

PAPAHĀNAUMOKUĀKEA
Marine National Monument

Ka wā ma mua, ka wā ma hope
The future is in the past

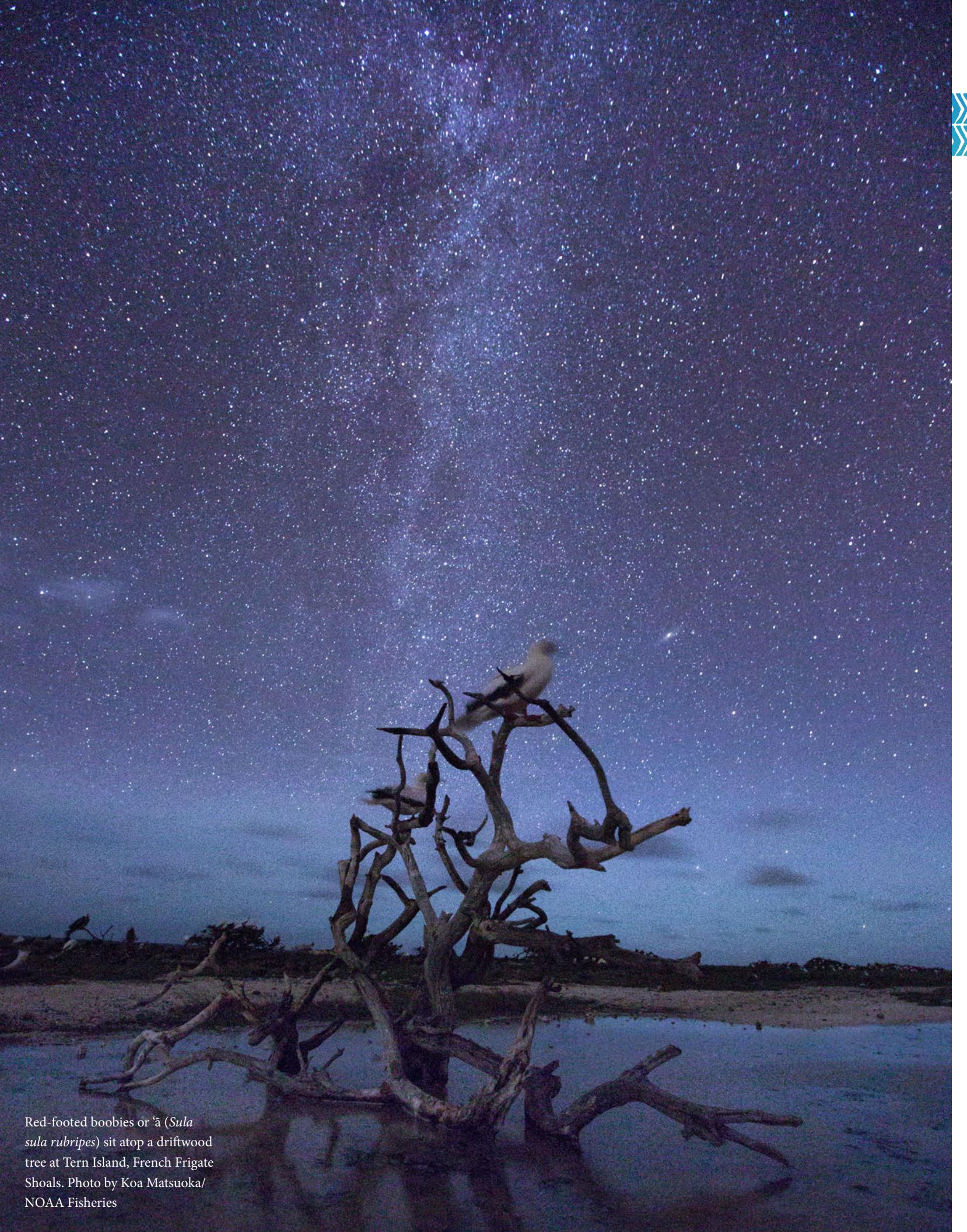


PERMITTED ACTIVITIES
2016 ANNUAL REPORT



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Red-footed boobies or ‘ā (Sula sula rubripes) sit atop a driftwood tree at Tern Island, French Frigate Shoals. Photo by Koa Matsuoka/NOAA Fisheries



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 honors the union of Papahānaumoku and Wākea, two ancestral gods believed to be the progenitors of the Hawaiian Islands, as well as the Native Hawaiian people. Focusing on the parts of the name, “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. As one name, Papahānaumokuākea is a symbol of potential and regeneration for the entire paeāina (Hawaiian archipelago).

