Maoli & Kānehūnāmoku Voyaging Academy	1	• Documentation of Hālau Holomoana’s “Ola I Ke Au A Kanaloa” Voyage and Maritime Vocation Program

» Special Ocean Use Revenue Reported

Each permittee with an SOU permit is required to “submit an annual report not later than December 31 of each year that describes activities conducted under that permit and revenues derived from such activities during the year” (50 CFR 404.11.f). In 2014, one SOU project was conducted in the Monument to allow for recordation and potential use of products derived from Kānehūnāmoku’s voyage to Nihoa and Mokumanamana onboard the schooner Makani ‘Olu and no SOU revenue was reportedly generated from this activity.

» Special Ocean Use Highlights

The Kānehūnāmoku Voyaging Academy is producing a feature length documentary about their trip to Papahānaumokuākea and the students that took part in the Hālau Holomoana program. Look for this documentary in the fall of 2015.



Introduction

Presidential Proclamation 8031 (Proclamation), issued by President George W. Bush on June 15, 2006, set aside the Northwestern Hawaiian Islands (NWHI) as the Papahānaumokuākea Marine National Monument (“PMNM” or “Monument”), creating one of the world’s largest marine protected areas, managed to protect ecological and cultural integrity. The Monument is administered jointly by three Co-Trustee agencies – the Department of Commerce through the National Oceanic and Atmospheric Administration (NOAA), the Department of Interior through the U.S. Fish and Wildlife Service (USFWS), and the State of Hawai‘i through the Department of Land and Natural Resources (DLNR) (collectively, the “Co-Trustees”). The Co-Trustee agencies work in close collaboration and consultation with the Office of Hawaiian Affairs (OHA) to ensure that both cultural and natural resources are protected in a manner aligned with Native Hawaiian resource management best practices. The day-to-day management of the Monument is overseen by a seven-member Monument Management Board (MMB) comprised of two sub-agencies of each Co-Trustee, plus the Office of Hawaiian Affairs. This unique management partnership of PMNM allows for the protection of the entire ecosystem, from remote sub-tropical islands to the deep sea, as well as areas of cultural significance.

The Monument includes a number of existing federal conservation areas: the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NWHICRER), managed by the U.S. Department of Commerce through NOAA; Midway Atoll National Wildlife Refuge (MANWR), Hawaiian Islands National Wildlife Refuge (HINWR) and the Battle of Midway National Memorial, managed by the U.S. Department of Interior through the USFWS. These designated areas remain in place within the Monument, subject to their applicable laws and regulations in addition to the provisions of the Proclamation. The Monument also includes State of Hawai‘i lands and waters, managed by the State through the DLNR. There are two State designated conservation areas that predated Monument designation: the Northwestern Hawaiian Islands Marine Refuge and the Kure Atoll State Wildlife Sanctuary, which remain subject to their applicable State laws and regulations. Inscription of the Monument as a World Heritage site in 2010 added to the genealogy of protection and recognition of the NWHI, as the only mixed natural/cultural site in the United States. This honor cumulates over one hundred years of safeguarding the area, starting with protections of Midway Atoll in 1903, when President Theodore Roosevelt sent the U.S. Marines to stop the slaughter of seabirds at Midway Atoll (see timeline of protections, pg. 8-9).

OPPOSITE NOAA scientific diver followed by large ulua while conducting coral reef surveys at 200 feet on Pearl and Hermes Atoll. Photo by Greg McFall/NOAA

Ua pa'a nā inoa kahiko Ancient Names Remembered

Mai kahiko mai, ua ho'opa'a 'ia nā inoa moku no kēia pae 'āina ma ka mō'olelo a me nā mele ko'ihonua, a 'o kekahi o nā moku, ua pa'a ka inoa, a ua pōina kona wahi i kānaka.

From ancient times, the island names of this archipelago were remembered in the stories and creation chants, and for some of the islands, their names were remembered, but their locations were forgotten by man.

— Puakea Nogelmeier (1995)

These wahi pana (storied places), although their names have been forgotten by many are not lost. To bring back this once common-place knowledge, the following is a compilation of the Hawaiian names by which the islands and atolls in Papahānaumokuākea are known.

Mokupāpapa, Hōlanikū (Kure Atoll)

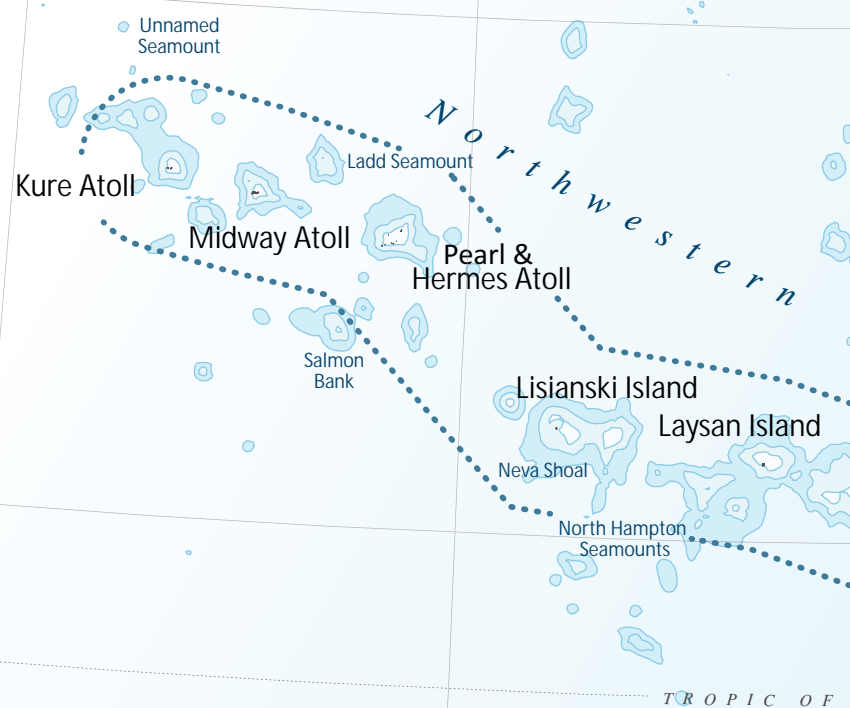
Mokupāpapa literally means “flat island,” which was ascribed to Kure Atoll by Hawaiian Kingdom officials in the 19th century, when King David Kalākaua sent an envoy to the atoll to take “formal possession” of it. Hōlanikū, meaning “bringing forth heaven,” is a single name that stands alone, corresponding to the location of Kure Atoll at the very end of the island chain. This name is used in many different contexts to describe the homeland of gods such as Kāne and Kanaloa, Nāmamaokaha'i, and Wainu'u.

Pihemanu, Kuaihelani (Midway Atoll)

Pihemanu means “loud din of birds” and refers to the loud chatter of the millions of birds that come to this atoll each year. Kuaihelani, meaning “the backbone of heaven,” describes a mythical floating island in the sky, which could derive from that fact that large lagoons, such as that at Midway, often reflect their image into the sky.

Holoikauaua, Manawai (Pearl and Hermes Atoll)

The name Holoikauaua celebrates the Hawaiian monk seals that haul out and rest here. Holoikauaua directly relates to the word 'ilioholoikauaua, which literally translates to “the quadruped running in the rough seas.” Manawai, which means “warped, depressed or bent in,” provides the imagery of the spiritual process of bending inward to reveal unchanging nature of one's true undying spirit. It can also be defined as “branching water.” Wai can also refer to “wai-lua” or “spirit.” This interpretation focuses on the transitional nature of water as a natural element.



Papa'āpoho, Kapou (Lisianski Island)

“Papa'āpoho” describes a flat area with a hollow or depression, which is exactly how this raised atoll is shaped. Kapou, meaning “post, pillar, pole or shaft,” may refer to the unusual rainbow formations seen there that resemble “pillars going straight into the clouds.”

Reference: Nogelmeier, P. (1995, December). He mau inoa kahiko paha i nalo a hoea hou mai? [Ancient names that have disappeared and been recovered?]. *Ka 'Āha'i 'Ōlelo*, Puke VIII: III.



Over the course of the 180-hour/six-month program, participants prepared for their voyage by practicing cultural protocols specific to Kanaloa, one of the four main Hawaiian deities, who is associated with the ocean. Haumana trained onboard the sailing canoe Kānehūnāmoku, which is named after the mystical floating islands thought to be located in Papahānaumokuākea. They also learned basic celestial navigation skills in order to conduct traditional (non-instrument) long-distance navigation.

The group sailed aboard the schooner Makani 'Olu, headed for the two youngest islands in the Monument, Nihoa and Mokumanamana, arriving at Mokumanamana during Ke Ala Polohiwa a Kāne (Tropic of Cancer, and the summer solstice). In Native Hawaiian culture, Mokumanamana, which is positioned along the Tropic of Cancer, serves as the boundary between pō (a place of darkness and the realm of akua, or spirits) and ao (the realm of light where kānaka (people) and the rest of Hawaii's living creatures reside). With many heiau (shrines) located on the island, Mokumanamana remains a critical place for Native Hawaiian cultural research.

This was the first group of teenagers to sail to Papahānaumokuākea and to the border between pō and ao. For both haumana and alaka'i (teachers), the trip was one that they will never forget.

For more information, see the news story online at <http://www.hawaiinewsnow.com/story/25834662/local-teens-make-voyaging-history>.



TOP Hālau Holomoana students view Nihoa from afar. Photo by Ruben Carillo

ABOVE Kānehūnāmoku Voyaging Academy students trained on board the sailing canoe, Kānehūnāmoku, named after the mystical floating islands thought to be located in Papahānaumokuākea, Kānehūnāmoku. Photo by Ruben Carillo

The two are also paired in the Hawaiian genealogical chant Kumulipo, giving validation for the observations of the environment.



ABOVE Feather kähili keumiki (right) and keaukā (left), were created with koa'e 'ula and 'iwa feathers gathered from Pearl and Hermes and Kure Atoll. Photo by Kai Markell/OHA

<i>Hanau ka 'iwa ka makua</i>	BORN IS THE FRIGATE BIRD, THE PARENT
<i>Puka kana keiki he koa'ekoako'ae lele</i>	OUT CAME ITS CHILD, THE TROPICBIRD AND FLEW

In a separate project, USFWS staff stationed at Midway Atoll and OHA partnered in an effort to collect and transfer deceased whole birds to O'ahu, where Native Hawaiian practitioners can, once appropriate and necessary permits are obtained, utilize the parts. One such project is led by Native Hawaiian cultural practitioner Shad Kane, who is working with 'Iolani Palace on constructing two kähili for them, both made of hulu mōli from Midway Atoll.

"We want to re-establish kähili within the Palace, as it looks very Victorian right now," said 'Iolani Palace curator Heather Diamond.

The importance of these seabird feathers lies within the mana, or spiritual power, that they hold.

"Most royal kähili are associated with seabird feathers" said Kane. "These seabirds fly the highest in the sky and therefore are more closely associated with the gods. The higher they fly, the more mana they have."

