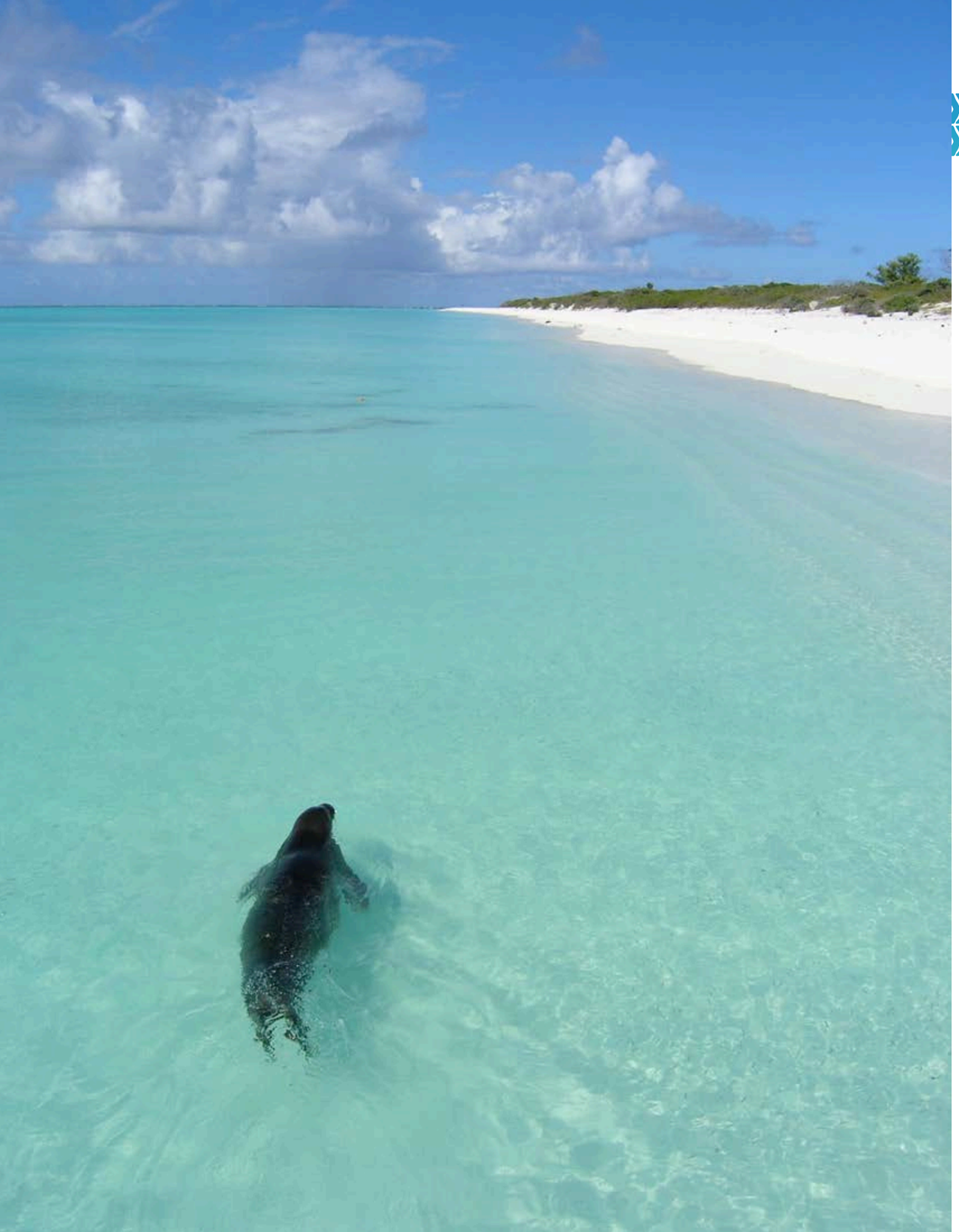
PAPAHĀNAUMOKUĀKEA
Marine National Monument

PERMITTED ACTIVITIES 2015 ANNUAL REPORT

Contents



Introduction

On June 15, 2006, the Northwestern Hawaiian Islands Marine National Monument was established by Presidential Proclamation 8031, establishing not only the largest marine protected area in the world at the time, but also a site created expressly to protect ecological and cultural integrity. A year later, it was given its Hawaiian name, Papahānaumokuākea which represents the union of Papahānaumoku (goddess of the earth) and Wākea (god of the sky), which resulted in the creation, or birthing, of the entire Hawaiian archipelago and Native Hawaiians themselves. Taking the name apart further, "Papa" (earth mother, foundation), "hānau" (birth), "moku" (islands), and "ākea" (wide) suggests a fertile woman giving birth to a wide stretch of islands beneath a benevolent sky. Taken as one long name, Papahānaumokuākea can be seen as a symbol of hope and regeneration for the paeʻāina (Hawaiian archipelago).

Papahānaumokuākea Marine National Monument ("PMNM" or "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 Hawaiʻi 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, including 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 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 Hawaiʻi lands and waters, managed by the State through the DLNR. Two State-designated conservation areas predate 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 UNESCO World Heritage site in 2010 as the only mixed natural/cultural site in the United States added to the genealogy of protection and recognition of the NWHI. This honor is the culmination of 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 protection, pg. 8-9).

Opposite Approximately 1,400 critically endangered Hawaiian monk seals remain in the wild. The Hawaiian monk seal is the only seal species found in Hawaiʻi. The majority of their population is within the unpopulated and protected areas of Papahānaumokuākea Marine National Monument. Photo by Cynthia Vanderlip/State of Hawaiʻi, DLNR

Ua paʻa nā inoa kahiko
*Ancient Names Remembered**

Mai kahiko mai, ua hoʻopaʻa ʻia nā inoa moku no kēia pae ʻāina ma ka moʻolelo a me nā mele koʻihonua, a ʻo kekahi o nā moku, ua paʻa ka inoa, a ua poina 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)*

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

Hōlanikū, Mokupāpapa (Kure Atoll)

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, Nāmakaokahaʻi, and Wainuʻu. 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.

Kuaihelani, Pihemanu (Midway Atoll)

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

Manawai, Holoikauaua (Pearl and Hermes Atoll)

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

Kapou, Papaʻāpoho (Lisianski Island)

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

Kamole, Kauō (Laysan Island)

Kamole means "ancestral root, foundation, source or cause," such as a root that runs through the earth and traces one's ancestry back to the source. Kamole also describes the location of Laysan Island, the first major landfall following French Frigate Shoals moving toward the northwest. Kauō, meaning "egg," describes both the island's shape and the abundance of seabirds that nest here.

Kamokuokamohoaliʻi, Koʻanakoʻa, Nalukākala (Maro Reef)

Kamokuokamohoaliʻi means "the island of Kamohoaliʻi," referring to Pele's brother Kamohoaliʻi, the shark deity. The name signifies the extremely high number of sharks prevalent at Maro Reef, more than any other location in the Monument. Koʻanakoʻa 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.

ʻŌnūnui, ʻŌnūiki, Pūhāhonu (Gardner Pinnacles)

ʻŌnūnui means "large protuberance" and is a variant of the name Ununui, which refers to a large altar. ʻŌnūiki means a "small protuberance." Both names correspond to the large and small rock protuberances that make up Gardner Pinnacles and, with the 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 describes 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.

Lalo, Kānemilohaʻi, Mokupāpapa (French Frigate Shoals)

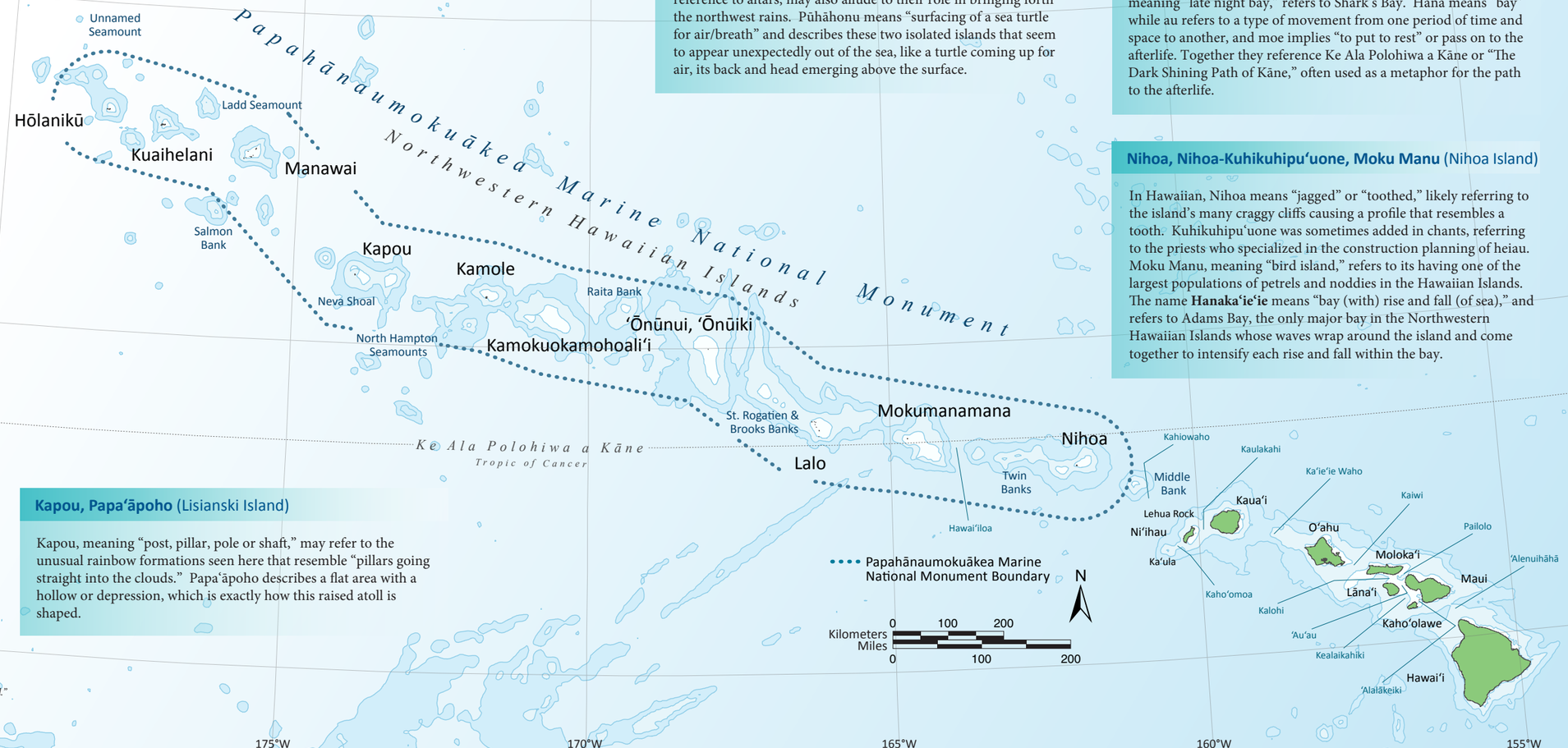
The word lalo means "down, downward, low, lower, under, below, depth, west or leeward." Lalo is closely associated with the direction of pō (darkness) or ancestral lands "where dwelt the souls of gods." The name Lalo depicts low-lying islands partially submerged below the surface, which aptly describes the atoll. Recorded in chants, the name Mokupāpapa refers to an island, or islands, northwest of Niʻihau. 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, Kānemilohaʻi, as a guardian during her first journey to Hawaiʻi from Tahiti.