Papahānaumokuākea Marine National Monument (“PMNM” or “Monument”) is administered jointly by four 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), the State of Hawai‘i through the Department of Land and Natural Resources (DLNR) and the Office of Hawaiian Affairs (OHA) (collectively, the “Co-Trustees”). The Co-Trustees work in close collaboration 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 the Office of Hawaiian Affairs and two sub-agencies each of NOAA, USFWS and DLNR. This unique management partnership of PMNM allows for the protection of the entire ecosystem, from remote sub-tropical islands to the deep sea, as well as areas of great archaeological and historic significance.

The Monument includes a number of existing federal conservation areas: the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (NWHI CRER), managed by the U.S. Department of Commerce through NOAA; Midway Atoll National Wildlife Refuge (MANWR), Hawaiian Islands National Wildlife Refuge (HINWR) and the Battle of Midway National Memorial, managed by the U.S. Department of Interior through the USFWS. These designated areas remain in place within the Monument, subject to their applicable laws and regulations in addition to the provisions of the Proclamation. The Monument also includes State of Hawai‘i lands and waters, managed by the State through the DLNR. There are two State designated conservation areas that predated Monument designation: the Northwestern Hawaiian Islands Marine Refuge and the Kure Atoll State Wildlife Sanctuary, which remain subject to their applicable State laws and regulations.

Inscription of the Monument as a UNESCO World Heritage site in 2010 added to the genealogy of protection and recognition of the NWHI as the only mixed natural/cultural site in the United States. This honor cumulates over one hundred years of safeguarding the area, starting with protections of Midway Atoll in 1903, when President Theodore Roosevelt sent the U.S. Marines to stop the slaughter of seabirds at Midway Atoll (see timeline of protection, pg. 8-9). It is important to note that historically, Native Hawaiians have regarded the region as sacred, and as such, this served as a form of human protection.

On August 26, 2016, President Obama signed Proclamation 9478 expanding Papahānaumokuākea Marine National Monument to include the waters and submerged lands to the extent of the seaward limit of the United States Exclusive Economic Zone (U.S. EEZ) west of 163° West Longitude and extending from the boundaries depicted on the map accompanying Proclamation 8031. At the time of its creation a decade prior, PMNM was the largest contiguous fully-protected conservation area in the United States at 139,797 square miles (362,073 km²). The expanded boundaries of the Monument make it once again the largest permanent fully protected area on the planet at 582,578 square miles (1,508,870 km²), nearly the size of the Gulf of Mexico.

Ua pa'a nā inoa kahiko

Ancient Names Remembered*

Mai kahiko mai, ua ho'opa'a 'ia nā inoa moku no kēia pae 'āina ma ka mo'olelo a me nā mele ko'i'honua, a 'o kekahi o nā moku, ua pa'a 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, Nāmakaokaha'i, and Wainu'u. 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, Pihehmanu (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. Pihehmanu 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 'ilioholoikauaua, which literally translates to "the quadruped running in the rough seas."

Kapou, Papa'āpoho (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." Papa'āpoho 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.

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

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

'Ōnūnui, 'Ōnūki, Pūhāhonu (Gardner Pinnacles)

'Ōnūnui means "large protuberance" and is a variant of the name Ununui, which refers to a large altar. 'Ōnūki 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, Kānemiloha'i, 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 Ni'iuhau. The nearest shoal-like place is French Frigate Shoals, an atoll of reefs, low sand islets, and the 120-foot-high La Pérouse Pinnacle. Moku (islet) combined with pāpapa (low, flat, expansive reef) means "islets with low-lying reefs." It is said that on this low, flat sand island, Pele (the volcano goddess) left one of her brothers, Kānemiloha'i, as a guardian during her first journey to Hawai'i from Tahiti.