Kānehūnāmoku Voyaging Academy's Hālau Holomana

The Hālau Holomana is a training program of the Kānehūnāmoku Voyaging Academy for high school-aged haumana (students). This program exposes these haumana to careers in ocean and seafaring related jobs, such as tug boat captaining, boat building and marine conservation, while interweaving the values of canoe sailing and 'ohana wa'a (canoe family). The aim is to instill the haumana with a sense of community pride and the perpetuation of canoe culture. The program culminated in a 10-day voyage to expose participants to life at sea and develop a sense of passion for the ocean through a cultural lens.

As part of the program, 14 haumana prepared for a voyage, with the mission to travel to Papahānaumokuākea and retrace the steps of Pele (the Fire Goddess, goddess of the volcanoes) from one navigational landmark of Mokumanamana, to another at Kanaloa (known today as Kaho'olawe). The voyage, which would be an intense cultural and spiritual experience, required thorough preparation to understand the importance of these ancestral islands.

Kauō, Kamole (Laysan Island)

Kauō, meaning "egg," describes both the island's shape and the abundance of seabirds that nest here. Kamole means "ancestral root, foundation, source or cause," providing imagery of something rooted or anchored, with an alternative meaning of a long route, as the main root runs through the earth and traces one's ancestry back to a source. Kamole also corresponds to the location of Laysan Island, which is the first major landfall following French Frigate Shoals moving toward the northwest.

Ko'anako'a, Nalukākala, Kamokuokamohoali'i (Maro Reef)

Ko'anako'a literally means "the settlement of coral," referring to Maro's expansive coral reefs. Nalukākala describes surf that arrives in swells, such as the surf that froths over shallow reefs. Kamokuokamohoali'i means "the island of Kamohoali'i," referring to Pele's brother Kamohoali'i, the shark deity, signifying the extremely high number of sharks prevalent at Maro Reef, more than at any other location in the Monument.

'Ōnūnui, 'Ōnūiki, Pūhāhonu (Gardner Pinnacles)

Ōnūnui means "large protuberance" and is a variant of the name "Ununui" which refers to a large altar. Ōnūiki means a "small protuberance". Both names correspond to the large and small rock "protuberances" that make up Gardner Pinnacles and with their reference to altars, may also allude to their role in bringing forth the northwest rains. Pūhāhonu means "surfacing of a sea turtle for air/breath" and refers to these two isolated islands that seem to appear unexpectedly out of the sea, like a turtle coming up for air, its back and head emerging above the surface.

Kānemiloha'i, Mokupāpapa, Lalo (French Frigate Shoals)

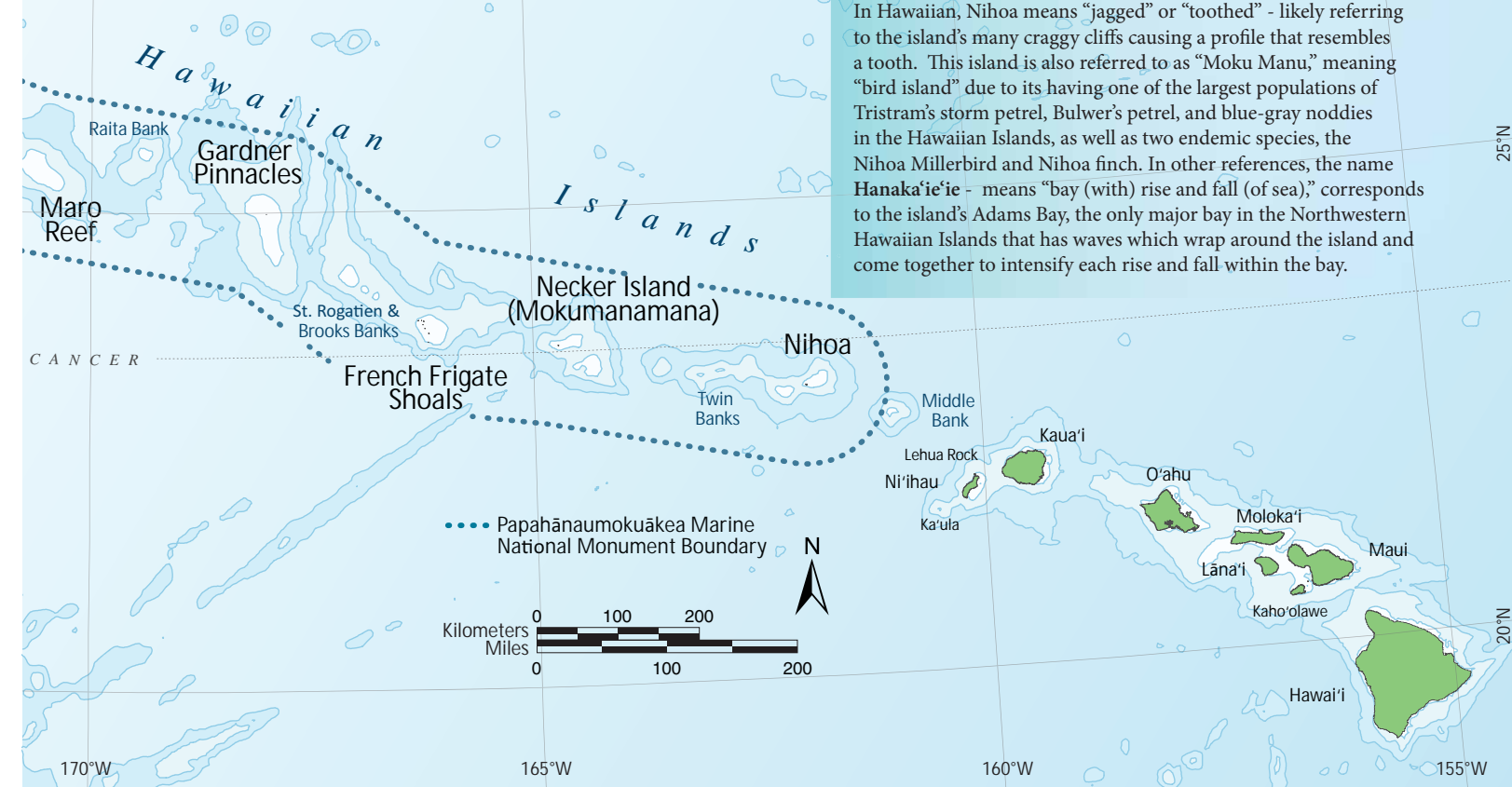
Recorded in chants, the name Mokupāpapa refers to an island, or islands, of the name's description located northwest of Ni'ihau. The nearest shoal-like place is French Frigate Shoals. An atoll of reefs, low sand islets, and the 120-foot-high La Pérouse Pinnacle. Moku 'islet' combined with pāpapa 'low, flat, expansive reef' means 'islets with low-lying reefs'. It is said that on this low, flat sand island, Pele (the volcano goddess) left one of her brothers, Kānemiloha'i, as a guardian during her fist journey to Hawai'i from Tahiti. The word lalo means "down, downward, low, lower, under, below, depth, west or leeward." Lalo is closely associated with the direction of pō (darkness) or ancestral lands "where dwelt the souls of gods." Lalo also provides us with the imagery of low-lying islands partially submerged below the surface, which aptly describes the atoll.

Mokumanamana, Kamokumanamana, Hā'ena (Necker Island)

Mokumanamana is often translated as "branched" or "pinnacled" island, which is a suitable description, but many people who have studied its religious and cultural sites suggest that the repetition of the word mana (meaning "spiritual power") after the word moku ("island") relates to the spiritual significance of the island, given the 33 shrines along the its kua (spine) and the Hawaiian axes of life and death that cross directly over it. The name Hā'ena, defined as "red-hot burning heat," possibly refers to the intensity of a specific kapu (restriction) of sacredness or royalty of the island. Hanakeaumoe, meaning "late night bay," refers to Shark's Bay. Hana means "bay" while "au" refers to a type of movement from one period of time and space to another, and "moe" implies "to put to rest" or pass on into the afterlife, together referencing Ke Ala Polohiwa a Kāne or "The Dark Shining Path of Kane," and is often used as a metaphor for the path to the afterlife.

Nihoa, Moku Manu (Nihoa Island)

In Hawaiian, Nihoa means "jagged" or "toothed" - likely referring to the island's many craggy cliffs causing a profile that resembles a tooth. This island is also referred to as "Moku Manu," meaning "bird island" due to its having one of the largest populations of Tristram's storm petrel, Bulwer's petrel, and blue-gray noddies in the Hawaiian Islands, as well as two endemic species, the Nihoa Millerbird and Nihoa finch. In other references, the name Hanaka'ie'ie - means "bay (with) rise and fall (of sea)," corresponds to the island's Adams Bay, the only major bay in the Northwestern Hawaiian Islands that has waves which wrap around the island and come together to intensify each rise and fall within the bay.



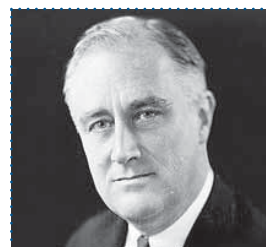
Timeline of Protections

1900's 1910's 1920's 1930's 1940's 1950's 1960's 1970's 1980's 1990's



1903
In response to U.S. Navy reports that large numbers of seabirds were being slaughtered for feathers and eggs, President Theodore Roosevelt signs Executive Order No. 199A, placing Midway Atoll under control of the Navy.

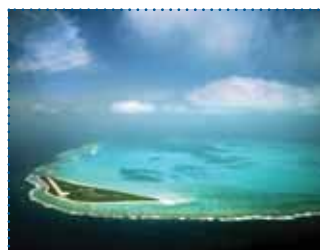
1909
President Theodore Roosevelt issues Executive Order No. 1019 creating the Hawaiian Islands Bird Reservation around islands from Nihoa to Kure Atoll to further protect these islands and their resources.



1940
President Franklin D. Roosevelt signs Presidential Proclamation No. 2416 changing the name of the Hawaiian Islands Bird Reservation to the Hawaiian Islands National Wildlife Refuge, managed by the U.S. Fish & Wildlife Service and broadening refuge purposes to protect all wildlife.



1988
President Ronald Reagan signs legislation assigning stewardship responsibilities for Midway Atoll to the U.S. Fish & Wildlife Service.



1993
The State of Hawai'i Board of Land and Natural Resources designates Kure Atoll a State Seabird Sanctuary, now the Kure Atoll State Wildlife Sanctuary.



1976
The Tripartite agreement among the State of Hawai'i, U.S. Fish & Wildlife Service, and NOAA Fisheries provides a framework for extensive ecological research in the NWHI beginning in 1976. From October 1976 to September 1981, the agencies, along with the University of Hawai'i Sea Grant Program, survey the islands, banks, reefs, shelves, seamounts and overlying waters within the 200-nautical mile Fishery Conservation Zone and amass data on the various marine and land inhabitants. Two major symposia covering the joint efforts are held at the University of Hawai'i at Manoa in 1979 and 1983. The proceedings of these symposia contain the results of more than 100 research projects.



LEFT OHA Staff members look on as cultural specialist Kalani Akana installs Keaukā made with 'iwa feathers. Photo by Kai Markell/OHA

RIGHT 'Iwa, or great frigate bird amidst naupaka. Photo by Hōkū Cody/NOAA volunteer

whenever they happened upon them or when they had time in between the monk seal field camp activities and research they were conducting. They also dried, cleaned and prepared feathers for long-term preservation. On Kure Atoll, there was additional support from DLNR's Division of Forestry and Wildlife staff, who helped with the on-island collection process and provided materials for optimum care and storage of the feathers.