Mokumanamana, Kamokumanamana, Hāʻena (Necker Island)

Mokumanamana is often translated as "branched" or "pinnacled," which is a suitable description of the island. But many people who have studied its religious and cultural sites suggest that the repetition of the word mana (spiritual power) after the word moku (island) relates to the spiritual significance of the island, given the 33 shrines along its kua (spine) and the Hawaiian axes of life and death that cross directly over it. The name Hāʻena, defined as "red-hot burning heat," possibly refers to the intensity of a specific kapu (restriction) or sacredness 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 to the afterlife. Together they reference Ke Ala Polohiwa a Kāne or "The Dark Shining Path of Kāne," often used as a metaphor for the path to the afterlife.

Nihoa, Nihoa-Kuhikuhipuʻuone, 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. Kuhikuhipuʻuone was sometimes added in chants, referring to the priests who specialized in the construction planning of heiau. Moku Manu, meaning "bird island," refers to its having one of the largest populations of petrels and noddies in the Hawaiian Islands. The name **Hanakaʻieʻie** means "bay (with) rise and fall (of sea)," and refers to Adams Bay, the only major bay in the Northwestern Hawaiian Islands whose waves wrap around the island and come together to intensify each rise and fall within the bay.



* **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 ʻAhaʻi ʻOlelo*, Puke VIII: III.

Kikiloi, Kekuewa. *"Rebirth of an Archipelago: Sustaining a Hawaiian Cultural Identify for People and Homeland."* Honolulu: Kamehameha Schools, 2010. Print.

Timeline of Protections

1900s 1910s 1920s 1930s 1940s 1950s 1960s 1970s 1980s 1990s 2000s 2010s

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.

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.

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 authorizes the creation of a NWHI Reserve. President Clinton issues 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.

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 14) other PSSAs worldwide, including the Florida Keys, the Great Barrier Reef and the Galapagos.

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 Atoll 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
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 32) mixed (natural and cultural) World Heritage Sites in the world.

Above Two masked boobies enjoy an afternoon chat astride two threatened Hawaiian green turtles at French Frigate Shoals. More than 95% of the green turtles in Hawai'i nest and breed on and around the tiny islets of French Frigate Shoals. Just like the management agencies, the animals of Papahānaumokuākea partner for protection. Photo by Mark Sullivan/NOAA Fisheries

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 direct results of human activities occurring beyond Monument boundaries. These include marine and terrestrial alien and invasive species, marine debris and vessel groundings, and climate change effects such as sea level rise and ocean acidification. 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. At the same time, this process enables scientists, managers and Native Hawaiian researchers and cultural practitioners to accomplish 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 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 person passing through PMNM without interruption does not constitute a permitted activity. However, domestic vessel notification must be provided prior to entering and upon leaving the Monument. For U.S. flag vessels with onboard e-mail capability, notification is required upon entering and exiting the reporting area (area extending 10 miles out and entirely around the Monument boundary). For domestic vessels less than 300 gross tons without e-mail capability, entry must be provided at least 72 hours, but not more than one month, prior to entering PMNM, and 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.papahanaumokuakea.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,

Above The ceremonial sites atop Mokumanamana, and similar sites across Polynesia, speak to the seamless, multigenerational connections among man, nature and spiritual realms. Photo by Kalei Nu'uhiwa

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 process. In order to inform the public about activities proposed within the NWHI, permit applications are posted on the Monument website (http://www.papahanaumokuakea.gov/permit/applicationrev.html) for public review. 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.

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 Practices 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 conducting ceremonies at historic cultural sites on Nihoa and 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 uses, including ecotourism or documentary filmmaking. 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.

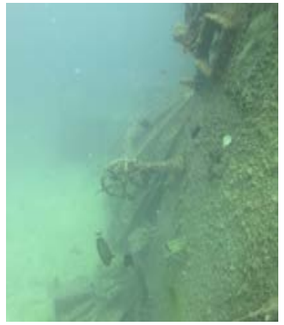
Recreation

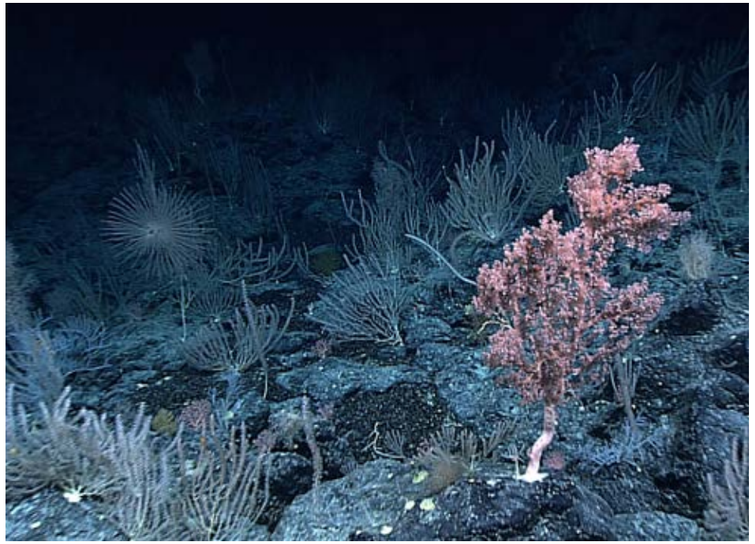
Recreation permits are for activities conducted for personal enjoyment and are limited to occur only within the Midway Atoll Special Management Area. Recreation activities must not result in the extraction of Monument resources or be involved in a fee-for-service transaction. Examples of activities that 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 A curious Galapagos shark approaches NOAA scientist Dr. Randall Kosaki and team as they slowly decompress on their way to the surface from a 300 foot dive at Pioneer Bank, Papahānaumokuākea Marine National Monument. Photo by NOAA and Richard Pyle/Bishop Museum

Below Crewmember Kaʻohinani Kamalu handles the head sail as the waʻa nears Nihoa. Photo by Polynesian Voyaging Society and ʻŌiwi TV

2015 Permitted Activities





Top The wheelhouse deck and helm of the USNS *Mission San Miguel* at Maro Reef. Photo by Tate Wester/NOAA

Above Heiau (place of worship) at Mokumanamana. Photo by Kekuewa Kikiloi/University of Hawai'i

Right A high-density community of deep-sea corals and sponges at a depth of 2,000 meters (that's more than a mile deep!) surveyed during the expedition. Photo by NOAA Office of Ocean Exploration and Research, 2015 Hohonu Moana

A common theme of activities conducted in 2015 may be captured in the Hawaiian saying (reflected on the cover), "Ahu kupanaha iā Hawai'i 'imi loa"[1], translated to mean "pursuing new knowledge brings bountiful rewards." A suite of activities was conducted by managers, cultural practitioners, community members and researchers, continuing collaborative research and resulting in new discoveries. The following excerpts from activities that occurred in 2015 capture just a few of the remarkable things that occurred:

Maritime Heritage

Scientists discover remains of World War II-era U.S. Navy ship USNS *Mission San Miguel.*

Deep Ocean Discoveries

NOAA deep sea remotely operated vehicles descend to new depths observing new or unknown species.

Cultural Practices

Native Hawaiian researchers gain new understanding of the placement of uprights at Mokumanamana and their relation to celestial movements.

[1] Phrase of Hawaiian historian Zepherin Kepelino Kahoali'i Keauokalani, as stated in Beckwith, Martha WI, ed. 1932. "Kepelino's Traditions of Hawaii." Bernice P. Bishop Museum Bulletin 95. Honolulu.

Increased Diversity

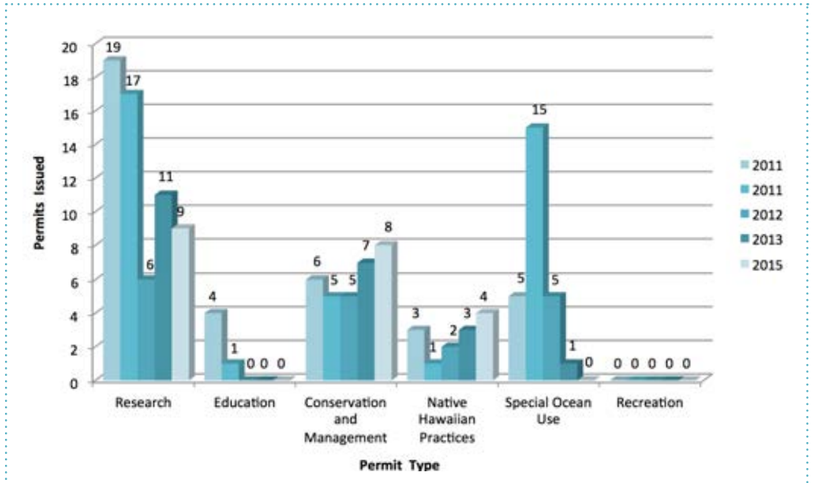
Researchers discover a new species of *Hyposmocoma* moth on Nihoa Island.

Above Looking west from the kawelu grasslands of Middle Valley, Nihoa. Photo by Tim Kroessig

Permits Issued in 2015

In 2015, 30 permit applications were received and 21 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 and two were not issued. Figure 1 displays a comparison of the number of permits by type, issued from 2010-2015.

Figure 1. Number of Monument permits issued from 2010-2015 by permit type.