Mokumanamana, Kamokumanamana, Hā'ena (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 Hā'ena, defined as "red-hot burning heat," possibly refers to the intensity of a specific kapu (restriction) or sacredness of the island. Hanakeumoe, 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.

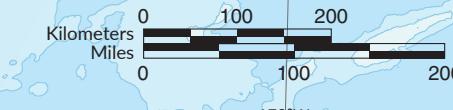
Nihoa, Nihoa-Kuhikuhipu'uone, Moku Manu (Nihoa Island)

In Hawaiian, Nihoa means "jagged" or "toothed," likely referring to the island's many craggy cliffs causing a profile that resembles a tooth. Kuhikuhipu'uone 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 Hanaka'ie'ie 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 haea hou mai? [Ancient names that have disappeared and been recovered?]. *Ka Āha'i O'oleo*, Puke VIII: III.

Kikilo, Kekuwa. "Rebirth of an Archipelago: Sustaining a Hawaiian Cultural Identity for People and Homeland." Honolulu: Kamehameha Schools, 2010. Print.

Original Papahānaumokuākea Marine National Monument Boundary
Expanded Papahānaumokuākea Marine National Monument Boundary





Timeline of Protections

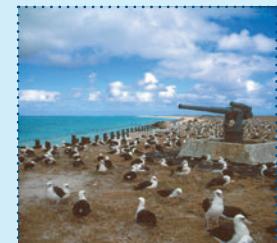
1900s 1910s 1920s 1930s 1940s 1950s 1960s 1970s 1980s 1990s



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.



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.

2000s



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.



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 200

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.

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.



2016
On Friday, August 26, 2016, President Barack Obama signs a proclamation expanding PMNM to 582,578 square miles (1,508,870 km²), nearly the size of the Gulf of Mexico, making it once again the biggest protected area - terrestrial or marine - on the planet.



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.



Monument Permitting Program

» Overview

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

ABOVE A juvenile Hawaiian monk seal or 'iloholoikauaua (*Neomonachus schauinslandi*) rests on a beach on Tern Island, French Frigate Shoals. Photo by Mark Sullivan/NOAA Fisheries

» 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 persons passing through PMNM without interruption does not constitute a permitted activity, however domestic vessels must provide notification prior to entering and 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 notification 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 Armed Forces must be carried out in a manner that avoids, to



ABOVE Famed undersea explorer Dr. Sylvia Earle is about to present President Obama with a picture of the fish that bears his name during his visit to Midway Atoll in September 2016. Official White House Photo by Pete Souza

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 the DOC, DOI and State of Hawai‘i Co-Trustees. 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 Proclamation 8031 in order to be approved by the 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 category 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.



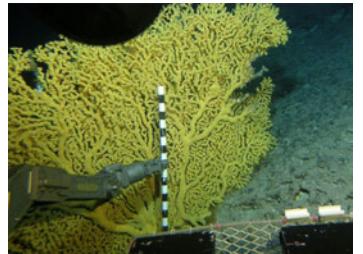
LEFT White tern chick or manu o kū (*Gygis alba*). Photo by Koa Matsuoka/NOAA Fisheries

BELLOW NOAA student intern Cameron Ogden-Fung swims with a Galapagos shark or manō (*Carcharhinus galapagensis*). Photo by Richard Pyle/Bishop Museum and NOAA





2016 Permitted Activities



ABOVE FROM LEFT TO RIGHT

A manipulator arm from a HURL Pisces manned submersible helps to measure an ancient gold coral or ko'a (*Kulamanamana haumeaae*) stand on a ledge approximately 500 m. depth at Bank 11 Northwest of Kure Atoll. Photo by NOAA Office of Ocean Exploration and Research

Nihoa Island from afar. Photo by Brad Ka'aleleo Wong/OHA

NOAA Ship *Oscar Elton Sette* crew loads collected debris into a storage container on the deck for transport back to Honolulu. After the nets are unloaded from the *Sette*, they will become electricity as part of Hawaii's Nets to Energy partnership with Covanta Energy and Schnitzer Steel. Photo by Kyle Koyanagi/NOAA Marine Debris Program