The feathers were collected to be used for cultural practice and education. Some were used in the creation of a lei 'uo (feather lei) on the Lonomakua (the name given to the material form that represents the Hawaiian deity Lono during makahiki – the traditional Hawaiian new year season) used for traditional makahiki practices on Moloka'i and Kaho'olawe.

Two kähili (royal standards used as a symbol of the ali'i chiefs and families of the Hawaiian Islands) created by OHA were installed in Lili'uokalani Hall at the Office of Hawaiian Affairs. The kähili were named after two brother demigod navigators associated with PMNM, Keaumiki and Keaukā. Keaumiki is made with koa'e 'ula feathers from Kure Atoll and Keaukā are intertwined with 'iwa feathers collected from Pearl and Hermes. It is very fitting that the pair of kähili are partially made with these respective feathers.

"These two manu (birds) always appear in the sky together, and they express a dualism in their existence," said Hōkū Cody. "Both birds can often be seen flying together, as the 'iwa often chase the koa'e 'ula for their food, and look similar to a parent chasing their child."

NATIVE HAWAIIAN PRACTICES

Three Native Hawaiian Practices permits were issued in 2014 (see Table 10) to enable the gathering of hulu manu (bird feathers) for the purpose of constructing kähili (standards of royalty) for the 'Iolani Palace, support the Ola I Ke Au A Kanaloa Voyage and Maritime Vocation Program, and support the use of traditional ecological knowledge to examine nearshore ecosystems.

» **Table 10.** Affiliations of Native Hawaiian Practice permittees and permitted projects in 2014.

NATIVE HAWAIIAN PRACTICES PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED NATIVE HAWAIIAN PRACTICES PROJECTS
'Iolani Palace	1	• Gathering Feathers of Migratory Birds Toward the Construction of Feather Kähili
Māna Maoli & Kānehūnāmoku Voyaging Academy	1	• Ola I Ke Au A Kanaloa Voyage and Maritime Vocation Program
Nā Maka o Papahānaumokuākea & Conservation International	1	• Using Traditional Ecological Knowledge to Examine Nearshore Ecosystems

» Native Hawaiian Practices Highlights

Co-managers Join Forces to Facilitate Hulu Manu Collection for Cultural Practices

Two projects in 2014 involving the collection of hulu manu (bird feathers) from various locations within PMNM exemplified the collaborative efforts of the Monument's seven co-managing agencies. Collections of feathers were permitted under two permits; Co-Trustees permit and a Native Hawaiian Practices permit issued to Ms. Heather Diamond of the 'Iolani Palace.

Over the summer, two NOAA Hawaiian Monk Seal Research Program field season participants, Koa Matsuoka and Hōkū Cody, collected hulu manu from Pearl and Hermes Atoll and Kure Atoll, respectively. Target species were mōli or Laysan albatross (*Phoebastria immutabilis*), ka'upu or black-footed albatross (*Phoebastria nigripes*), 'iwa or great frigatebird (*Fregata minor*), and koa'e 'ula or red-tailed tropicbird (*Phaethon rubricauda*). The researchers collected feathers

BELOW Koa'e 'ula, or red-tailed tropicbird, in flight. Photo by Hōkū Cody/NOAA volunteer



2000's

1996

President William Clinton issues Executive Order No. 13022, transferring Midway Atoll management responsibilities from the U.S. Navy to the U.S. Fish & Wildlife Service.

2005

Hawai'i State Governor Linda Lingle signs regulations establishing the NWHI Marine Refuge, which includes all state waters extending three miles seaward from any coastline between and including Nihoa and Kure Atoll, but excluding Midway Atoll. This designation allows for the management and long-term conservation of marine resources within state waters.

2008

The International Maritime Organization (IMO), a specialized agency of the United Nations, designates the Monument as a Particularly Sensitive Sea Area (PSSA). This designation allows for the implementation of a ship reporting system, called CORAL SHIPREP, requiring all transiting vessels with the intent to enter a U.S. port or place of a certain size to notify when entering and exiting Monument boundaries; other international transiting vessels are recommended by the IMO to avoid Monument waters or participate in the reporting system. The Monument is the second marine protected area in the United States to receive PSSA designation. It joins ten (now 12) other PSSAs worldwide, including the Florida Keys, the Great Barrier Reef and the Galapagos.

2000 and 2001

President William Clinton issues Executive Order No. 13158, directing the development of a plan to protect the NWHI coral reef ecosystem, and calls for public participation in the design of additional protection measures for the NWHI. As a result of public comments and negotiations between President Clinton and Congress, the 2000 Amendments to the National Marine Sanctuaries Act authorized creation of a NWHI Reserve. President Clinton issued Executive Orders No. 13178 and No. 13196 in December 2000 and January 2001, creating the NWHI Coral Reef Ecosystem Reserve to include areas adjacent to state waters extending seaward to approximately 50 nautical miles.



2006

President George W. Bush signs Presidential Proclamation 8031, establishing the NWHI Marine National Monument with contiguous boundaries to include the NWHI Coral Reef Ecosystem Reserve, the Midway National Wildlife Refuge, the Hawaiian Islands National Wildlife Refuge, the Battle of Midway National Memorial, Kure Atoll Wildlife Sanctuary, and the Hawai'i State NWHI Marine Refuge. The Monument designation promotes coordinated management of the unique resources within the NWHI region.

2010's



2010

Delegates to the United Nations Educational, Scientific and Cultural Organization's (UNESCO) 34th World Heritage Convention in Brasilia, Brazil unanimously vote to inscribe the Monument as one of only 26 (now 31) mixed (natural and cultural) World Heritage Sites in the world.



Monument Permitting Program

»» Overview

Despite the continued protection of the NWHI and the area's relative isolation in the Pacific, significant global threats to the Monument's ecosystem exist. Many of these threats are a direct result of human activities occurring beyond Monument boundaries. These include climate change such as sea level rise, ocean acidification, marine and terrestrial alien species, marine debris and vessel groundings. The Monument's stringent permitting process is the first line of defense against many of these threats. The permitting process allows for managing, monitoring and reporting activities to evaluate and mitigate cumulative impacts. Similarly, this process enables scientists, managers and Native Hawaiian researchers and cultural practitioners to accomplish a number of activities focused on resource protection, habitat conservation, management and further integration of Hawaiian cultural knowledge and practices with mainstream research and management approaches.

»» Presidential Proclamation 8031

PMNM's permitting program is designed to manage and minimize human impact, ensuring the protection of the Monument's natural, cultural and historic

ABOVE White terns, or manu-o-kū in flight at Kure Atoll. Photo by Cynthia Vanderlip/DLNR

Island to Midway Atoll to increase the species' chance of survival. Those two populations were approaching 1,000 total birds until the 2011 Tōhoku Tsunami hit their island homes, bringing their numbers down to roughly 600 individuals.

With efforts to prevent extinction, wildlife biologists determined the specific conditions that Laysan ducks need to survive, including a rat-free environment, freshwater, thick vegetation for shelter, and arthropods (invertebrates with exoskeletons such as insects, crustaceans and arachnids) for sustenance. Kure Atoll, about 1,350 miles northwest of Honolulu, was selected for a new colony of birds because it met the necessary conditions, being void of predators since the 1990s and undergoing intensive native habitat restoration since 2007.

Collaboration was essential to the translocation success, with many partners involved, including the U.S. Geological Survey (USGS), USFWS, U.S. Coast Guard, DLNR and the Hawai'i Wildlife Center.

The event marked the ten-year anniversary of an initial Laysan duck translocation effort within the Monument. Establishing additional populations of the species will reduce its risk of extinction from natural disasters, introduced species or disease outbreaks.

Dr. Michelle Reynolds of USGS Pacific Island Ecosystems Research Center, said, "In the face of rising sea levels, a predator-free, larger and higher elevation Hawaiian island will ultimately be needed to recover the species since inundation is expected to impact wildlife on low-lying islands."



LEFT After successfully snaring a Laysan duck on a noose carpet, Michelle Reynolds dashes back to free its leg from the trap and put it safely into a bird bag. A noose carpet is composed of numerous loops of fishing line attached to a wire mesh; when a duck steps into one of these "nooses," it tightens around the bird's leg. Photo by Eric Dale/USFWS Volunteer

ABOVE USFWS biologist Meg Duhr-Schultz (right) holds a Laysan duck while USGS biologist Michelle Reynolds clamps an aluminum band on its leg for the translocation. Photo by Eric Dale/USFWS Volunteer





Endangered Laysan Ducks Translocated from Midway Atoll to Kure Atoll.....

In September, 28 Laysan ducks (*Anas laysanesis*) were translocated from Midway Atoll to Kure Atoll. The translocation serves as an extinction prevention measure for the endangered birds as they face threats such as disease, natural disasters and predation from non-native species.

The Laysan duck, endemic to Hawai'i, is the rarest duck in the Northern hemisphere and has the smallest geographic range of any duck species in the world. It once occurred across the Hawaiian Archipelago but disappeared from the main Hawaiian Islands with the arrival of invasive rats around 800 years ago. Its disappearance from the NWHI occurred later, with the very last population isolated on Laysan Island for more than 150 years.

The Laysan duck population was recorded at 11 birds in 1911; their numbers climbed quickly after the non-native rabbits were eradicated from Laysan in 1923. In 2004 and 2005, ducks were successfully translocated from Laysan

TOP A male/female pair of Laysan ducks on Eastern Island at Midway Atoll National Wildlife Refuge. Photo by John Klavitter/USFWS

ABOVE Upon arrival at Kure Atoll, some of the ducks were released in a 500-gallon "wildlife guzzler" filled by rainwater. Photo by Cynthia Vanderlip/DLNR

resources. In accordance with Presidential Proclamation 8031 and codifying regulations in 50 CFR Part 404, all activities in the Monument, with limited exceptions, require a permit. Activities are either prohibited (not allowed), exempted (no permit is needed), or regulated (must be considered through the Monument's joint-permitting process).

Prohibited activities include:

- » Exploring for, developing, or producing oil, gas or minerals within the Monument
- » Using or attempting to use poisons, electrical charges or explosives in the collection or harvest of a Monument resource
- » Introducing or otherwise releasing an introduced species from within or into the Monument
- » Anchoring on or having a vessel anchored on any living or dead coral with an anchor, anchor chain or anchor rope

Exempted activities include:

- » Response to emergencies threatening life, property or the environment
- » Law enforcement purposes
- » Activities and exercises of the Armed Forces (including the U.S. Coast Guard)
- » Passage without interruption

Any vessel or persons passing through PMNM without interruption does not constitute a permitted activity, however domestic vessel notification must be provided prior to entering and leaving the Monument. Notification of entry must be provided at least 72 hours, but not more than one month, prior to the entry date. Notification of departure from the Monument must be provided within 12 hours of leaving. For more information regarding the Monument's ship reporting requirements, please see http://www.papahānaumokuākea.gov/resource/ship_reporting.html.

In addition to the Monument's ship reporting requirements, all activities and exercises of the U.S. Armed Forces must be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities.