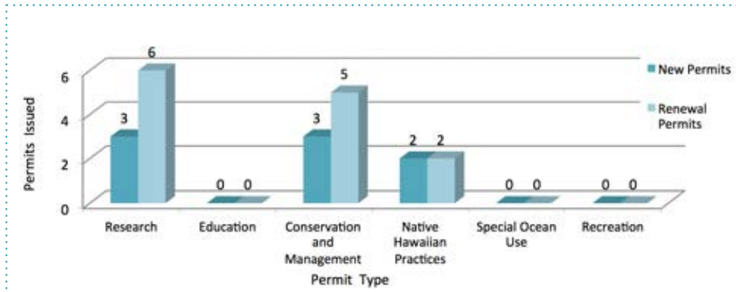


The Monument Co-Trustees grant both single- and multi-year permits. In calendar year 2015 the Monument permitting program tracked 60 permits, 39 of which were issued and active prior to 2015 (Figure 2). All active permits, regardless of year issued, were monitored for permitting and reporting requirements in 2015. 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.

Figure 2. Number of Monument permitted activities per calendar year 2010-2015.

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 2015 by permit category.



Levels of Human Presence

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

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 57 percent decrease in flights to and from the Monument.

Table 1. The number of permitted flights to and from the Monument from 2010 - 2015.

Airport/Airstrip Location	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
French Frigate Shoals	11	0	0	0	0	0
Midway Atoll	61	51	55	38	22	26

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 - 2015.

	2010	*2011*	*2012*	*2013*	*2014*	*2015*
Vessel Entries and Exits	19	22	12	16	16	19
Individual Vessels Used	6	8	5	6	8	9

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 2010-2015[2]. 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

[2] Data presented in all tables and figures reflects only information from permit reports submitted to PMNM upon completion of a PMNM access and/or project. Not all permit reports have been received for activities that occurred in 2015 at the time of publication.

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 51 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 2010-2015.

	2010			*2011*			*2012*			*2013*			*2014*			*2015*		
Island / Atoll	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
Nihoa	0	6	<1	0	11	<1	0	12	<1	0	12	<1	0	13	<1	0	10	<1
Mokumanamana	0	10	<1	0	12	<1	0	3	<1	0	4	<1	0	3	<1	0	11	<1
French Frigate Shoals	1	16	7	3	14	7	3	24	7	0	16	3	0	17	1	0	22	2
Laysan Island	6	18	8	4	15	7	6	27	8	0	27	5	0	14	1	0	25	<1
Lisianski Island	0	2	<1	0	8	<1	0	20	<1	0	7	<1	0	14	<1	0	23	<1
Pearl and Hermes Atoll	0	4	<1	0	7	1	0	20	<1	0	7	<1	0	10	<1	0	17	<1
Midway Atoll	69	88	79	59	77	68	66	97	76	43	69	55	41	48	46	43	60	51
Kure Atoll	0	13	3	0	20	5	6	28	6	6	13	7	6	15	6	6	17	7
Total			**97**			**88**			**97**			**70**			**54**			**60**

Table 3.2. Total amount of person-use days for each island and atoll in 2010-2015.

Island / Atoll	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Nihoa	79	99	102	91	110	39
Mokumanamana	26	53	10	8	3	48
French Frigate Shoals	2,669	2,910	2,631	1,283	472	1,045
Laysan Island	3,114	2,622	3,139	1,850	446	321
Lisianski Island	160	269	141	86	113	251
Pearl and Hermes Atoll	242	365	271	233	159	322
Midway Atoll	29,133	25,066	28,119	20,254	17,421	18,518
Kure Atoll	1,225	2,121	2,452	2,797	2,558*	2,773*
Total	**36,648**	**33,505**	**36,865**	**26,602**	**21,282**	**23,317**

*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 2015. Of the 60 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.

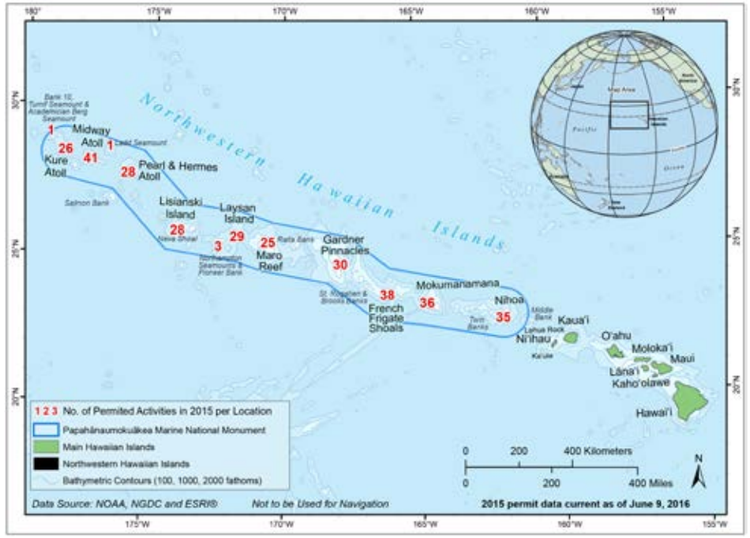


Figure 4. Locations of 2015 permitted activities. The number of permitted projects at each location is indicated in red.

Permitted Versus Actual Visitation Records

The number of individuals permitted to access the Monument and conduct activities is often not reflective of the actual number of people who conducted work in the Monument. For example, PMNM permits authorize limited access to personnel qualified to conduct specific activities; however the actual number of individuals who access the Monument is often less than the amount permitted due to scheduling conflicts and other logistical complications that necessitate flexibility when selecting a team to conduct permitted activities in the Monument. In other instances, permits that are active for more than one calendar year are included in the total count of permitted individuals but may not utilize their permit each year due to scheduling conflicts, lack of funding, or other priorities. Table 4 shows the difference in the number of permitted individuals compared to the actual number of individuals who took part in a permitted activity.

Table 4. Number of individuals permitted in 2015, compared to the actual number of people who conducted permitted activities in the Monument by permit type.

Permit Type	**Number of People Permitted**	**Actual Number of People Who Performed Permitted Activities**
Research	153	78
Education	0	0
Conservation & Management	549	260
Native Hawaiian Practices	61	55
Special Ocean Use	164	1
Recreation	1	0
Total	**928**	**394**

Details of 2015 Permitted Activities

RESEARCH

A total of nine research permits and two amendments to a 2014 research permit were issued in 2015. Research permits were issued to Co-Trustee agency personnel, university researchers and other research organizations in Hawai'i to conduct work on fish, corals, marine mammals, algae and ocean areas within PMNM. Information gained from annual research cruises continues to inform scientists, managers and others on 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 2015.

Research Permittee Affiliation	Number of Permits Issued	Permitted Research Projects
NOAA, National Ocean Service, Office of National Marine Sanctuaries, Papahānaumokuākea Marine National Monument	2	• Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology • Pacific Reef Assessment and Monitoring Program
NOAA, Office of Oceanic and Atmospheric Research, Unmanned Aircraft Systems Program & NOAA, National Ocean Service, Office of National Marine Sanctuaries	1	• Bathymetric Mapping in Papahānaumokuākea Marine National Monument
Texas A&M University - Corpus Christi & University of Hawai'i, Hawai'i Institute of Marine Biology	1	• Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs
Hawai'i Pacific University	1	• Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems
University of Hawai'i, Hawai'i Institute of Marine Biology	5	• Assessing Health and Community Structure of Corals on Shallow-water Reefs • Quantifying the Movements and Ecology of Top Predators • Bleached Coral Recovery Assessment • Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems • Assessing Coral Reef Herbivorous Fish Ecology
Florida State University	2	• Amendments to 2014 Permit for Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling • (1) additional locations • (2) additional equipment and location depths

Research projects permitted in 2015 included a variety of activities aimed at monitoring coral reef ecosystem health, studying the genetic connectivity of marine organisms, and tracking the movements of top predators. While nine new research permits were issued in 2015, 20 permits were issued in prior years and remained valid. Of these, 18 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 2015.

Permitted Research Project	Catch and Release or Observational Research	Biological or Physical Samples Collected
Quantifying the Movements and Ecology of Top Predators	None recorded	• 14 manybar goatfish or moano (*Parupeneus multifasciatus*) • 20 milletseed butterflyfish or lauwiliwili (*Chaetodon miliaris*) • 11 bluestripe butterflyfish or kīkākapu (*Chaetodon fremblii*) • 2 orange-cheek surgeonfish or na'ena'e (*Acanthurus olivaceus*) • 8 giant trevally or ulua aukea (*Caranx ignobilis*)
Bathymetric Mapping in Papahānaumokuākea Marine National Monument	• Deployed 39 XBTs (Expendable Bathyermographs) • 36 CTD (Conductivity, Temperature and Depth) casts occurred • 29,923 km^2 of multibeam mapping occurred • 146 Hours of in-water high resolution video recording • 98 hours of on-bottom high resolution video recording • 1,707 files of single-beam sonar surveys • 807 files of sub-bottom profiler surveys	• 2 amphibods or 'ukukai (*Amphipoda*) • 3 barnacle (*Scalpellidae*) • 4 samples of black coral or ko'a (*Antipatharia, Heteropathes pacifica* and *Parantipathes sp.*) • 4 brittlestar or pe'ape'a (*Ophiuroidea*) • 1 ctenophore (*Platyctenidae*) • 3 demosponge or hu'akai (*Cladohizidae* and *Stelodoryx sp.*) • 2 sample of demosponge or hu'akai (*Cladohizidae* and *Stelodoryx sp.*) • 10 samples of glass sponge or hu'ahu'akai (*Aulocalycoida-Hexactinosida, Caulophacus (oxydiscus) sp., Chonelasma sp., Farrea nr occa, Lefroyella sp.,* and *Lophocalyx sp.*) • 2 glass sponge or hu'ahu'akai (*Hyalostylus sp.* and *Semperella sp.*) • 18 samples of gorgonian coral or ko'a (*Acanthogorgia sp., Chrysogorgia averta, Chrysogorgia flavescens, Eknomisis sp., Hemicorallium sp., Iridogorgia sp., Iridogorgia sp., Isididae, Jasonisis sp., Keratoisis sp., Keratoisis sp., Narella, Pleurogorgia militaris,* and *Plexauidae*) • 1 mushroom coral or ko'a (*Pseudoanthomastus sp.*) • 3 hydrozoa • 2 mysid (*Mysidae*) • 31 manganese-crusted basalt rocks weighing (0.5 - 9.4 kg) • 2 sea lilly (*Comatulida* and *Sarametra triserialis*) • 2 seastar or pe'a (*Brisingidae* and *Pythonaster sp.*) • 1 shrimp (species unknown) • 4 squat lobster or ula (*Chirostylidae*) • 3 worm or ko'e (*Polychaeta*)
Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling	• 170,837 photos taken during AUV Sentry dives at Pioneer bank, Academician Seamount, French Frigate Shoals and Mokumanamana Island • 2,120 km^2 of multibeam mapping at Pioneer Bank, French Frigate Shoals and Mokumanamana Island • ~ 17 L of seawater	None recorded

Table 6 Continued. Observational, catch and release, and collection activities that occurred in 2015.