Marine debris is found in an array of different hues at Pearl and Hermes Atoll. Photo by April Surgent

In 2016, we celebrate a decade of accomplishments made in conservation management, restoration and discovery, and recognize Hawaii's role in ushering in a new genre of marine conservation: large-scale marine protected areas (LSMPAs). As we celebrate 10 years of Papahānaumokuākea Marine National Monument protections in the NWIHI, it is important to look back at the past even as we look forward to a bright future. A common theme of activities conducted in 2016 may be captured in the Hawaiian proverb (reflected on the cover), *Ka Wā Ma Mua, Ka Wā Ma Hope*¹, literally translates to “in the time in front, the time in back,” encompassing a view of the world that looks back at what came before to inform the perspectives and actions in the present and future, in essence it states that “the future is in the past.” A suite of activities was conducted by managers, cultural practitioners, community members and researchers, continuing ongoing collaborative research and embarking on new paths to discovery. The following projects from 2016 illustrate just a few of the many activities that occurred:

Deep-sea Communities

Scientists seek to understand the effects of decades of trawling on deep-sea corals and sponge communities.

Education

Hawaiian youth use the traditional forms of navigation of their ancestors to sail to the Northwestern Hawaiian Islands.

Monument Research and Conservation

NOAA ships *Oscar Elton Sette* and *Hi‘ialakai* serve as a home away from home for researchers, cultural practitioners and educators at work in PMNM.

Etched in Time

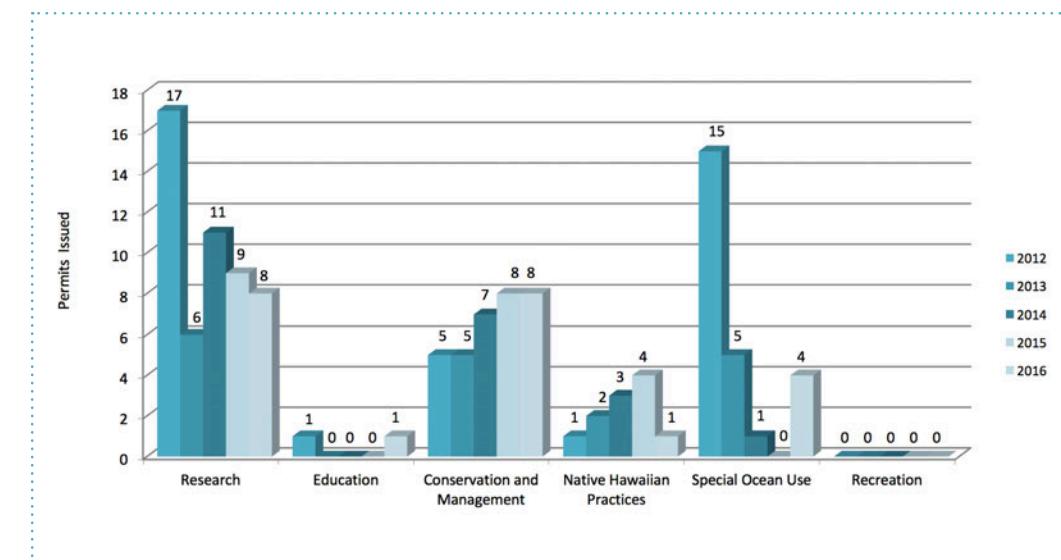
A field researcher and artist uses glass fishing floats which washed ashore in PMNM to create a body of work to share the Monument with the world.

¹ Hawaiian proverb - source unknown

» Permits Issued in 2016

In 2016, 29 permit applications were received and 22 permits were issued. All permit applications must complete a rigorous process of environmental and cultural review and documentation of meeting the applicable permitting criteria, which include the Findings in Proclamation 8031. As permit applications are reviewed and processed, individual applicants may elect to withdraw a permit application. This year, five applications were withdrawn and two were not issued and instead continued processing in 2017. Figure 1 displays a comparison of the number of permits by type issued from 2011-2016.