All other activities not prohibited or exempted must be authorized by a Monument permit signed by all three Co-Trustee agencies. Permit applications are reviewed by managers, scientists and other experts within the Co-Trustee agencies and by Native Hawaiian cultural specialists through an agency review



RIGHT A view of Tern Island with seabirds and rainbows. Photo by Justin Rivera/NOAA



process. In order to inform the public about activities proposed within the NWHI, permit applications are posted on the Monument website (<http://www.papahānaumokuākea.gov/permit/applicationrev.html>) for public review and notification. In addition to agency review, all permit applications must meet applicable Findings (i.e., permit criteria) listed in the Proclamation in order to be approved by the Monument Co-Trustees. For a list of all Findings in the Proclamation, please see the inset box on the next page. For activities proposed within the NWHI State Marine Refuge, permit applications must also be approved by the State of Hawai'i Board of Land and Natural Resources.

All issued permits contain a Permitted Activity Description, including information on the number of permitted personnel; Permitted Activity Locations; and General Terms and Conditions that satisfy Proclamation 8031, Monument regulations, and MMB agency mandates and policies. Issued permits also specify the requirements for compliance with quarantine protocols to avoid introduction of alien species, and list prohibited activities such as the disturbance of cultural sites or historic artifacts. Special Conditions may also be applied to particular permits, placing additional restrictions on activities in order to minimize impacts to Monument resources.



to transport all passengers to Honolulu. This was the fourth emergency landing of aircraft on Midway in the last decade, including three commercial airliners and a U.S. military fighter jet.

ABOVE U.S. Coast Guards' C-130's at Midway's Henderson Field Airport. Photo by Dan Clark/USFWS

In addition, Midway Atoll also provided a psychological and physical safe haven for NOAA staff living in remote island field camps on Laysan Island, Lisianski Island and Pearl and Hermes Atoll. In early August, several impending hurricanes converging in the NWHI necessitated an evacuation of those camps, which was a coordinated multi-agency effort between NOAA, USFWS, the U.S. Navy, and the U.S. Coast Guard. The field staff were transported via military ship and air transport to Midway until a time when they could be returned to Honolulu, resulting in an abbreviated monk seal field camp season. USFWS coordinated with the Coast Guard to position two Coast Guard C-130's on Midway from Air Station Barber's Point on O'ahu to ensure their ability to respond to regional search and rescue missions and assess port and harbor conditions following the storms' passing.

"It was a unique situation in the Northwestern Hawaiian Islands with three hurricanes, one of which became a super-typhoon, on trajectories that could have impacted any of the islands and atolls," said Refuge Manager Dan Clark. "Monument Co-Trustees made the sound decision to err on the side of caution by evacuating the field camps."

In addition, during 2014, five medical emergency evacuations requiring immediate air transport had to be performed.

"Midway Atoll is sometimes called upon to provide that safe haven for people working on exposed areas in the Northwestern Hawaiian Islands," said Clark. "It is part of who we are and what we do."

Henderson Field Airport Provides a Safety Net

Midway Atoll, home to the Midway Atoll National Wildlife Refuge and Battle of Midway National Memorial, is located 2,600 miles from Japan, 3,200 miles from California, and 1,300 miles from Honolulu. This remote outpost provides a safe haven for field crew working in the Monument as well as the broader public in times of emergency.

Henderson Field airport, located on Sand Island at Midway Atoll and managed by USFWS through a cost-share agreement with the Federal Aviation Administration, provides the primary means for regular transport of food, personnel, supplies and equipment to Midway Atoll, as well as emergency transport of medicine and staff needing medical attention. It also serves as an emergency diversion point for Extended-Range Twin-Engine Operational Performance Standards (ETOPS) operations, affording large jet aircraft transiting the Pacific Ocean an emergency landing site. The airfield potentially saved the lives of 352 people when a commercial flight on a Boeing 777 made an emergency landing there during the summer.

On July 10 at 9:02 p.m., the pilots of United Airlines Flight 201 en route to Guam from Honolulu declared an in-flight emergency as a result of smoke in the cockpit and requested permission to land at Henderson Field airport. The plane landed safely and no injuries were reported. The crew and passengers were provided shelter and hot meals on Midway, while medical staff stood by to assist as needed. A second United Airlines aircraft landed early the following morning

BELOW Red-footed boobies, or 'ā nest amid healthy out-planted stands of 'Aweoweo (Hawaiian goosefoot) intertwined with pohuehue (beach morning glory) as USFWS volunteers rest in the background after spraying non-native Indian fleabane plant. Photo by USFWS

RIGHT United Airlines Flight 201 makes an emergency landing at Midway Atoll's Henderson Field airport. Photo by Eric Dale/USFWS Volunteer



» Permitting Criteria

The Monument's permitting criteria are the Findings defined in Proclamation 8031. All permit applications must meet the applicable Findings prior to the issuance of a permit:

- » The activity can be conducted with adequate safeguards for the resources and ecological integrity of the Monument.
- » The activity will be conducted in a manner compatible with the management direction of the Proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument resources, qualities, and ecological integrity; any indirect, secondary, or cumulative effects of the activity; and the duration of such effects.
- » There is no practicable alternative to conducting the activity within the Monument.
- » The end value of the activity outweighs its adverse impacts on Monument resources, qualities, and ecological integrity.
- » The duration of the activity is no longer than necessary to achieve its stated purpose.
- » The applicant is qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
- » The applicant has adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
- » The methods and procedures proposed by the applicant are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument resources, qualities, and ecological integrity.
- » The applicant's vessel has been outfitted with a mobile transceiver unit approved by NOAA Office of Law Enforcement and complies with the requirements of Proclamation 8031.
- » There are no other factors that would make the issuance of a permit for the activity inappropriate.

In addition to the ten general Findings above there are additional specific Findings that are required for Special Ocean Use, Native Hawaiian Practices, and Recreation permit applications.



» Types of Permits

Permit applications may be issued in one of six permit categories, if Co-Trustees find that the activity: 1) is research designed to further the understanding of Monument resources and qualities; 2) will further the educational value of the Monument; 3) will assist in the conservation and management of the Monument; 4) will allow Native Hawaiian practices; 5) will allow a special ocean use; or 6) will allow recreational activities.

Research

Research permits are for activities that enhance the understanding of PMNM's resources and improve resource management decision-making. The types of activities that may be conducted under research permits include biological inventories, ecosystem-based research, habitat characterization, and archaeological research.

Education

Education permits are for activities that further the educational value of the Monument. These activities may assist a broader audience in understanding the ecosystems within the Monument, share lessons learned in resource management with outside partners, promote Native Hawaiian knowledge and values, or aid in outreach with schools and community groups. Permits are considered for activities that have clear educational or public outreach benefits and that aim to "bring the place to the people," rather than the people to the place. Examples of education projects include teacher-at-sea programs, distance learning projects and university field classes.

Conservation and Management

Conservation and management permits are for activities that enable the general management of PMNM. These activities may include field station operations, marine debris removal, development and maintenance of infrastructure, and long-term resource monitoring programs such as monitoring of endangered species, seabird populations and terrestrial native plant communities. Conservation and Management permits also provide a mechanism for response and follow-up to urgent events in the Monument that may not have been anticipated, such as vessel groundings, coral bleaching episodes and invasive species outbreaks.

Native Hawaiian Practices

Native Hawaiian practice permits are for activities that constitute Native Hawaiian cultural practices. Activities under this permit must be noncommercial, deemed appropriate and necessary by traditional standards, benefit the NWHI and Native Hawaiian community, perpetuate traditional knowledge, and restrict the consumption of harvested resources from the Monument. Examples of permitted activities include application of traditional non-instrument navigation techniques on Native Hawaiian voyaging canoes and

Upon returning to O'ahu, the nets were taken to Schnitzer Steel Industries where they were cut into smaller pieces and transported to the City and County of Honolulu's H-Power plant run by Covanta Energy Corporation. There the nets were incinerated to produce electricity as part of the Hawaii's Nets to Energy Program, an innovative public-private partnership. NOAA has been sending derelict nets to H-Power via this partnership annually since 2002.

The team also identified four and removed two derelict boats from the lagoon at Pearl and Hermes Atoll that were confirmed to have washed up in the NWHI as a result of the 2011 Japan tsunami. At Midway Atoll National Wildlife Refuge, the team removed six tons of plastic trash, paying special attention to the bottle caps and cigarette lighters commonly eaten by birds.

The Marine Debris Project is a cooperative effort between NOAA, USFWS, Schnitzer Steel Industries, Inc., Covanta Energy Corporation, the State of Hawai'i, and the U.S. Coast Guard. NOAA's Pacific Islands Fishery Science Center has led this mission every year since 1996, removing a total of 754 metric tons of marine debris, including this year's haul.

The primary source of funding for these large scale marine debris removal efforts in recent years has been remediation funds from the 2005 grounding of the M/V Casitas at Pearl and Hermes Atoll. With these monies exhausted as of 2014, until another source of funding is found, future marine debris removal efforts will consist of survey, removal and storage of marine debris at Midway Atoll until it can be opportunistically removed by the Coast Guard or other ships returning to O'ahu from Midway.

LEFT Conducting shoreline marine debris removals at Lisianski Island. Photo by NOAA

BELOW NOAA divers find the large derelict fishing gear net that was reported in September 2013 at Pearl and Hermes. Scuba and free divers removed a piece of derelict fishing gear that was more than 28 feet long, 7 feet wide, and had a dense curtain that extended 16 feet deep. The large net weighed 11.5 tons. Photo by NOAA





TOP Loading small boat with derelict fishing gear at Lisianski Island. Photo by NOAA



ABOVE A diver cuts a protected green sea turtle free at Pearl and Hermes Atoll. Three green sea turtles were freed at Pearl and Hermes Atoll during this mission. Photo by NOAA

RIGHT Hawaiian monk seal hauled out on large net at Pearl and Hermes Atoll. Photo by NOAA



Partners Remove 57 Tons of Marine Debris from Northwestern Hawaiian Islands

From September 25-October 27, a team of 17 divers led by NOAA Fisheries' Coral Reef Ecosystem Division carried out a 33-day expedition to the Monument aboard NOAA Ship *Oscar Elton Sette*, conducting in-water and shoreline marine debris survey and removal operations at Maro Reef, Lisianski Island, Pearl and Hermes Atoll and Midway Atoll National Wildlife Refuge.

The primary objective of this year's effort was to conduct a large-scale survey and removal of derelict fishing gear (primarily nets) in areas where high densities of debris have been known to accumulate. Secondary objectives included the continuation of a coral injury assessment study and NOAA Marine Debris Program standing-stock and accumulation rate studies at Midway Atoll.

In 21 operational days, the team surveyed 3.92 square kilometers of shorelines and shallow coral reef environments and removed 57 tons of derelict fishing nets and plastic litter from the islands, atolls and coral reefs. At Pearl and Hermes Atoll, the divers disentangled three sea turtles from derelict nets and relocated a 28-foot by 7-foot "super net" first found in September 2013, which extended 16 feet deep, weighed 11.5 tons and required more than four days of cutting and preparation before being towed back to the ship.

conducting ceremonies at historic cultural sites on Nihoa or Mokumanamana. Permit conditions and guidelines are developed by the Co-Trustees and OHA in consultation with the Native Hawaiian Cultural Working Group and the broader Native Hawaiian community.