Permitted Research Project	Catch and Release or Observational Research	Biological or Physical Samples Collected
Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs (continued)	• 88 rapid mapping surveys conducted • 24 transect surveys conducted	• 48 snail or pipipi kōlea (*Littorarina pintado*) • 48 snail or pipipi (*Nerita picea*) • 11 snail or pūpū (*Purpura aperta*) • 285 black-foot limpet or ʻopihi makaiauli (*Cellana exarata*) • 271 yellow-foot limpet or ʻopihi ʻālinalina (*Cellana sandwicensis*) • 15 shingle urchin or hāʻukeʻuke (*Colobocentrotus atratus*) • 43 thin-shelled rock crab or ʻaʻama (*Grapsus tenuicrustatus*) • 13 intermediate drupe or pūpū awa (*Thais intermedia*) • 8 bubble shell (*Smaragdinella calyculata*) • 24 spotted drupe or makaloa (*Drupa ricina*) • 48 Hawaiian periwinkle or pipipi (*Echinolittorina hawaiiensis*)
Incidence and Amount of Plastic Ingestion in Five Petrel Species and Relate Patterns to Geographic Location, Age Classes, and Life-history Characteristics	None recorded	• 68 Bonin petrel (*Pterodroma hypoleuca*)
Species Inventory Update and Abundance Determination of Alien Marine Invertebrates Associated With Natural and Man Made Habitats Within the Monument	None recorded	• 1 tunicate or ʻūpī (*Ascidia sp.*)
Assessing Health and Community Structure of Corals on Shallow-water Reefs	• 214 transect surveys conducted • 1265 transect survey photos documented • 550 manta tow survey photos documented • 39, 3D surveys conducted	None Recorded
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems	None recorded	• 63 masked angelfish (*Genicanthus personatus*) • 63 Hawaiian dascyllus or ʻālo'iloʻi (*Dascyllus albisella*) • 52 threespot chromis (*Chromis verater*) • 53 goldring surgeonfish or kole (*Ctenochaetus strigosus*) • 44 potters angelfish (*Centropyge potteri*) • 35 yellowstriped squirrelfish or ʻalaʻihi (*Neoniphon aurolineatus*) • 30 yellowfish soldierfish or ʻūʻū (*Myripristis chryseres*) • 30 Hawaiian chromis (*Chromis ovalis*) • 21 regal parrotfish or lauia (*Scarus dubius*) • 20 soldierfish or ʻūʻū (*Myripristis amaena*) • 13 pacific gregory (*Stegastes fasciolatus*) • 9 whitetail chromis (*Chromis leucura*) • 4 yellow-threaded goatfish or weke nono (*Parupeneus chrysonemus*) • 4 chocolate-dipped chromis (*Chromis hanui*) • 3 butterflyfish (*Prognathodes sp.*) • 2 Hawaiian longfin anthias (*Pseudanthias hawaiiensis*) • 1 Hawaiian gregory (*Stegastes marginatus*) • 1 arc-eye hawkfish or pilikoʻa (*Paracirrhites arcatus*)

Table 6 Continued. Observational, catch and release, and collection activities that occurred in 2015.

Permitted Research Project	Catch and Release or Observational Research	Biological or Physical Samples Collected
Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology	None recorded	• 130 samples of ~20 cm^2 alga or limu • 6 samples of ~10 cm^2 sponges or huʻakai (*Prosuberites sp.* and *Stylissa carteri*) • 1 sample of ~20 cm^2 sponges or huʻakai (*Chondrosia sp.*) • 6 samples of ~20 cm^2 cyanobacteria • 3 samples of ~10 cm^2 Byozoa • 1 brittle star or peʻapeʻa (*Ophiuroidea*) • 1 sample of ~10 cm^2 black coral or koʻa (*Antipathes griggi*) • 1 sea star or peʻa (*Pentaceraster cumingi*) • 1 sea cucumber or loli (*Holothuria cf. dofleinii*) • 1 sample of ~10 cm^2 Tunicate or ʻūpī • 1 Zoanthid (*Palythoa caesia*) • 1 sample of ~10 cm^2 zonathid (*Parazoanthus sp.*) • 1 sample of ~20 cm^2 coral or koʻa (*Leptoseris hawaiiensis*) • 1 sample of ~10 cm^2 coral or koʻa (*Leptoseris sp.* and *Coscinaraea wellsi*) • 1 sample of ~20 cm^2 hydroid (*Litocarpia sp.*)
Monitoring of Laysan and Black-footed albatross from Midway Atoll, French Frigate Shoals and Laysan Island	• 21 GPS tags deployed • 14 GLS tags recovered	• 90 feathers from Laysan albatross or mōlī (*Phoebastria immutabilis*) • 99 feathers from black-footed albatross or kaʻupu (*Phoebastria nigripes*) • 9 samples of 1 mL blood from Laysan albatross or mōlī (*Phoebastria immutabilis*) • 9 samples of 1 mL blood from black-footed albatross or kaʻupu (*Phoebastria nigripes*)
Bleached Coral Recovery Assessment	None recorded	• 152 L of seawater • 372 samples of 4 cm^2 rice coral or koʻa (*Montipora capitata*)
Maintenance and Operation of a Radionuclide Aerosol Sampler/Analyzer (RASA) on Midway Atoll to Monitor the Comprehensive Test Ban Treaty	None recorded	• 36 air samples
Terrestial Sampling of Endemic Hawaiian Hyposmocoma Moths in Papahānaumokuākea	None recorded	• 9 moth larvae or ʻōpūlauoho (*Hyposmocoma nihoa)* • 11 moth larvae or ʻōpūlauoho (*Hyposmocoma menehune)* • 15 moth larvae or ʻōpūlauoho (*Hyposmocoma kikokolu)* • 5 moth larvae or ʻōpūlauoho (*Hyposmocoma sp.)*

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 2015.

Table 7. Remote monitoring instruments installed under research permits in 2015.

Permitted Research Project	Instruments Installed for Remote Monitoring
Bathymetric Mapping of Papahānaumokuākea Marine National Monument	• Installed 39 XBTs (Expendable Bathythermographs)
Deployment of High-Frequency Acoustic Recording Packages (HARPs) for Year-Round Cetacean Monitoring	• 1 High-Frequency Acoutic Recording Package (HARP) recovered and redeployed
Quantifying the Movements and Ecology of Top Predators	• 24 acoustic receiver moorings recovered

Above Deep-sea corals and sponges provide habitat and refuge for many other animals living on or near the seafloor. Here, a sponge covered with hundreds to thousands of tiny anemones also provides a home to several brittlestars (pink), crinoids or "sea lilies" (yellow), and a basket star (brown). Photo by NOAA Office of Ocean Exploration and Research, 2015 Hohonu Moana

Research Highlights

Exploring the Deep-Water Habitats of Papahānaumokuākea

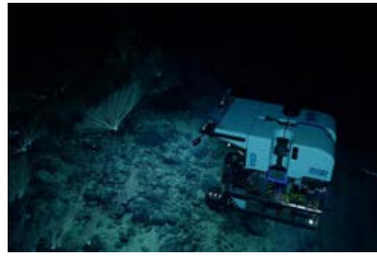
In August 2015, scientists aboard NOAA ship *Okeanos Explorer* conducted a 24-day expedition to explore deep-water habitats in Papahānaumokuākea as part of a four-leg mission called "Hohonu Moana: Exploring Deep Waters off Hawai'i." Since over 98% of PMNM lies at depths below 100 meters (more than 300 feet), most of the Monument's deep-water ecosystems have remained virtually unexplored. This expedition sought to provide baseline information on these little-known environments in order to support management and research efforts of the Monument.

Researchers used NOAA's two-body remotely operated vehicle (ROV) system to conduct 18 dives, some as deep as 4,829 meters – which is almost 16,000 feet, or 3 miles down. These dives, which totaled 95 hours of bottom time, included the deepest dive ever conducted inside the Monument. Many of the ROV surveys focused on identifying and characterizing vulnerable deep-water marine environments, particularly high-density communities of deep-sea corals and sponges. The dives discovered seven new high-density communities inside PMNM and extended the depth and geographic range of three previously known ones.

"As a result of the advanced technologies and capabilities aboard Okeanos Explorer, we have the opportunity to investigate scientific questions in much more detail than was possible," said Daniel Wagner, Ph.D., PMNM research specialist with NOAA's Office of National Marine Sanctuaries and expedition science co-lead. "The high definition cameras of the Okeanos Explorer's underwater vehicles allow us to see what deep-sea organisms look like in their natural environments."

The expedition also included the first-ever collection of physical specimens by the *Okeanos Explorer* since the exploratory research vessel was launched in 2010. A total of 90 specimens were collected, including 35 biological samples – all of which represent either likely new species to science or new records to the region. The expedition also made use of the *Okeanos Explorer's* multibeam sonar systems to generate high-resolution maps for more than 29,000 km2 of seafloor in the Northwestern Hawaiian Islands, including three seamounts inside PMNM that had never been mapped before.

A particularly fascinating aspect of this expedition was the ability for land-based scientists and the public to take part in the ROV dives via live streaming video feeds. The team onboard used a high-bandwidth satellite connection to stream data to shore-based exploration command centers, where scientists from around the world were able to participate in the expedition in real time. A total of 45 shore-based scientists from the U.S., Japan and Canada participated. In addition, the dives were broadcast over the Internet in real time, with lively commentary from Wagner and his co-lead scientist Christopher Kelley, Ph.D., from NOAA's Office of Exploration and Research. The live video feeds garnered more than 400,000 views over the course of the expedition.