» **Figure 1.** Number of Monument permits issued from 2012-2016 by permit type.



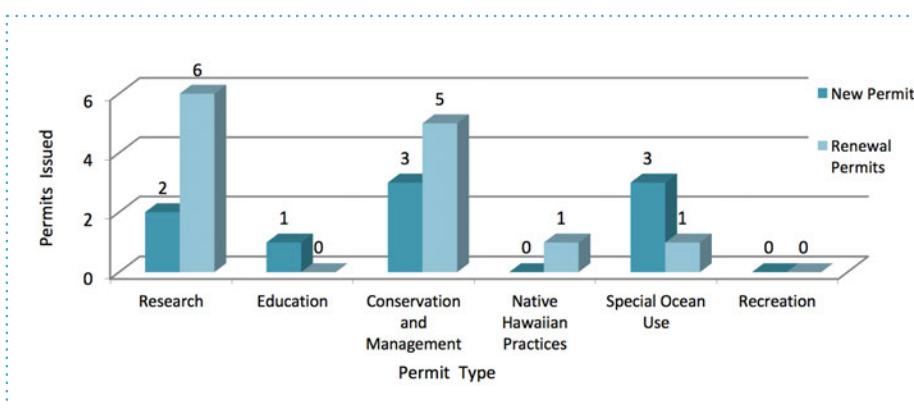
The Monument Co-Trustees grant both single- and multi-year permits. In calendar year 2016, the Monument Permitting Team tracked 52 permits, 30 of which were issued and active prior to 2016 (Figure 2). All active permits, regardless of year issued, were monitored for permitting and reporting requirements in 2016. 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 2012-2016.



Since 2011, 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 2016 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 vessel and and permit related aircraft 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.

» **Table 1.** The number of permit associated flights to and from the Monument from 2012 - 2016.

AIRPORT/AIRSTRIPE LOCATION	2012	2013	2014	2015	2016
Midway Atoll	55	38	22	26	33

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 2012 - 2016.

	2012	2013	2014	2015	2016
Vessel Entries and Exits	12	16	16	19	18
Individual Vessels Used	5	6	8	9	10

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 2011-2016². 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 2016 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 49 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 2012-2016.

ISLAND / ATOLL	2012			2013			2014			2015			2016		
	MIN	MAX	AVG	MIN	MAX	AVG	MIN	MAX	AVG	MIN	MAX	AVG	MIN	MAX	AVG
Nihoa	0	12	<1	0	12	<1	0	13	<1	0	10	<1	0	12	<1
Mokumanamana	0	3	<1	0	4	<1	0	3	<1	0	11	<1	0	5	<1
French Frigate Shoals	3	24	7	0	16	3	0	17	1	0	22	2	0	20	2
Laysan Island	6	27	8	0	27	5	0	14	1	0	25	<1	0	11	1
Lisianski Island	0	20	<1	0	7	<1	0	14	<1	0	23	<1	0	16	<1
Pearl and Hermes Atoll	0	20	<1	0	7	<1	0	10	<1	0	17	<1	0	17	1
Midway Atoll	66	97	76	43	69	55	41	48	46	43	60	51	39	64	49
Kure Atoll	6	28	6	6	13	7	6	15	6	6	17	7	6	6	6
TOTAL	97		70		54		60		59						

Table 3.2. Total amount of person-use days for each island and atoll in 2012-2016.

ISLAND / ATOLL	2012	2013	2014	2015	2016
Nihoa	102	91	110	39	52
Mokumanamana	10	8	3	48	8
French Frigate Shoals	2,631	1,283	472	1,045	776
Laysan Island	3,139	1,850	446	321	400
Lisianski Island	141	86	113	251	270
Pearl and Hermes Atoll	271	233	159	322	427
Midway Atoll	28,119	20,254	17,421	18,518	17,918
Kure Atoll	2,452	2,797	2,558*	2,773*	2,190*
TOTAL	36,865	26,602	21,282	23,317	22,041

*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 2016. Of the 73 active permits, many authorized activities were conducted 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.