Special Ocean Use

Special Ocean Use permits are for activities related to commercial ocean uses, including ecotourism or documentary filmmaking, that have a net benefit to the Monument. Special ocean use is defined as any activity or use of the Monument to generate revenue or profits for one or more of the persons associated with the proposed activity, and will not destroy, cause the loss of, or injure Monument resources. Special ocean use proposals involving activities outside of the Midway Atoll Special Management Area must be for educational or research purposes and directly benefit conservation and management of the Monument.

Recreation

Recreation permits are for activities conducted for personal enjoyment and are limited to occur only within the Midway Atoll Special Management Area. Recreation activities must not result in the extraction of Monument resources or be involved in a fee-for-service transaction. Examples of activities that may be permitted include snorkeling, wildlife viewing and kayaking. Restrictions may be placed on recreation permits in accordance with the MANWR Visitor Services Plan.



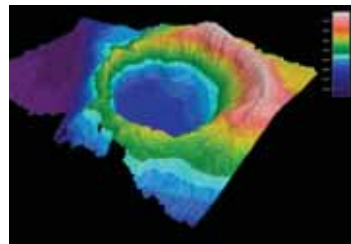
LEFT Large blackfoot 'opihi, or 'opihi makaiauli line the shoreline; in the distance, the intertidal monitoring team checks for waves. Photo by Hoku Johnson/NOAA

BELOW The .50-caliber gun muzzle with identifying plate helped pinpoint the wreckage as that of a P-40K Warhawk. Photo by Kelly Keogh/NOAA





2014 Permitted Activities



TOP UAS Project Lead Todd Jacobs (foreground) and Puma operator LTJG Tanner Sims prepare to launch the Puma at French Frigate Shoals. Photo by Justin Rivera/NOAA

ABOVE Mysterious crater mapped off the southeast of Maro Reef by the R/V *Falkor*. Although it appears unlikely, the perfectly round shaped crater looks more like a meteorite impact crater than an undersea volcano. Photo by Colleen Peters/Schmidt Ocean Institute

RIGHT Male Laysan duck on Midway Atoll National Wildlife Refuge. Photo by E.J. Peiker/Nature Photographer accompanied by USGS Biologist Michelle Reynolds



Interagency collaboration was exceptionally cohesive in 2014, allowing operations both large and small to occur with participation and support from a cross-cut of management agencies as well as partners. A suite of activities were conducted by managers, cultural practitioners, community members and researchers, including collaborative efforts to continue research on coral bleaching events, the translocation of 28 Laysan Ducks from Midway Atoll to Kure Atoll, the collection of hulu manu (bird feathers) for use in cultural ceremonies and practices, and a very large-scale marine debris effort culminating in the removal of over 57 tons of debris. The following activities that will be highlighted in detail later projects captures just a few of the remarkable activities that occurred in 2014:

Mapping Expedition

Scientists chart 30 percent of Papahānaumokuākea's seafloor.

Unmanned Aircraft System (UAS) Operations Debut in PMNM

Scientists use unmanned aircraft systems in PMNM for the first time to survey wildlife.

Cultural Practices

Co-managers join forces to facilitate hulu manu (seabird feather) collection for cultural practices.

“This operation validated our hopes that we can use the aircraft in the Monument for a variety of missions without harming the environment to get data that we wouldn’t otherwise get,” said Todd Jacobs, project scientist for NOAA’s Unmanned Aircraft Systems Program and project lead. “We were able to survey in remote coves for monk seals and turtles in conditions that we may not have been able to safely land people ashore.”

“The monk seal mission was wildly successful,” said Dr. Charles Littnan, NOAA Pacific Islands Fisheries Science Center Lead Scientist for the Hawaiian Monk Seal Research Program. “We were able to identify animals on the beach and in the water, identify mother-pup pairs, and get a sense of the age class of the animal – all things that are important for population monitoring. The data collected by the Puma will nicely supplement our current hands-on approach to the recovery of the species.”

“The Hawaiian Island National Wildlife Refuge really doesn’t have any aerial photographs - historic or recent - that we can use for bird or vegetation surveys, so this was a proof of concept for us to see what we could see,” said Michele Kuter, USFWS National Wildlife Refuge Biological Science Technician. “We were able to make passes and do some transect lines and get some still images of the whole island for a couple of the islands at French Frigate Shoals, and survey for seabirds along the cliffs of Nihoa.”

A second mission was carried out in July utilizing NASA’s *Ikhana* UAS, which has a further range and higher resolution optics than the Puma, to conduct similar activities in both the Main and Northwestern Hawaiian Islands. This mission contributes to the efforts of resource managers to supplement monitoring and research in the Monument. Scientists will compare data collected from both systems with traditional survey methods and satellite data to assess the best use of this technology for managing the Monument, as well as other large-scale protected areas.

Both UAS missions were a collaborative effort amongst all Monument co-managing agencies, with the final operational profiles taking into account concerns regarding overflight and filming of cultural resources, aircraft interactions with birds and other wildlife, integration with other ship and shore based operations, and what exactly the video footage would be used for.



LEFT Is it a bird, or an Unmanned Aircraft System? A seabird soars in the foreground while the Puma flies above. Photo by Justin Rivera/NOAA

TOP Dr. Charles Littnan views images from the Puma while Project Lead Todd Jacobs looks on. Photo by Justin Rivera/NOAA

ABOVE A view of Trig Island from the Puma. Numerous sea turtles and some monk seals can be seen. Photo by NOAA



ABOVE UAS Project Lead Todd Jacobs (foreground) and Puma operator LTJG Tanner Sims watch as they launch the Puma at French Frigate Shoals. Photo by Justin Rivera/NOAA

» Conservation and Management Highlights

Scientists Use Unmanned Aircraft Systems to Survey Wildlife

The first deployment of an unmanned aircraft system (UAS) in the NWHI demonstrated they can be used to conduct research without harming the region's fragile ecosystem. From June 16-23, scientists from NOAA and USFWS used the Puma UAS, deployed from NOAA Ship *Hi'ialakai*, to perform surveys of Hawaiian monk seals or 'ilioholoikauaua (*Monachus schauinslandi*), sea turtles, sea birds and vegetation and to look for marine debris in Papahānaumokuākea Marine National Monument.

The Puma is a 13-pound, battery-powered aircraft with a nine-foot wingspan, equipped with real-time video and still photo capability. The aircraft can be hand-launched from any location on land or at sea from a boat and is controlled by specially-trained pilots with NOAA's Office of Marine and Aviation Operations. Durable and rugged for deployment to remote marine areas and repeat usage, the aircraft can fly for up to two hours on a charge and cover a range of about 50 square miles.

Researchers conducted a total of seven flights, one over Trig Island and four over Tern Island, both at French Frigate Shoals, and two at Nihoa. Scientists were excited about the results of the deployments.

Marine Debris

Partners remove 57 tons of marine debris from the Northwestern Hawaiian Islands.

Laysan Duck Translocation

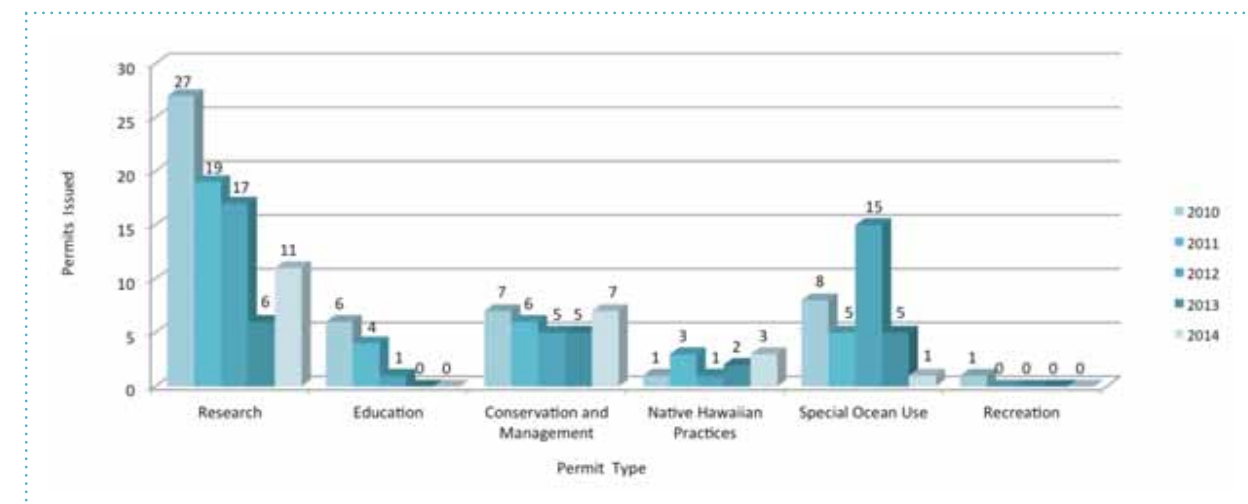
Endangered Laysan ducks are translocated to a new home on Kure Atoll.



» Permits Issued in 2014

In 2014, 32 permit applications received and 22 permits were issued. All permit applications must complete a rigorous process of environmental and cultural review and documentation of meeting the applicable permitting criteria, which include the Findings in Proclamation 8031. As permit applications are reviewed and processed, individual applicants may elect to withdraw a permit application. This year, seven applications were withdrawn, one was not issued, and the remaining two were reassigned for continued processing in 2015. Figure 1 displays a comparison of the number of permits by type, issued from 2010-2014.

» **Figure 1.** Number of Monument permits issued from 2010-2014 by permit type.



The Monument Co-Trustees grant both single- and multi-year permits. In calendar year 2014 the Monument permitting system tracked 52 permits, 30 of which were issued and active prior to 2014 (Figure 2). All active permits, regardless of year issued, were monitored for permitting and reporting requirements in 2014. Multi-year permits are issued specifically for projects that span two or more calendar years. In accordance with Hawai'i Administrative Rules, the duration for a Monument permit in State waters is limited to no longer than one year from the date of issuance (HAR Title 13 § 60.5-6). Multi-year permits may be issued for activities that occur outside of State of Hawai'i waters (defined as 0-3 nautical miles from emergent land, excluding Midway Atoll) for up to five years.