Top *Okeanos Explorer's* ROV Deep Discoverer surveys a deep-water coral assemblage at 2000 m during an expedition to PMNM in2015. Photo by NOAA Office of Ocean Exploration and Research, 2015 Hohonu Moana

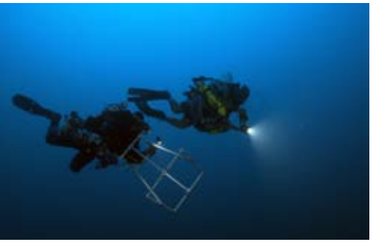
Above NOAA Ship *Okeanos Explorer* docked at Pearl Harbor. Photo by NOAA Office of Ocean Exploration and Research, 2015 Hohonu Moana

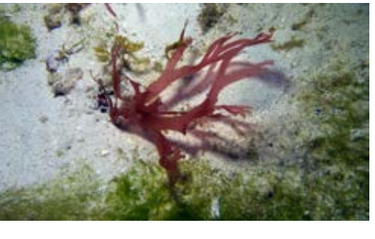
Left Expedition science leads Christopher Kelley (background) and Daniel Wagner (foreground) monitor an ROV dive in the science control room of the *Okeanos Explorer*. Photo by NOAA Office of Ocean Exploration and Research, 2015 Hohonu Moana

Below NOAA scientist Brian Hauk and Bishop Museum scientist Richard Pyle descend to a reef at 300 feet on Pioneer Bank, Papahānaumokuākea Marine National Monument. Photo by NOAA and Robert Whitton/ Bishop Museum

Bottom An unidentified red algae photographed at 290 feet, Pioneer Bank, Papahānaumokuākea Marine National Monument. It may represent a new record for the Hawaiian Islands (not recorded here before), or possibly a completely new species previously unknown to science. Photo by NOAA and Richard Pyle/Bishop Museum

Right A new species of seahorse collected by NOAA scientists at 300 feet on Pioneer Bank inside Papahānaumokuākea Marine National Monument. Photo by Brian Hauk/NOAA





Research Expedition Finds Highest Known Rates of Endemism

A 28-day research expedition in September 2015 aboard NOAA Ship *Hiʻialakai* to explore the deep coral reefs within Papahānaumokuākea yielded numerous species of marine life never before seen, including a possible new species of seahorse and a sea star not previously found in Hawaiʻi.

Using advanced diving technology to survey reefs at depths up to 300 feet, much deeper than conventional scuba gear allows, scientists were able to observe rarely seen ecosystems. Fish surveys at these depths around the northernmost atolls revealed an extremely high abundance of species found only in the Hawaiian Islands.

"On some of the deep reefs we surveyed, 100 percent of the fishes we recorded were endemic, meaning that they are all unique to the Hawaiian archipelago," said Randall Kosaki Ph.D., NOAA deputy superintendent of Papahānaumokuākea with the Office of National Marine Sanctuaries and chief scientist of the expedition. "This is the highest level of endemism recorded from any marine ecosystem on Earth."

The team was the first to dive on several open-ocean seamounts in the Monument, which were first mapped using high resolution multibeam sonar in 2014 and 2015. These undersea mountains rise from the floor of the ocean in 14,000 feet of water and summit within 200 to 300 feet of the surface.

Scientists collected specimens and photographs of new records of marine life from the seamounts, including potential new species of fish, algae and invertebrates. The specimens will be sent to experts at various museums around the world to confirm their identity.

The research team consisted of scientists from NOAA's Office of National Marine Sanctuaries, NOAA's Pacific Islands Fisheries Science Center, the Hawaiʻi Institute of Marine Biology, the Bernice P. Bishop Museum and Divers Alert Network (DAN). Scientists from DAN also conducted physiological studies on the divers when they came up from depths, the results of which will be made available once they are published.

Above A high-endemism reef fish community at 300 feet on Kure Atoll inside Papahānaumokuākea Marine National Monument. Every fish in the picture is a Hawaiian endemic species (not known from anywhere else except Hawaiʻi). Photo by NOAA and Richard Pyle/ Bishop Museum

Above Corals at southern site at Lisianski Island that were previously bleached in 2014, but showed signs of recovery in August 2015. Photo by Courtney Couch/Hawai'i Institute of Marine Biology

Researchers Follow up on Major Coral Bleaching Event in Papahānaumokuākea

In July and August 2015, researchers returned to Papahānaumokuākea to revisit sites affected by a mass coral bleaching event that occurred from August to October 2014 that primarily affected the central and northern Northwestern Hawaiian Islands. Lisianski Island was hit the hardest, with its corals experiencing up to 90% bleaching at depths less than 15 feet. The mass coral bleaching event was attributed to warming in the Northern Pacific ocean due to changes caused by the Pacific Decadal Oscillation, unusual warming in the Northern Pacific Ocean and climate change, unusually calm waters, and very sunny conditions. Mass bleaching occurs when corals are pushed beyond their thermal tolerance for extended periods of time. Their symbiotic algae, which give them their vibrant colors and 90% of their energy, leave or are expelled from the coral host, causing them to turn white. While corals that bleach can still recover if temperatures return to normal, prolonged bleaching can result in significant coral mortality.

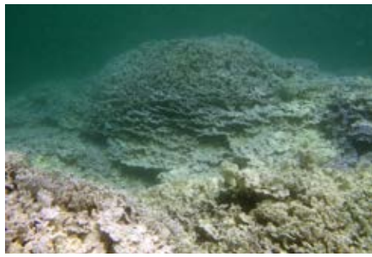
When Courtney Couch, Ph.D., from the Hawai'i Institute of Marine Biology, and her team returned to Lisianski Island in August 2015 to determine the extent of bleaching recovery or mortality, they got out of the water with mixed feelings.

On a positive note, bleaching levels had dropped, likely due to the fact that the regions were not experiencing thermal stress so early in the season, and a number of reefs showed positive signs of recovery, with many vibrantly colored corals in areas that were previously bleached in 2015.

Unfortunately, there was also considerable coral mortality surrounding Lisianski Island, where coral cover declined by 60% across the permanent sites. The most extensive mortality – 85 to 100% – occurred along the eastern coast of the island, which was once dominated by one of the Archipelago's last remaining large populations of the beautiful and endemic purple rice coral *Montipora dilatata*. Lower levels of mortality were observed at Pearl and Hermes and Midway Atolls.

In addition to conducting visual surveys, the team also photographed many of the sites to create 3-D reconstructions that HIMB researcher John Burns is using to assess the impact of bleaching-induced mortality on reef structure. So far, the team has learned that the extensive coral mortality observed along eastern Lisianski is resulting in reductions in both habitat complexity and volume, meaning fewer nooks and crannies to support reef life.

Couch concludes, "While we are all concerned by the bleaching-related mortality, we shouldn't lose hope. Many reefs in the Monument only bleached moderately or not at all and showed promising signs of recovery. Now we need to focus on understanding why some reefs and corals can cope better than others and how well reefs around Lisianski will be able to bounce back."



Top and Above Corals at a permanent site at Lisianski Island in 2014 and 2015 where most of the coral severely bleached in 2014. The top image was taken in September 2014. The purple rice coral *Montipora dilatata*, which covered 70% of the reef at this site in 2014, died during the last 11 months and resulted in 99% coral cover loss. The image above, taken in August 2015, shows the dead corals are now overgrown with algae, but may provide habitat for new corals to settle and grow on. Photo by Courtney Couch/Hawai'i Institute of Marine Biology

Left HIMB Team conducting coral health surveys. Photo by Chris Wall/Hawai'i Institute of Marine Biology

Researchers Discover New Moth Species on Nihoa Island

In June 2015, a new moth species was discovered on Miller's Peak on Nihoa Island. USFWS Scientist Jon Sprague collected the caterpillar's silk cases from the island for University of Hawai'i researcher Daniel Rubinoff, Ph.D., to study. The specimens belong to the genus *Hyposmocoma*, which is very diverse and contains over 400 species, all of them endemic to the Hawaiian Islands. These moths are found in a wide range of elevations, from sea level to 9,000 feet. This new species and others found on Nihoa are unique to the island and found nowhere else in the world.

Hyposmocoma larvae or ʻōpūlauoho behave like hermit crabs in that they take their case or home everywhere they go. Unlike hermit crabs, the caterpillars make their own cases out of self-spun silk and any material they find around them. There are many different types of cases within the genus that are used to help identify the species. The cases are named after their resemblance to common items such as burrito, cone, bowtie, candy wrapper, cloves, cigar, purse, bugles, etc. The larva of the newly discovered *Hyposmocoma* moth species from Nihoa has a cone-shaped case.

Discovering new species can be exciting and difficult when it comes to the genus *Hyposmocoma*. New species look very similar to previously discovered moths, which is typical for the genus. Adult moths or ʻōkaʻi, within case type, do not show much variation. As a result, a lot of time and effort is spent trying to identify new species. Fortunately, modern DNA analysis makes identifying different species much easier. After scientists collect caterpillars in the field, they are brought into the lab for analysis where the real magic happens. Caterpillars are reared to adult moths and then frozen for molecular work. In most cases, moths are DNA sequenced and new species are identified for description.

Below Looking west towards Dog's Head from East Valley. Photo by Tim Kroessig

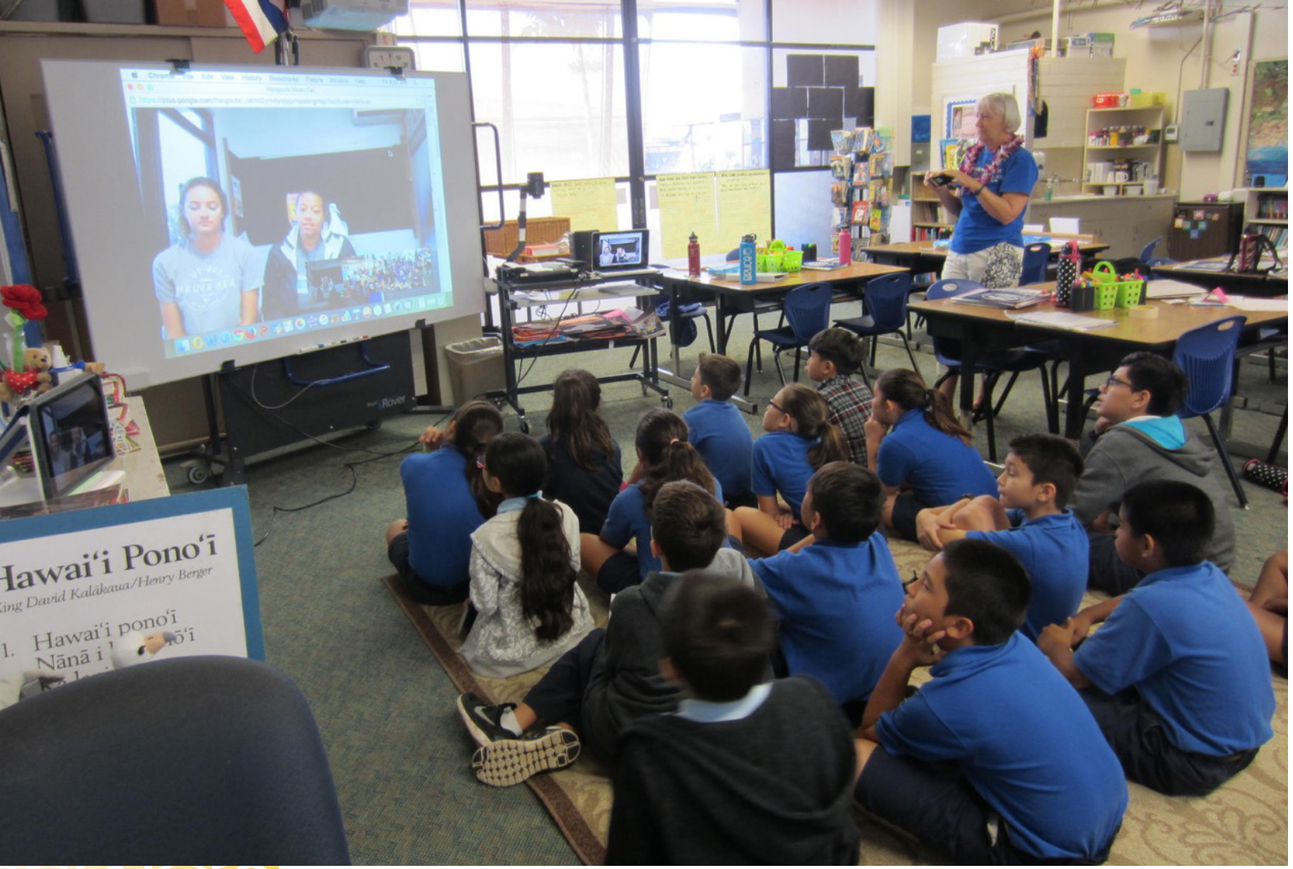
Right Diversity of *Hyposmocoma* larvae cases. Photo courtesy of Daniel Rubinoff/University of Hawai'i

Discovery of new moth species is important for both teaching and research purposes. These discoveries help us to better understand evolution across the Hawaiian Islands and beyond. All specimens are deposited in the University of Hawai'i Insect Museum, with additional material often going to the Bishop Museum and the U.S. National Museum (Smithsonian) to make the research more widely accessible. *Hyposmocoma* moth research has helped piece together a picture of what the NWHI looked like 11 to 14 million years ago. Knowing that each of the case types have specific ecological needs, researchers have reconstructed an image of the NWHI when they were young and mountainous. Purse cases tell us that there were forests and tree ferns and the giant purses indicate there were wet forests with trees. The carnivore cases demonstrate that there were tree snails of some kind as well as a rainforest, and the cone and burrito cases suggest there were streams. None of these features currently occur in the NWHI.

The discoveries of new *Hyposmocoma* moth species and their case types in the NWHI provide important ecological information about species found on the main Hawaiian Islands. Using the age of the species and their case types, researchers can confirm that the species in the main Hawaiian Islands originally evolved in the NWHI. Similarly, the case types provide their specific ecologies which reveal what the general forest structure and streams would have looked like on the islands. These *Hyposmocoma* moths serve as an important indicator species of evolution in the Hawaiian Islands. Each discovery of a new moth species provides one more piece of the puzzle.

Top Nihoa. Photo by Rachel Rounds

Above Adult *Hyposmocoma* moth. Photo courtesy of Daniel Rubinoff/University of Hawai'i



EDUCATION

While no education permits were issued in 2015, efforts continued to grow the development of field-to-classroom learning opportunities. To this end, several live Google Video Chat sessions were held between 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 in the 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. In the fall, three 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 that 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 2016.

Above Midway Atoll National Wildlife Refuge volunteers Google chat with Kamehameha third graders, facilitated by Barbara Mayer. Photo by Kainoa Kaulukukui-Narikawa/NOAA Sanctuaries

CONSERVATION AND MANAGEMENT

A total of 11 conservation and management permit applications were processed in 2015. Eight permits were issued (Table 8) and two applications were withdrawn by the applicant.

Table 8. Affiliations of conservation and management permittees and permitted projects in 2015.

Conservation and Management Permittee Affiliation	Number of Permits Issued	Permitted Conservation and Management Projects
Monument Co-Trustees[3]	1	• Monument Co-Trustees
NOAA, Office of Marine and Aviation Operations (OMAO)	3	• Support for permitted activities aboard NOAA Ship *Oscar Elton Sette* • Support for permitted activities aboard NOAA Ship *Hi'ialakai* • Support for Permitted Activities Aboard NOAA Ship *Okeanos Explorer*
NOAA, National Ocean Service (NOS), Office of National Marine Sanctuaries (ONMS), Papahānaumokuākea Marine National Monument (PMNM)	1	• Maritime Heritage Conservation and Management Activities
NOAA, National Marine Fisheries Service, Pacific Islands Regional Office & Pacific Islands Fisheries Science Center	2	• Selective removal of predatory sharks near Hawaiian monk seal pupping sites of French Frigate Shoals • Unmanned Aircraft System Monitoring Surveys of PMNM Resources
University of Hawai'i Marine Center	1	• Support for Permitted Activities Aboard R/V *Kilo Moana*

[3] See Table 9 (next page) for a detailed list of activities that occurred under the 2015 Co-Trustees Permit.

Table 9 below outlines activities that occurred in 2015, which were permitted under the Conservation and Management Monument 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 conservation and management of Monument resources.

Table 9. Activities conducted in 2015, which were permitted under the conservation and management Monument Co-Trustee permit in 2014, for NOAA, USFWS and DLNR.

Co-Managing Agency	Activities Conducted
USFWS, Hawaiian and Pacific Islands National Wildlife Refuge Complex	• Management, operation and maintenance of Midway Atoll facilities • Demobilization of Laysan Island and facilities • Laysan botanical collections • FAA Henderson Airfield seawall repairs and taxiway paving at Midway Island • *Verbesina* removal at Midway Atoll • Bulky dump restoration at Midway Atoll • Lead-based paint remediation at Midway Atoll • Seabird Tissue Archiving and Monitoring Project (STAMP) • M/V *Kahana* field support missions • M/V *American Contender* field support missions
USFWS, Pacific Islands Fish and Wildlife Office	• Nihoa Millerbird translocation to Laysan Island • Nihoa loulu (*Pritchardia remota*) seed collection • M/V *Searcher* field support missions
NOAA, National Marine Fisheries Service	• Marine debris removal • Sea turtle monitoring at French Frigate Shoals • Monk seal field camps/population assessment • Data collections requested by USFWS, Pacific Islands Fish and Wildlife Office
NOAA, Office of National Marine Sanctuaries	• Vessel support for conservation and management activities aboard M/V *Searcher* • Midway Atoll tide gauge station operation and maintenance
State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife	• Midway HMS media event • Management, operation and maintenance of Kure Atoll facilities
Office of Hawaiian Affairs	• Collection of hulu manu in partnership with the NOAA, NMFS, Hawaiian monk seal field camps

Conservation and Management Highlights

Scientists Discover Remains of World War II–era U.S. Navy ship

On August 3, 2015, during the annual month-long Reef Assessment and Monitoring Program (RAMP) cruise, a four-person maritime heritage team discovered the remains of a World War II-era U.S. Navy tanker, USNS *Mission San Miguel*, which sank nearly 60 years ago after running aground on Maro Reef. At 523 feet in length, it is the largest ship reported lost in the Monument.

Mission San Miguel was used to deliver petroleum products across the globe during WWII. On October 1, 1957, she departed Apra Harbor, Guam in the Mariana Islands, bound for Seattle, Washington, and ran aground on October 8, 1957, while running at full speed and carrying only ballast water. The Navy safely evacuated the 42-member crew, but the exact location of the wreck site was unknown due to poor LORAN (long range navigation) reception and bad weather.

Top Divers swim over the hull structure of USNS *Mission San Miguel*. Photo by Tate Wester/ NOAA

Above USNS *Mission San Miguel* (place and data unknown). Photo by Auke Visser/www.aukevisser.nl

Top The auxiliary helm of the USNS *Mission San Miguel* still standing as the ship rests on her port side. Photo by Tate Wester/NOAA

Above One of the USNS *Mission San Miguel's* anchors rests in the reef at Maro Reef. Photo by Rebecca Weible/NOAA

Following thoughtful study of the historic records of the loss event, along with analysis of the course the ship was running prior to running aground on the reef, the Maritime Heritage Field Team, led by Jason Raupp, Ph.D., Research Fellow in the Department of Archaeology at Flinders University in Australia, headed to Maro Reef in hopes of relocating this enormous shipwreck site that had been eluding maritime archaeologists for years. The ship was found lying on its side at a depth of 80 feet on Maro Reef, an intricate maze of reef with murky visibility. With barely any emergent land, it can often be a cryptic place to work.

"To identify the remains of this tanker in the maze-like structure of Maro Reef is thrilling," said Raupp. "We carefully researched the available data and worked closely with *Hi'ialakai* crew members and NOAA Corps officers to determine a search area that ultimately led to the location of the site."

Prior to its discovery, the ship had been listed as a potential environmental threat in NOAA's Remediation of Underwater Legacy Environmental Threats (RULET) project database, which identifies the location and nature of potential sources of oil pollution from sunken vessels. Since the discovery and survey, NOAA's Office of Response & Restoration and the U.S. Coast Guard were able to determine that it is no longer believed to be an environmental threat. Over time, the wreck has become a thriving artificial reef and will be left where it sank to be studied and mapped by scientists. Since researchers were not able to locate the entire ship, surveys for the remaining portions of the ship are planned for the future.

"This discovery gives us a rare, exciting glimpse at this period in maritime transport history and reminds us of the important role these unheralded working vessels played during World War II and in the decades following," said Kelly Keogh, Ph.D., PMNM maritime heritage program coordinator.

State Field Crews Contribute to Huli'ia Seasonal Calendar for Hōlanikū

Over the past five years, Pelika Andrade (Nā Maka o Papahānaumokuākea, Hawai'i Sea Grant, UH Hilo) and her colleagues have been developing and refining a tool called Huli'ia, which is based on a traditional Hawaiian worldview and relationship to place. Huli'ia, which means "to search", is intended to provide a mechanism to guide activities and best management practices for a geographic place and its natural cycles that would be most beneficial to the productivity and health of that place.

Hōlanikū, or Kure Atoll, is one of four places in the Hawaiian archipelago that will be highlighted in the Huli'ia seasonal calendar series. This "new-old" tool was developed on the foundation of the understanding of traditional roles, relationships, responsibilities and kinship people had with the natural world and their cultural landscapes. It was developed with the intent to ensure that future generations have the same knowledge, resources and opportunities of their ancestors.

Hōlanikū is managed by the State of Hawai'i DLNR's Division of Forestry and Wildlife (DOFAW). It lies at the northernmost end of the Hawaiian archipelago within the Monument. Since 1993, a dedicated crew of DLNR technicians and volunteers have worked to restore Hōlanikū's habitats by clearing invasive plants, reintroducing native plants, eradicating rats, hauling nets and marine debris off the reefs and beaches, and monitoring the health of the atoll's plant and animal populations. Field crews spend six months at a time living and working on the atoll. Activities at Hōlanikū provide field crews with the opportunity to integrate cultural practices into the adaptive management approach.