TOP The haul of derelict fishing nets is transported to Hawaii's Nets to Energy Program. Photo by Toni Parras/NOAA

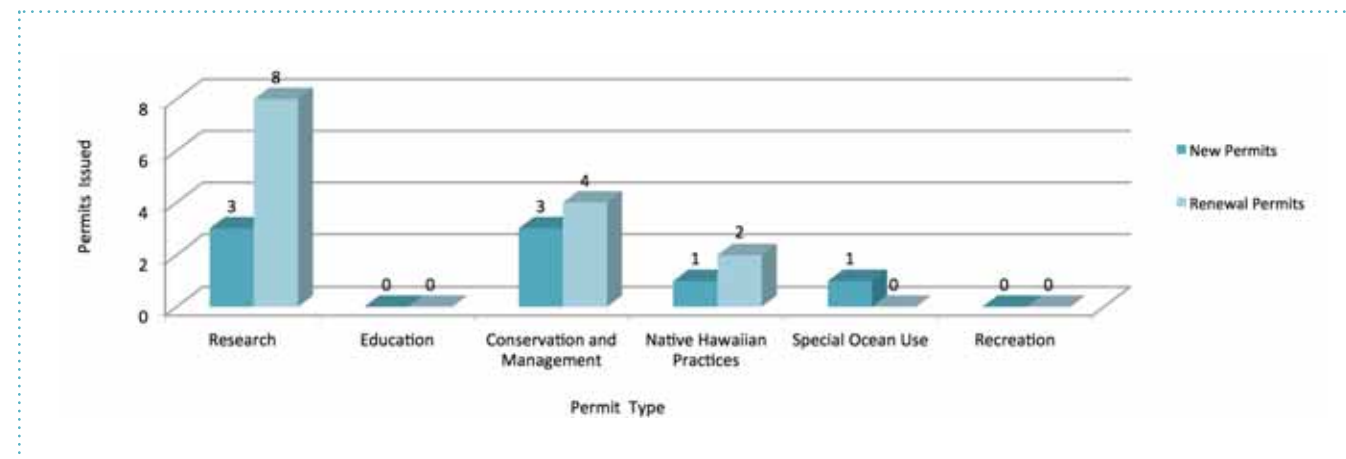
ABOVE Installment of kähili bearing hulu manu from Papahānaumokuākea Marine National Monument. Photo by Kai Markell/OHA

» Figure 2. Number of Monument permitted activities per calendar year 2010-2014.



Since 2010, the number of new and renewal permits issued has been reported and tracked by the MMB (Figure 3 below). In order for a permit application to be considered a renewal, the proposed activity must have been a previously permitted project activity in the NWHI. This metric provides a quick estimate of the number of new projects permitted (note that permits requesting renewal of activities with a new principal investigator are counted as “new” permits). Both new and renewal applications undergo the same rigorous joint-permitting review process. Single-year, multi-year, new and renewal metrics are used to summarize and track Monument permits.

» Figure 3. New and renewal permits in 2014 by permit category.



» Levels of Human Presence

Effectively tracking Monument permits and the associated number of permitted aircraft and vessel entries within the Monument allows for accurate reporting of levels of human presence. The level of human presence in the Monument is strictly managed and continually evaluated to monitor and mitigate for

Table 9 below outlines activities that occurred in 2014, which were permitted under the 2013 Monument Co-Trustee permit due to non-issuance of a 2014 Co-Trustee permit. Reports of activities conducted under this permit are logged and monitored in the same manner as activities conducted under separate permits, and all reports are shared among Co-Trustee agencies in order to facilitate cooperative management of all Monument resources. A conservation and management permit of this nature is necessary for coordinated management of Monument resources.

» Table 9. Activities conducted in 2014, which were permitted under the conservation and management Monument Co-Trustee permit in 2013, for NOAA, USFWS and DLNR.

CO-MANAGING AGENCY	ACTIVITIES CONDUCTED
USFWS, Hawaiian and Pacific Islands National Wildlife Refuge Complex	<ul style="list-style-type: none"> • Management, operation, and maintenance of Midway Atoll facilities • Management, operation, and maintenance of Laysan island and facilities • Laysan botanical collections • Tern Island pipe survey and removal operations • FAA Henderson Airfield seawall repairs and taxiway paving at Midway Island • <i>Verbesina</i> removal at Midway Atoll • Bulky dump restoration at Midway Atoll • Lead-based paint remediation at Midway Atoll • Seabird Tissue Archiving and Monitoring Project (STAMP) • Transfer of albatross remains to Dr. Scott Schaffer (UC Santa Cruz) • M/V <i>Kahana</i> field support missions
USFWS, Pacific Islands Fish and Wildlife Office	<ul style="list-style-type: none"> • Nihoa Millerbird translocation project • M/V <i>Searcher</i> field support missions
NOAA, National Marine Fisheries Service	<ul style="list-style-type: none"> • Marine debris removal • Sea turtle monitoring at French Frigate Shoals • Monk seal field camps/population assessment
NOAA, National Ocean Service, Office of National Marine Sanctuaries	<ul style="list-style-type: none"> • Midway Atoll tide gauge station operation and maintenance • Vessel support for conservation and management activities aboard M/V <i>Searcher</i> • Maritime heritage collection at Lisianski • Sediment collections requested by USFWS, Pacific Islands Fish and Wildlife Office
State of Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife	<ul style="list-style-type: none"> • Management, operation, and maintenance of Kure Atoll facilities • Laysan duck translocation to Kure Atoll
Office of Hawaiian Affairs	<ul style="list-style-type: none"> • Collection of hulu manu in partnership with the NOAA, NMFS, Hawaiian monk seal field camps

CONSERVATION AND MANAGEMENT

A total of 10 conservation and management permit applications were processed in 2014. Seven permits were issued (Table 8), two applications were withdrawn by the applicant, and the 2014 Co-Trustees permit was not issued. Conservation and management activities under the Co-Trustees permit for 2014 were authorized under the 2013 Co-Trustees permit, which was extended by the PMNM Senior Executive Board through the end of 2014.

» Table 8. Affiliations of conservation and management permittees and permitted projects in 2014.

CONSERVATION AND MANAGEMENT PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED CONSERVATION AND MANAGEMENT PROJECTS
NOAA, Office of Marine and Aviation Operations	2	<ul style="list-style-type: none"> • Support for Permitted Activities Aboard NOAA Ship <i>Oscar Elton Sette</i> • Support for Permitted Activities Aboard NOAA Ship <i>Hi'ialakai</i>
Schmidt Ocean Institute	1	<ul style="list-style-type: none"> • Support for Permitted Activities Aboard R/V <i>Falkor</i>
NOAA, National Ocean Service, Office of National Marine Sanctuaries, Papahānaumokuākea Marine National Monument	1	<ul style="list-style-type: none"> • Maritime Heritage Conservation and Management Activities
NOAA, National Marine Fisheries Service, Pacific Islands Regional Office & Pacific Islands Fisheries Science Center	1	<ul style="list-style-type: none"> • Selective removal of predatory sharks near Hawaiian monk seal pupping sites of French Frigate Shoals
NOAA, Office of Oceanic and Atmospheric Research, Unmanned Aircraft Systems Program & NOAA, National Ocean Service, Office of National Marine Sanctuaries	1	<ul style="list-style-type: none"> • Environmental Monitoring Using Airborne Surveys of the Natural Resources of PMNM
University of Alaska - Fairbanks	1	<ul style="list-style-type: none"> • Support for Permitted Activities Aboard R/V <i>Sikuliaq</i>

cumulative impacts. Human presence is necessary to carry out resource management objectives and conduct necessary scientific and cultural research.

Currently, the only location equipped to accept aircraft within the Monument is Midway Atoll. Funding constraints and other infrastructure limitations closed the airstrip at Tern Island within French Frigate Shoals in 2011. Since 2010, there has been a 64 percent decrease in flights to and from the Monument.

» Table 1. The number of permitted flights to and from the Monument from 2010 - 2014.

AIRPORT/AIRSTRIIP LOCATION	2010	2011	2012	2013	2014
French Frigate Shoals	11	0	0	0	0
Midway Atoll	61	51	55	38	22

Permitted vessel entries and exits are defined as any instance in which a vessel is permitted to enter the Monument to conduct authorized activities and subsequently exits the Monument. For reporting purposes, any further authorized entry of the same vessel is counted as a second vessel entry.

» Table 2. The number of permitted vessel entries into the Monument from 2010 - 2014.

	2010	2011	2012	2013	2014
Vessel Entries and Exits	19	22	12	16	16
Individual Vessels Used	6	8	5	6	8

The Monument permitting system ensures all commanding officers/captains and crew of permitted vessels are well-versed in vessel compliance measures and rules to protect the Monument. In accordance with Monument regulations, vessel discharge and anchoring is highly regulated within the Monument and, in many areas, prohibited. Authorized vessels must have an operating vessel monitoring system on board at all times within the Monument to pinpoint the vessel's location for law enforcement officers if needed. Vessels are also required to successfully complete a hull and rodent inspection prior to receiving a Monument permit. Permits for authorized vessels may place special conditions on activities including restrictions on speed and limitations on authorized locations to anchor.

Another metric to account for the level of human presence is the number of people on land. Due to the fragility and remote nature of these islands and atolls, any human presence has the potential to impact resources. Table 3.1 indicates the minimum, maximum and average number of people recorded on land per day on each island or atoll in the Monument from 2010-2014. The total number of person-use days measures individual presence per island or atoll in the Monument and is shown in Table 3.2. Person-use days are calculated based

on the number of individuals on site each day. For example, five authorized personnel staying for three nights on Nihoa would equal 15 total person-use days at Nihoa. Midway Atoll continues to have the highest level of human presence, sustaining an average population of 46 individuals necessary to operate Midway facilities and contract workers for environmental remediation.

Table 3.1. The minimum, maximum and average person-use days at each island and atoll in 2010-2014.

ISLAND / ATOLL	2010			2011			2012			2013			2014		
	MIN	MAX	AVERAGE	MIN	MAX	AVERAGE	MIN	MAX	AVERAGE	MIN	MAX	AVERAGE	MIN	MAX	AVERAGE
Nihoa	0	6	<1	0	11	<1	0	12	<1	0	12	<1	0	13	<1
Mokumanamana	0	10	<1	0	12	<1	0	3	<1	0	4	<1	0	3	<1
French Frigate Shoals	1	16	7	3	14	7	3	24	7	0	16	3	0	17	1
Laysan Island	6	18	8	4	15	7	6	27	8	0	27	5	0	14	1
Lisianski Island	0	2	<1	0	8	<1	0	20	<1	0	7	<1	0	14	<1
Pearl and Hermes Atoll	0	4	<1	0	7	1	0	20	<1	0	7	<1	0	10	<1
Midway Atoll	69	88	79	59	77	68	66	97	76	43	69	55	41	48	46
Kure Atoll	0	13	3	0	20	5	6	28	6	6	13	7	41	94	47
TOTAL			97			88			97			71			97

Table 3.2. Total amount of person-use days for each island and atoll in 2010-2014.

ISLAND / ATOLL	2010	2011	2012	2013	2014
Nihoa	79	99	102	91	110
Mokumanamana	26	53	10	8	3
French Frigate Shoals	2,669	2,910	2,631	1,283	472
Laysan Island	3,114	2,622	3,139	1,850	446
Lisianski Island	160	269	141	86	113
Pearl and Hermes Atoll	242	365	271	233	159
Midway Atoll	29,133	25,066	28,119	20,254	17,421
Kure Atoll	1,225	2,121	2,452	2,797	2,341*
TOTAL	36,648	33,505	36,865	26,602	21,065

*Total person-use-days for Kure Atoll are estimated based on project activity dates.

Locations of Permitted Activities

The map in Figure 4 indicates locations at which permitted activities occurred in 2014. Of the 52 active permits, many authorized activities at multiple locations. Thus, for example, a single permit may have allowed activities only at French Frigate Shoals, or a permit may authorize activities at all islands and atolls.