Left Winter 2015 Kure Field Team. Photo by State of Hawai'i DLNR/DOFAW

Below Kure. Photo by Cynthia Vanderlip/State of Hawai'i DLNR

Several years ago, one of Andrade's former students, Hāwane Rios, joined the field crew. With support, she successfully introduced the team to the Huliʻia process. Since then, the written and photographic documentation of observations has become part of field crews' daily activities. Field crew members observe, photograph and discuss many topics – everything from weather events to fruiting plants to seabird behavior – in order to capture visual changes across time and seasons. Hōlanikū field camp leaders Matthew Kanoa Saunter and Naomi Worcester agreed that the crews will utilize the seasonal calendar to adapt their restoration activities.

"The calendar will show timing and correlations that will allow us to track trends, connections and relationships," Saunter stated. Worcester added that practicing cultural observations has been valuable because "it gives volunteers the opportunity to develop observational skills and appreciate that aspect of the place because it catches all the things we can't define scientifically."

The project team will update the calendar as needed to better care for the place according to the needs and signs from the ecosystem. The other three communities in the Huliʻia seasonal calendar series, Kawaihae and Kaʻūpūlehu on Hawaiʻi Island and Hāʻena on Kauaʻi, will document community engagement interactions such as the intricacies of fishing, farming, education, sailing, paddling, restoration, hunting, recreation and more.

The final calendar, inclusive of all four communities, will ultimately support the conversation and documentation of best practices of mālama ʻāina (caring for the land) derived from this process. Overall, Huliʻia will support the union of Hawaiian culture, community and adaptive resource management by honoring and perpetuating a traditional way of understanding the environment.

Below Green Island at Kure Atoll. Photo by State of Hawaiʻi DLNR/DOFAW

Record-Breaking Number of Albatross Nests on Midway Atoll National Wildlife Refuge

"Kudos to all the people in this world who help preserve wildlife and outstanding landscapes – for us and for future generations to enjoy. Every bit of 'information' (like your albatross count), contribute to doing just that. Keep up the good work."

– USFWS Pacific Region Flickr post comment on photo of volunteer nest counters

Results from the latest annual nesting albatross census on Midway Atoll National Wildlife Refuge confirm that Midway continues to host the largest nesting albatross colony in the world. Nineteen volunteers systematically covered the entire surface of the atoll's three small islands counting active nest sites from each of two species – Laysan (mōlī) and black-footed albatross (kaʻupu) – from December 11, 2014 through January 2, 2015. Their final count resulted in over 1.39 million individual birds, assuming two adults per nest, for both species combined.

Above December 2014 volunteer albatross counters on Eastern Island on Midway Atoll National Wildlife Refuge systematically count nests resulting in record breaking nest count numbers for the 2015 hatch year. Photo by Dan Clark/USFWS

Above Albatross on Midway 2015 Photo by Dan Clark/USFWS

Right Volunteer albatross counters on Midway Atoll National Wildlife Refuge 2014-2015 Hatch Year Nest Count. Photo by USFWS

This year (hatch year 2015) far surpassed any previous documented year for nesting Laysan albatross on Midway Atoll, with 666,044 pairs recorded. The current year count for Laysan albatross represents a 52% increase over the average number from hatch years 2010 to 2014. Black-footed albatross nesting pairs came in at 28,610, also a new record, up 18% from the 2010-2014 average. The previous high year for Laysan albatross was 2006 with 487,527, and 2011 for black-footed albatross, with 28,581.

The reference "hatch year 2015" defines the albatross breeding season from the time eggs were laid in November 2014, hatched in January 2015, and expected to leave Midway Atoll by July 2015. This year reaffirms the importance Midway Atoll National Wildlife Refuge continues to play in the critical part of the Laysan and black-footed albatross life cycle. USFWS' management actions ensure adequate nesting sites are free of harm from non-native predators (such as mice) and invasive plant species to safeguard the overall survival of both species into the future.

"In the 1920s, the entire Laysan albatross population in the Northwestern Hawaiian Islands, where most of them historically nest, was estimated to be fewer than 20,000 birds owing to illegal egg poachers and feather hunters," noted Deputy Refuge Manager Bret Wolfe. "We'll be closely analyzing and comparing our data with those collected at other nesting sites within Papahānaumokuākea, like Kure Atoll State Wildlife Sanctuary, to determine if this year's numbers are an anomaly or part of a larger trend."

NATIVE HAWAIIAN PRACTICES

Four Native Hawaiian Practices permits were issued in 2015 (see Table 10). One activity supported the use of traditional ecological knowledge to examine nearshore ecosystems. Another was issued to the Polynesian Voyaging Society as part of their Mālama Honua Worldwide Voyage for a multidisciplinary expedition to leverage expertise and resources from scientists, marine managers, educators and cultural practitioners to further integrate western science and Native Hawaiian ways of knowing. Another group of practitioners was issued a permit to continue years of research relating the positioning of various Mokumanamana cultural sites to the movements of the sun, moon and stars. The fourth assessed the archaeological sites on the islands of Mokumanamana and Nihoa.

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
Nā Maka o Papahānaumokuākea & Conservation International	1	• Using Traditional Ecological Knowledge to Examine Nearshore Ecosystems
Polynesian Voyaging Society	1	• Malama Honua Worldwide Voyage, Sail to Papahānaumokuākea
Edith Kanaka'ole Foundation	1	• Summer Solstice Cultural Research and Native Hawaiian Practices on Mokumanamana (Necker) Island
University of Hawai'i, Center for Hawaiian Studies and Nohopapa Hawai'i	1	• Documentation and assessment of cultural sites on Mokumanamana (Necker) and Nihoa Islands

Native Hawaiian Practices Highlights

Science and Culture Come Together in First Joint Expedition to Papahānaumokuākea

With the Polynesian double-hulled voyaging canoe *Hikianalia* back in Hawai'i after a year and a half of sailing the South Pacific, the first destination on their Hawai'i sail plan was the island of Nihoa. This voyage was meant to give a younger generation of leaders an opportunity to voyage alone, with Polynesian Voyaging Society Kaleo Wong at the helm for the first time.

Below Crew does cultural protocol upon approaching Nihoa. Photo by Polynesian Voyaging Society and 'Ōiwi TV

Top The *Hikianalia* and *Searcher* off Nihoa in Papahānaumokuākea Marine National Monument. Photo by Hoku Johnson/NOAA Fisheries

Above ʻOpihi are abundant along the shoreline of Nihoa in Papahānaumokuākea Marine National Monument. Photo by Hoku Johnson/NOAA Fisheries

The sail was a difficult one given the weather. The tradewinds had disappeared the week before the scheduled departure date in late June, which left the navigators questioning if the canoe would make it to Nihoa. After leaving the Marine Education Training Center in Honolulu, the crew spent over two days coaxing the canoe with only light breezes across Kaʻieʻie Waho (the channel between Oʻahu and Kauaʻi) as well as Kaulakahi (the channel between Kauaʻi and Niʻihau). At one point, a large school of baitfish congregated under the waʻa and slowly followed along as the canoe inched across the ocean.

After finally reaching Lehua, just north of Niʻihau, the crew decided to postpone heading any further due to lack of wind. As the sun sank into the ocean, the crew spent the night under brilliant stars, the Hoku moon (one of four full moons in the monthly Hawaiian moon calendar) and felt light winds as their waʻa drifted in the currents. The next morning, a steady southwest breeze had filled in, and Captain Kaleo Wong decided to take the chance and attempt the journey. Kaleo and watch captain/apprentice navigator Jason Patterson held their course like veteran navigators, and the following morning Nihoa arose out of the sea off the starboard manu (bow) as the first light of dawn peaked over the horizon.

The trip also combined aspects of scientific research with Native Hawaiian traditional observations. Onboard *Hikianalia* were scientists from the Marine Monitoring Program of The Nature Conservancy of Hawaiʻi, who planned to conduct nearshore reef monitoring using protocols very similar to those done in the main Hawaiian Islands.

Once at Nihoa, the *Hikianalia* crew joined the intertidal monitoring researchers that had arrived aboard the R/V *Searcher* a few days earlier. The combined team conducted ʻopihi (Hawaiian limpet) counts and reef fish surveys as part of the annual intertidal zone monitoring efforts that have been ongoing in the Monument since 2009. This was the first time traditional navigators, cultural practitioners, and government and university scientists worked together in the field, sharing knowledge, experience and vision regarding how to best conserve the archipelago's natural and cultural resources.

"The best part about the joint expedition was being able to talk with the Hikianalia crew about ways to mālama, or care for, our ocean resources," said Makani Gregg, cultural researcher traveling aboard the R/V Searcher. "We were able to get on the shoreline with each other and count ʻopihi on some of the healthiest shorelines in the world."

Awe was the common feeling among all participants at the sight of the magnificent beauty of Nihoa's cliffs and the amazingly abundant resources around the island. These huakaʻi (voyage) have allowed many to develop relationships with these ancestral places as well as with each other. The trip exemplifies the Monument's mission to conduct seamless integrated management, blending contemporary science used to inform conservation activities with the traditional knowledge and Hawaiian worldview that dominates the land and seascapes of Papahānaumokuākea.

The expedition was sponsored by the Office of Hawaiian Affairs, NOAA's Office of National Marine Sanctuaries, Polynesian Voyaging Society, Texas A&M University, University of Hawaiʻi-Hilo, The Nature Conservancy, Conservation International Hawaiʻi, Kīpahulu ʻOhana, Nā Mamo o Muoleʻa, and Nā Maka o Papahānaumokuākea.

Top Researchers conduct surveys along the rocky shorelines of Nihoa in Papahānaumokuākea Marine National Monument. Photo by Hoku Johnson/NOAA Fisheries

Above *Hikianalia* crewmember Duane DeSoto looking on as the team approaches Nihoa. Photo by Polynesian Voyaging Society and ʻŌiwi TV

Left Cultural researcher Makani Gregg counts ʻopihi during a shoreline survey at Nihoa. Photo by Hoku Johnson/NOAA Fisheries

Documenting Cultural Resources and Ancestral Presence at Nihoa and Mokumanamana

In June and July 2015, Kekuewa Kikiloi, Ph.D., led a research team to Nihoa, located 155 miles northwest of Kauaʻi. Appearing inhospitable and uninhabitable from a distance, a closer view of the basalt island reveals numerous cultural sites that provide proof of human presence at Nihoa. For three days the team carried out archaeological mapping and limited excavations of agricultural terraces within the central amphitheater of the island.