EDUCATION

While no education permits were issued in 2014, efforts continued to grow the development of field-to-classroom learning opportunities. To this end, several live Google Video Chat sessions were held between fourth grade students on O‘ahu and scientists aboard NOAA research ships conducting work in the Monument. The sessions were preceded by an in-classroom presentation by PMNM staff on O‘ahu several weeks prior to the chat to introduce students to the different types of work being done in the Monument and to collect questions from the students to send to scientists on the ships to prepare for the actual live sessions. Over the summer, five separate Google Video Chats were held on two separate research expeditions (the Monk Seal Field Team Deployment cruise and the RAMP cruise), reaching approximately 200 students and teachers. In some cases, these sessions were followed up by another in-classroom presentation by scientists back from the cruises who answered more questions and provided hands-on educational activities. This ‘distance learning’ concept is being further developed by PMNM staff and partners and will continue to grow in 2015.

ABOVE Mokupāpapa Discovery Center educator Etta Karth teaches Fo‘ Da ‘Aina School children about the Northwestern Hawaiian Islands. Photo by NOAA

Details of 2014 Permitted Activities

RESEARCH

A total of 11 research permits and two amendments to a 2013 research permit were issued in 2014. Research permits were issued to Co-Trustee agency personnel, university researchers and other research organizations in Hawai'i to conduct work on seabirds, fish, corals, marine mammals, algae and ocean areas within PMNM. Information gained from annual research cruises continues to inform scientists, managers and others of the NWHI terrestrial, and ocean ecosystems and their inhabitants and aids in overall management and evaluation of ecosystem health. Table 5 lists research permits issued for each organization or institution, together with project titles.

Table 5. Affiliations of Research permittees and permitted projects in 2014.

RESEARCH PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED RESEARCH PROJECTS
University of Hawai'i, Hawai'i Undersea Research Laboratory	1	<ul style="list-style-type: none"> Bathymetric Mapping in Papahānaumokuākea Marine National Monument seafloor
University of Hawai'i, Hawai'i Institute of Marine Biology	5	<ul style="list-style-type: none"> Assessing Health and Community Structure of Corals on Shallow-water Reefs Quantifying the Movements and Ecology of Top Predators Evaluation of NWHI Coral Reef Bioerosion Characterization of <i>Pocillopora meandrina</i> (POME) Colony Cryptic Fish and Invertebrate Communities Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems
NOAA, National Ocean Service, Office of National Marine Sanctuaries, Papahānaumokuākea Marine National Monument	3	<ul style="list-style-type: none"> Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology Pacific Reef Assessment and Monitoring Program Species Inventory Update and Abundance Determination of Alien Marine Invertebrates Associated With Natural and Man Made Habitats Within the Monument
NOAA Fisheries, Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Division	2	<ul style="list-style-type: none"> Amendments to 2013 Permit for Videographic Surveys of Coral Reef Fish Using Baited Remote Underwater Stereo-Video Systems (1) additional personnel (2) additional locations
Texas A&M University - Corpus Christi & University of Hawai'i, Hawai'i Institute of Marine Biology	1	<ul style="list-style-type: none"> Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs
Florida State University	1	<ul style="list-style-type: none"> Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling

Researchers Document Major Coral Bleaching Event in the Northwestern Hawaiian Islands

Scientists aboard back-to-back research expeditions to Papahānaumokuākea documented a mass coral bleaching event at select reefs in the NWHI this summer. Early stages of bleaching were detected during the Reef Assessment and Monitoring Program (RAMP) cruise in August, and adjustments were made to a subsequent 25-day research cruise itinerary in September to allow for an in-depth follow-up on the bleaching event.

Courtney Couch, a research biologist with the Hawai'i Institute of Marine Biology, initially joined the RAMP expedition to conduct surveys to determine how extensively diseases are affecting the NWHI and help managers identify and target coral disease hot spots, determine whether coral health is changing over time, and explore the extent to which disease is influencing coral communities and overall reef health in Papahānaumokuākea. What she found was a mass bleaching event.

Reefs around Lisianski Island were most heavily impacted, with up to 90 percent of the coral colonies in less than 30 feet of water exhibiting signs of bleaching. Prevalence of bleaching between 30 and 100 feet was between 30 and 40 percent. Scientists also observed moderate to severe bleaching at several reefs in the lagoons at Midway Atoll National Wildlife Refuge and Pearl and Hermes Atoll. Corals of the genus *Montipora* were most heavily impacted.



LEFT Example of healthy and bleached *Montipora dilitata* at Lisianski. Photo by Courtney Couch/HIMB



ABOVE A school of nenue, or chubs, swarm around an acoustic receiver at Midway Atoll. Photo by Chelsie Counsell/HIMB

RIGHT Nyssa Silbiger photographs a previously-placed calcium carbonate block before extracting it from a reef in Midway lagoon. Photo by Toni Parras/NOAA



In addition to their extensive research underwater, scientists participated in several live Google Video Chats broadcast from the *Hi'ialakai* to elementary students back in the Main Hawaiian Islands. Godwin, along with other NOAA staff, scientists and graduate student researchers from the Hawai'i Institute of Marine Biology (HIMB) answered questions and shared their experiences with approximately 175 fourth grade students and teachers back on O'ahu. Students gave rave reviews to their teachers about the chat sessions. This distance learning initiative is key to the mission of bringing the Monument to the people and aligns well with NOAA Administrator Kathryn Sullivan's goal of increasing the environmental intelligence of the nation's youth.

Research projects permitted in 2014 included a variety of activities aimed at monitoring ecosystem dynamics, studying the genetic connectivity of marine organisms, and tracking the movements of top predators. While 11 new research permits were issued in 2014, 11 permits were issued in prior years and remained valid. Of these, 16 research permits involved collection activities. Collection activities requiring the removal of whole specimens (as opposed to extracting tissue and leaving the organism in situ) utilized the minimum sample size necessary in order to complete the project and satisfy statistical significance. Table 6 describes these observational, catch and release, and collection activities.

» **Table 6.** Observational, catch and release, and collection activities that occurred in 2014.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Assessing Health and Community Structure of Corals on Shallow-water Reefs	<ul style="list-style-type: none"> • 469 transect surveys conducted • 7335 photo surveys conducted • 2 hours of tow-board surveys conducted 	<ul style="list-style-type: none"> • 7 samples of ~4cm² rice coral (<i>Montipora capitata</i>)
Quantifying the Movements and Ecology of Top Predators	<ul style="list-style-type: none"> • 16 acoustic tags deployed on Galapagos sharks (<i>Carcharhinus galapagensis</i>) • 12 acoustic tags deployed on Ulua (<i>Caranx ignobilis</i>) 	<ul style="list-style-type: none"> • 16 samples of ~2g muscle biopsy samples from Galapagos sharks (<i>Carcharhinus galapagensis</i>) • 12 samples of ~2g muscle biopsy samples from ulua (<i>Caranx ignobilis</i>)
Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology	<ul style="list-style-type: none"> • 280 photo surveys conducted • 28 transect surveys conducted 	<ul style="list-style-type: none"> • 5 whole Cnidarians • 1 whole bryozoan • 1 whole coral • 98 whole alga specimens • 24 samples of ~1qt bags of sand • 17 whole sponges
Coral Reef Bioerosion Rates as Indicators of Community Response to Ocean Acidification	None recorded	<ul style="list-style-type: none"> • 20 of ~125cm³ reef rubble samples
Characterization of Pocillopora meandrina (POME) Colony Cryptic Fish and Invertebrate Communities	<ul style="list-style-type: none"> • 15 photo surveys conducted • 1,968 photos documented • 492 Pocillopora coral colonies observed 	<ul style="list-style-type: none"> • 1 whole dwarf scorpionfish (<i>Sebastapistes fowleri</i>) • 14 of ~0.5cm³ finclips of speckled scorpionfish (<i>Sebastapistes coniota</i>)
Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs	<ul style="list-style-type: none"> • 4 snorkel surveys resulting in 50 observations of fish and other intertidal flora and fauna 	<ul style="list-style-type: none"> • 6 crown of thorns (<i>Acanthaster planci</i>) • 275 black-foot limpet or 'opihi makaiuli (<i>Cellana exarata</i>) • 256 yellow-foot limpet or 'opihi 'ālinalina (<i>Cellana sandwicensis</i>) • 82 shingle urchin or hā'uke'uke kaupali (<i>Colobocentrotus atratus</i>) • 70 false limpet or false 'opihi (<i>Siphonaria normalis</i>) • 80 snail or makaloa (<i>Drupa ricina</i>) • 48 urchin or 'ina (<i>Echinometra oblonga</i>) • 96 snail or pipipi kolea (<i>Littoria pinctada</i>) • 80 bivalve or nahawele (<i>Isognomon californicum</i>) • 96 snail or pipipi (<i>Echinolittorina hawaiiensis</i>) • 23 snail or pipipi (<i>Nerita picea</i>)

» Table 6 Continued. Observational, catch and release, and collection activities that occurred in 2014.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling	<ul style="list-style-type: none"> < 37,000 photos taken during AUV Sentry dives at Pioneer Bank ~830 km of multibeam mapping occurred at Pioneer Bank and Hamptons Seamounts 	<ul style="list-style-type: none"> 96 tubes of ~ 100 ml of seawater to test radiocarbon levels 48 tubes of ~25 ml of seawater to test nutrient levels 48 tubes of ~250 ml of seawater to test total alkalinity 48 tubes of ~100 ml of seawater to test strontium concentrations
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems	None recorded	<ul style="list-style-type: none"> 1 spectacled parrotfish (<i>Chlorurus perspicillatus</i>) 2 striped boarfish (<i>Evistias acutirostris</i>) 2 masked angelfish (<i>Genicanthus personatus</i>) 1 yellow anthias (<i>Holanthias fuscipinnis</i>) 3 wrasse (<i>Suezichthys sp.</i>) 4 sling-jaw wrasse (<i>Epibulus insidiator</i>) 2 brick soldierfish (<i>Myripristis amaena</i>) 8 bigscale soldierfish (<i>Myripristis berndti</i>) 2 yellowstriped squirrelfish (<i>Neoniphon aurolineatus</i>)
Videographic Surveys of Coral Reef Fish Using Baited Remote Underwater Stereo-Video Systems	250 hours of video observations (1 hour per each deployment site)	None Recorded
Pacific Reef Assessment and Monitoring Program	• 1335 photo observations	None Recorded
Species Inventory Update and Abundance Determination of Alien Marine Invertebrates Associated With Natural and Man Made Habitats Within the Monument	• 1 land survey conducted over an area of 100 m	None Recorded
Bathymetric Mapping of Papahānaumokuākea Marine National Monument	<ul style="list-style-type: none"> • Deployed 32 XBTs (Expendable Bathythermographs) • 34 CTD (Conductivity, Temperature, and Depth) casts occurred • 126,788 km² of multibeam mapping occurred • 29,839 km of gravimeter surveys conducted • 29,839 km of magnetometer surveys conducted 	None Recorded
Petrel Species Research on Plastic Ingestion	None recorded	<ul style="list-style-type: none"> • 54 Tristram's storm petrel (<i>Oceanodroma tristrami</i>) • 46 Bonin petrel (<i>Pterodroma hypoleuca</i>)
Collection of Adult and Larval Moths to Conduct Species Descriptions and DNA Analysis of Their Evolutionary Relationships	None recorded	<ul style="list-style-type: none"> • 4 <i>Hyposmocoma</i> moth larval cases • 1 <i>Hyposmocoma</i> caterpillar

Scientists Conduct Fourteenth Year of Reef Assessment and Monitoring in the Northwestern Hawaiian Islands

The 2014 Reef Assessment and Monitoring Program (RAMP) expedition to the NWHI took place from August 11-31 aboard NOAA ship *Hi'ialakai*, after a slight delay due to hurricane activity in the Pacific. Researchers visited numerous sites in the Monument to conduct various research activities, including studies of coral disease and prevalence, bioerosion, coral cryptofauna, maritime heritage, and rapid ecological assessments of reef fish, corals and other invertebrates.