For Kikiloi and fellow researcher Anan Raymond, it was a return to a land where they have spent a significant amount of time conducting research. Their work has contributed to a growing body of knowledge on how Native Hawaiians voyaged to, and thrived upon, a remote island outpost.

Kikiloi said, "This was an area of high sanctity in the past. It's a continuous source of mana (spiritual power) if we choose to connect with it."

After completing their studies at Nihoa, the crew traveled 150 miles northwest to Mokumanamana to conduct similar activities. As evidenced by the repetition of the word "mana" in its name, Mokumanamana is recognized as an island of paramount spiritual importance. It was a center of traditional ritual power and origin of a system of religious worship that eventually spread throughout the Hawaiian Islands before Western contact. It sits on the border between Pō (the realm of darkness, gods and the afterlife) and Ao (the realm of light and the living), the point in traditional Hawaiian philosophy where life emerged from darkness into light. The island also sits on the invisible line that depicts the northern limit of the sun, Ke Ala Polohiwa a Kāne (Tropic of Cancer), which is often a metaphor for the pathway to the afterlife. As the team prepared to arrive, a spectacular sunrise confirmed the dichotomy of light and darkness as the sky seemingly split into two halves.

Right Kekuewa Kikiloi along with his field team conduct archaeological surveys of agricultural terraces on Nihoa. Photo by Keola Lindsey/OHA

Kikiloi's ongoing research of the agricultural terraces on both islands has contributed to our understanding of how people were able to survive while visiting and utilizing these islands for religious and ceremonial purposes.

Above Boobies perch atop ceremonial shrines in the Monument. Photo by Kaleomanuʻiwa Wong

Celestial and Terrestrial Observations at Mokumanamana

In June 2015, Pua Kanakaʻole Kanahele, Ph.D., led a group of 10 cultural practitioners to conduct research during Ke Ala Polohiwa a Kāne (the summer solstice) on Mokumanamana which sits on the line depicting the northern limit of which the sun travels, the Tropic of Cancer, also named Ke Ala Polohiwa a Kāne. During two previous summer solstices and a winter solstice, the team recorded measurements and observations of the numerous heiau (shrines) on the island. These heiau are made of large upright stones called manamana, and observation platforms that were used in traditional ceremonies and often correlated with the traveling of the sun, the moon and the stars. The group also researched chants, songs and stories to piece together ancestral knowledge of the place and to reclaim place names specific to the island that may help in understanding its purpose.

Above Mokumanama On-island Research Crew. Photo by Kalei Nu'uhiwa

This particular expedition focused on star constellations in relationship to the sites, the upright manamana alignments, single manamana and pivot stones located on the various pu'u (hills) on the island. The measurements were taken during traditional time intervals called Kauila and occurred from sunset till sunrise and validated previous findings regarding celestial and terrestrial alignments on the island.

"When we look at manamana, our ancestors are showing us the knowledge they had of their environment," said Kanahele. "When we look at the sun, we're looking at a corridor that the sun offers us as our boundary to live in. We look at Ke Ala Polohiwa a Kāne as our northern boundary and Ke Ala Polohiwa a Kanaloa (the winter solstice and Tropic of Capricorn) as our southern boundary of existence. Within this existence is where we mark our place, our island, our spot in the universe - we've been doing that for centuries."

SPECIAL OCEAN USE

Each of the two Special Ocean Use (SOU) permit applications that were received and processed in 2015 was withdrawn.

Right Special ocean uses include filming, photography, and other related activities. Photo by Andy Collins/NOAA Sanctuaries

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 2015. 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. USFWS is considering visitation options in the future if operational support becomes available.

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

Below Papahānaumokuākea staff take time out to plant native species of vegetation at Midway Atoll. Photo by Greg Schubert/ USFWS

*Species Mentioned in the Permitted Activities 2015 Annual Report**

Marine Mammals

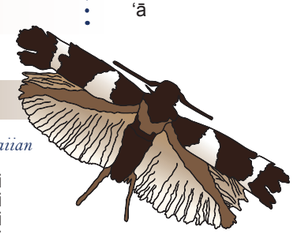
Scientific	*Common*	*Hawaiian*
Neomonachus schauinslandi	Hawaiian monk seal	ʻīlioholoikauaua

Fish

Scientific	*Common*	*Hawaiian*
Acanthurus olivaceus	orange-cheek surgeonfish	naʻenaʻe
Caranx ignobilis	giant trevally	ulua aukea
Centropyge potteri	russet angelfish	
Centropyge potteri	potters angelfish	
Chaetodon fremblii	bluestripe butterflyfish	kīkākapu
Chaetodon miliaris	milletseed butterflyfish	lauwiliwili
Chromis hanui	chocolate-dipped chromis	
Chromis leucura	whitetail chromis	
Chromis ovalis	Hawaiian chromis	
Chromis verater	threespot chromis	
Ctenochaetus strigosus	goldring surgeonfish	kole
Galeocerdo cuvier	tiger shark	
Genicanthus personatus	masked angelfish	
Sargocentron ensifer	yellow stripped squirrelfish	ʻalaʻihi
Myripristis amaena	soldierfish	ʻūʻū
Myripristis chryseres	yellowfish soldierfish	ʻūʻū
Neoniphon aurolineatus	yellowstriped squirrelfish	ʻalaʻihi
Paracirrhites arcatus	arc-eye hawkfish	pilikoʻa
Parupeneus chrysonemus	yellow-threaded goatfish	weke nono
Parupeneus multifasciatus	manybar goatfish	moano
Pomacentridae albisella	Hawaiian dascyllus	ʻaloʻiloʻi
Prognathodes sp.	butterflyfish	
Pseudanthias hawaiiensis	Hawaiian longfin anthias	
Scarus dubius	regal parrotfish	lauia
Stegastes fasciolatus	pacific gregory	
Stegastes marginatus	Hawaiian gregory	

Birds

Scientific	*Common*	*Hawaiian*
Diomedia nigripes	black-footed albatross	kaʻupu
Phoebastria immutabilis	Laysan albatross	mōlī
Pterodroma hypoleuca	bonin petrel	
Sula dactylatra	masked booby	ʻā



Insects

Scientific	*Common*	*Hawaiian*
Hyposmocoma kikokolu	moth	ʻōkaʻi
Hyposmocoma menehune	moth	ʻōkaʻi
Hyposmocoma nihoa	moth	ʻōkaʻi
Hyposmocoma sp.	moth	ʻōkaʻi

Invertebrates/Corals

Scientific	*Common*	*Hawaiian*
Acanthogorgia sp.	gorgonian coral	koʻa
Amphipoda	amphipods	ʻukukai
Antipatharia	black coral	koʻa
Antipathes griggi	black coral	koʻa
Ascidia sp.	tunicate	ʻūpī
Aulocalycoida-Hexactinosida	glass sponge	huʻahuʻakai
Brisingidae	seastar	peʻa
Caulophacus (oxydiscus) sp.	glass sponge	huʻahuʻakai
Cellana exarata	limpets (black foot)	ʻopihi makaiauli
Cellana sandwicensis	limpets (yellow foot)	ʻopihi ʻālinalina
Chirostyloidae	squat lobster	ula
Chondrosia sp.	sponge	huʻakai
Chonelasma sp.	glass sponge	huʻahuʻakai
Chrysogorgia averta	gorgonian coral	koʻa
Chrysogorgia flavescens	gorgonian coral	koʻa
Cladorhizidae	demosponge	huʻakai
Colobocentrotus atratus	shingle urchin	hāʻukeʻuke
Comatulida	sea lilly	
Coscinaraea wellsi	coral	koʻa
Drupa ricina	spotted drupe	makaloa
Echinolittorina hawaiiensis	Hawaiian periwinkle	pipipi
Echinometra oblonga	urchin	ina
Eknomisis sp.	gorgonian coral	koʻa
Farrea nr occa	glass sponge	huʻahuʻakai
Grapsus tenuicrustatus	thin-shelled rock crab	ʻaʻama
Hemicorallium sp.	gorgonian coral	koʻa
Heteropathes pacifica	black coral	koʻa
Holothuria cf. dofleinii	sea cucumber	loli
Hyalostylus sp.	glass sponge	huʻahuʻakai
Hydrozoa	hydrozoa	
Iridogorgia sp.	gorgonian coral	koʻa
Isididae	gorgonian coral	koʻa
Jasonisis sp.	gorgonian coral	koʻa
Keratoisis sp.	gorgonian coral	koʻa
Lanuginellinae	glass sponge	huʻahuʻakai
Lefroyella sp.	glass sponge	huʻahuʻakai
Leptoseris hawaiiensis	coral	koʻa
Leptoseris sp.	coral	koʻa
Litocarpia sp.	hydroid	
Littorina pintado	snail	pipipi kōlea
Lophocalyx sp.	glass sponge	huʻahuʻakai
Montipora capitata	rice coral	koʻa
Mysidae	mysid	
Narella	gorgonian coral	koʻa
Nerita picea	snail	pipipi
Ophiuroidea	brittlestar	peʻapeʻa
Palythoa caesia	zoanthid	
Parantipathes sp.	black coral	koʻa
Parazoanthus sp.	zoanthid	
Pentaceraster cumingi	sea star	peʻa
Platyctenidae	ctenophore	
Pleurogorgia militaris	gorgonian coral	koʻa
Plexauridae	gorgonian coral	koʻa
Polychaeta	worm	koʻe
Prosuberites sp.	sponge	huʻakai
Pseudoanthomastus sp.	mushroom coral	koʻa kohe
Purpura aperta	snail	pūpū
Pythonaster sp.	seastar	peʻa
Sarametra triserialis	sea lilly	
Scalpellidae	barnacle	pīʻoe
Semperella sp.	glass sponge	huʻahuʻakai
Smaragdinella calyculata	bubble shell	
Stelodoryx sp.	demosponge	huʻakai
Stylissa carteri	sponge	huʻakai
Thais intermedia	intermediate drupe	pūpū ʻawa

*Hawaiian naming practices differ from Western taxonomic nomenclature. Hawaiian names may be specific to a species or a group of organisms based on similar characteristics such as appearance, physiology, ecological function and habitat. For example, pipipi is the general name for a group of intertidal snails (e.g., *Echinolittorina hawaiiensis* and *Nerita picea*) and the name pipipi kōlea refers to the species *Littorina pintado*.

» Hawaiian phrase by Zepherin Kepelino Kahoali'i Keauokalani from ***Kepelino's Traditions of Hawaii*** (Beckwith, Martha WI, ed., Bernice P. Bishop Museum Bulletin 95, 1932). Front cover photo by Kaipo Ki'aha, Polynesian Voyaging Society and 'Ōiwi TV. Back cover photo by NOAA and Richard Pyle/Bishop Museum.

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