The 2014 RAMP cruise was part of long-term monitoring efforts of shallow coral reef environments (typically between 0 and 80 feet) dating back to 2000. Before these expeditions, little was known about the makeup of the reefs in the NWHI. For example, prior to 2000, there were only eight species of algae known from French Frigate Shoals; after the first two years of RAMP, more than 130 species were collected there, and the known records of coral species in the NWHI grew from 22 to 52 species in just two years.

NOAA Resource Protection Specialist and chief scientist on the expedition, Scott Godwin, was quick to point out, “The quantitative (measurable) data on coral and fish that is collected during efforts like the 2014 RAMP expedition are extremely important but the qualitative information (impressions and observations) also reveal the unique nature of places like the Monument.”



LEFT Chelsie Counsell observes coral communities at French Frigate Shoals. Photo by Courtney Couch/HIMB

ABOVE A sea slug (*Phillinopsis pilsbryi*) grazes on the reef at Midway Atoll. Photo by Scott Godwin/NOAA



ABOVE Researchers deploying the CTD unit (Conductivity, Temperature, Depth) used to support sonar mapping on the R/V *Falkor*. Photo by Daniel Wagner/NOAA

RIGHT A view of the sonar mapping control room aboard the R/V *Falkor*. Photo by Daniel Wagner/NOAA



Another objective of this mapping effort was to identify likely sites of deep-sea coral and sponge beds. In 2003, scientists discovered the existence of these beds within the Monument in more than 1,000 meters of water.

“On this trip, we discovered more sites in the Monument with the right type of topography to support these amazing deep sea coral gardens,” Dr. Kelley said. “We’ll have to wait until someone gets an opportunity to dive on the sites with a submersible or remotely operated vehicle to confirm they exist.”

Previous exploration of the few known beds led to the discovery of more than 50 new species of sponges and corals, according to Dr. Kelley. It is expected that more discoveries will be made as a result of the information gleaned from this trip.

The region’s geology was another key focus of the expedition. Ancient coral reefs that drowned as the earliest Hawaiian Islands subsided now hold a detailed record of that process spanning millions of years. Mapping can offer a big picture view of how various features are organized, which will help researchers better understand Hawaii’s geological history.

“We established SOI in 2009 and led the transformation of *Falkor* into a state-of-the-art research vessel to support the world’s leading ocean scientists on their essential, but difficult-to-implement research,” says Wendy Schmidt, who co-founded Schmidt Ocean Institute with her husband Eric. “The mapping and geological work conducted during [these cruises] will inform the work of Dr. Kelley and his team and, through our open sharing approach, all scientists who have a stake in better understanding this region.”

The team consisted of researchers from the University of Hawai‘i at Mānoa, NOAA, Schmidt Ocean Institute, the University of Sydney, and the University of British Columbia.

For more information about the expedition, visit <http://www.schmidtocean.org/story/show/2216>.

» **Table 6 Continued.** Observational, catch and release, and collection activities that occurred in 2014.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Laysan and Black-footed Albatross Monitoring	None recorded	<ul style="list-style-type: none"> • 114 feathers from Laysan albatross (<i>Phoebastria immutabilis</i>) • 102 feathers from black-footed albatross (<i>Phoebastria nigripes</i>) • 26 samples of <0.5 mL blood from Laysan albatross • 22 samples of <0.5 mL blood from black-footed albatross
Red-footed, Masked and Brown Booby Monitoring	<ul style="list-style-type: none"> • 40 GLS tags deployed and recovered • 11 GPS tags deployed • 25 GPS tags recovered 	<ul style="list-style-type: none"> • 8 samples of 1 mL blood from red-footed booby (<i>Sula sula rubripes</i>) • 36 breast feathers from red-footed booby • 2 diet samples from red-footed booby • 11 samples of 1 mL blood from masked booby (<i>Sula dactylatra</i>) • 36 breast feathers from masked booby • 3 breast feathers from brown booby (<i>Sula leucogaster</i>)

Other research activities involved the use of temporary devices to remotely monitor habitat variations, such as temperature, salinity, changes in sedimentation, and organism recruitment. These instruments are essential to obtaining long-term ecological data necessary for effective resource management in the face of climate change and other global threats to the Monument. Table 7 describes the temporary instruments installed or deployed in 2014.

» **Table 7.** Remote monitoring instruments installed under research permits in 2014.

PERMITTED RESEARCH PROJECT	INSTRUMENTS INSTALLED FOR REMOTE MONITORING
Bathymetric Mapping of Papahānaumokuākea Marine National Monument	<ul style="list-style-type: none"> • Installed 32 XBTs (Expendable Bathythermographs)
Quantifying the Movements and Ecology of Top Predators	<ul style="list-style-type: none"> • 21 acoustic receiver moorings replaced at PHR & FFS • 3 acoustic receiver moorings deployed at PHR & FFS • Equipped 7 Galapagos sharks with transmitters at FFS
Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling	<ul style="list-style-type: none"> • Installed 1 Lowell TCM-1 Tilt Current & Temperature Meter
Deployment and Maintenance of High-Frequency Acoustic Recording Packages (HARPs) for Year-Round Cetacean Monitoring	<ul style="list-style-type: none"> • 1 High-Frequency Acoustic Recording Package (HARP) recovered and redeployed

» Research Highlights

Baited Remote Underwater Video Stations Help Characterize Fish Populations

The characterization of the reef inhabitants of the NWHI has traditionally been conducted by surveys performed by researchers utilizing snorkeling and SCUBA technologies. Unfortunately, the presence of divers can impact the distribution and behaviors of fish species, including apex predators like jacks and sharks. In order to get a better understanding of reef fish distribution, NOAA Fisheries



TOP Researchers fit the cameras into their underwater housings and double-check the seal before deploying the BRUV. Photo by Jacob Asher/NOAA

RIGHT Emily Crigler and affiliate prepares to deploy a BRUV. Photo by Jacob Asher/NOAA



Ecosystem Specialist Jake Asher with the Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division conducted diver independent, videographic surveys of abundance and size distribution of coral reef fish using Baited Remote Underwater Video Stations (BRUVs).

A BRUV is a stereo-video system composed of high definition cameras and a bait arm mounted to a lightweight galvanized steel frame. The cameras are mounted 0.7 meters apart on a base bar that is inwardly converged at 8 degrees, which enables identification of fish species and sizes. Each BRUV can hold approximately 1 kg of bait and may be deployed for up to one hour, during which time the camera records the various reef species present and attracted to the bait.

Data processing and analysis of videographic data collected by the BRUVs from approximately 250 sites at depth ranges down to 100 meters throughout the Monument is currently underway. The data collected will complement visual survey data gathered from SCUBA accessible depths (0 - 30 meters) and provides a way to test for the impacts posed by the presence of divers on the estimations of apex predator densities in PMNM.

These BRUVs deployments in the NWHI will provide natural resource managers with information on reef fish populations without the effect of a diver's presence and is representative of populations spanning depth ranges down to 100 meters. To date, the deeper (>30 meters deep) marine habitats remain relatively underexplored due to the challenge of accessing those depths, which can only be achieved with submersibles or technical diving.

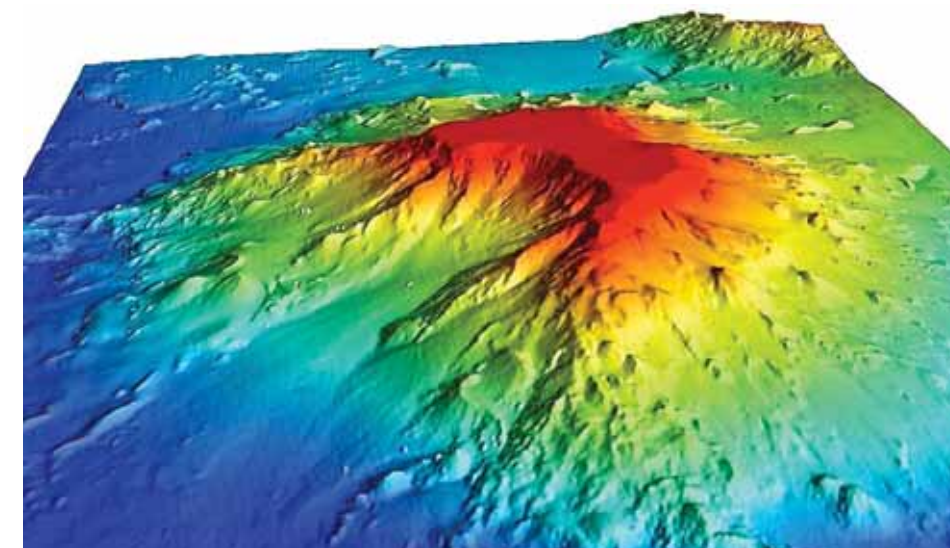
Mapping Expedition Charts Thirty Percent of Papahānaumokuākea's Seafloor.....

Two mapping expeditions to Papahānaumokuākea were conducted in 2014, the first from March 7-April 11 and the second from May 2-June 6. Prior to these expeditions, less than half the Monument's seafloor had been mapped, partly due to PMNM's size (encompassing an area greater than all U.S. national parks combined) and the limited availability of the advanced sonar systems required to conduct this mapping. During the expeditions, a total area of 127,000 square kilometers (61,000 square kilometers and 66,000 square kilometers from each cruise, respectively) of previously unmapped or poorly charted areas inside the Monument were mapped. This includes 18 seamounts and extensive banks off Pearl and Hermes, Midway and Kure atolls.

"The goal of the expedition was to fill large gaps in seafloor data in order to facilitate future research and discoveries in the region," said Dr. Christopher Kelley, program biologist with the Hawai'i Undersea Research Laboratory (HURL) and chief scientist of the expedition.

Carried out aboard the Schmidt Ocean Institute's (SOI) 272-foot R/V *Falkor*, the expedition utilized the ship's state-of-the-art seafloor mapping sonar systems, among the most advanced mapping technology in the world. Approximately 98 percent of the Monument's area is deeper than 100 meters, where features including seamounts, ridges and submerged banks are home to rare and likely undiscovered species of corals, fish and other animals. Mapping is key to finding out what lives in these places.

"We literally have better maps of the moon than of the ocean floor," said Dr. Randy Kosaki, NOAA's deputy superintendent for research at the Monument. "These bathymetric data will go a long way towards improving our understanding of Papahānaumokuākea's features. As natural resource managers, we can't manage what we don't understand."



LEFT 3-D maps of Turnif Seamount based on newly gathered sonar data. Photo by Chris Kelley/HURL

ABOVE Scientists aboard the Schmidt Ocean Institute's R/V *Falkor* set out to map PMNM's largely uncharted seafloor. Photo by Debbie Nail Meyer/Schmidt Ocean Institute