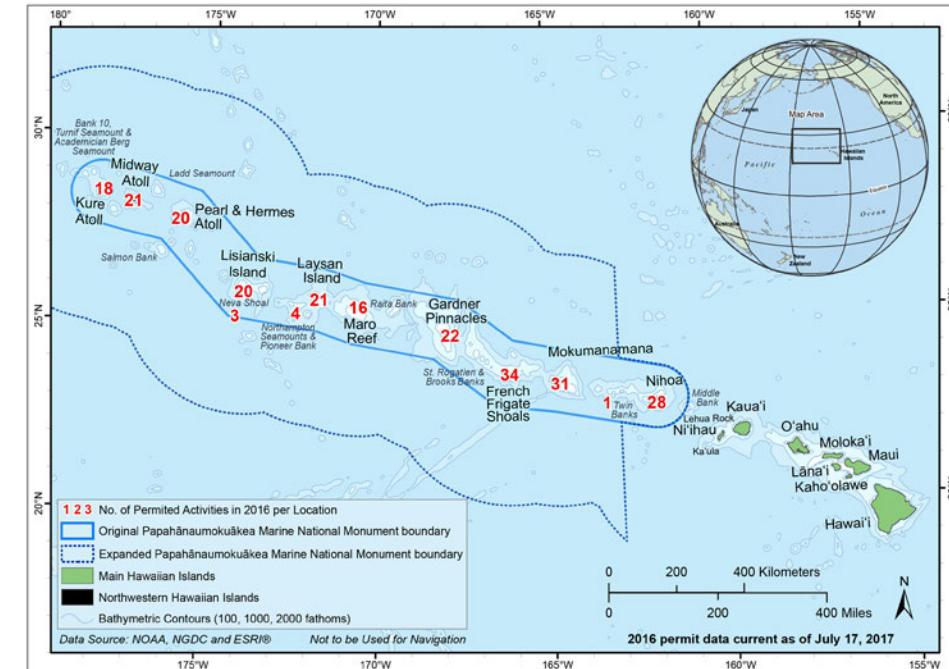


Figure 4. Locations of 2016 permitted activities. The number of permitted projects at each location is indicated in red.

» 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 number 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 focus on 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 2016, 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	189	101
Education	53	25
Conservation & Management	544	130
Native Hawaiian Practices	36	37
Special Ocean Use	33	37
Recreation	0	0
TOTAL	855	330



Details of 2016 Permitted Activities

» RESEARCH

A total of eight research permits, one amendment to a 2016 research permit and two amendments to a 2015 research permit were issued in 2016. Research permits were issued to Co-Trustee agency personnel, university researchers and other research organizations in Hawai‘i to conduct work on seabirds, insects, fish, corals, marine mammals, algae, nearshore and deep 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 2016.

RESEARCH PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED RESEARCH PROJECTS
NOAA, National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Program	1	• Pacific Reef Assessment and Monitoring Program
Hawai‘i Pacific University	2	• Plastic Ingestion in Four Petrel Species • Amendment to Include an Additional Petrel Species
University of Hawai‘i, Hawai‘i Institute of Marine Biology	1	• Characterization of Moray Eel Population Densities
University of Hawai‘i, Department of Plant and Environmental Protection Services	1	• Terrestrial Sampling of Endemic Hawaiian Hypsosomoma Moths in Papahānaumokuākea
Florida State University	1	• Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling
The Nature Conservancy	1	• Nearshore Reef Fish Assessments
University of California, Santa Cruz and San Jose State University	2	• Foraging Ecology of Great Frigatebirds and Boobies • Laysan and Black-footed Albatross Monitoring
NOAA, Office of Oceanic and Atmospheric Research, Unmanned Aircraft Systems Program & NOAA, National Ocean Service, Office of National Marine Sanctuaries	1	• Amendments to 2015 Permit for Bathymetric Mapping in Papahānaumokuākea Marine National Monument for the use of additional sonar frequencies and multibeam calibration instrumentation
Texas A&M University - Corpus Christi & University of Hawai‘i, Hawai‘i Institute of Marine Biology	1	• Amendments to 2015 Permit for Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs for Collection of Additional Intertidal Marine Invertebrates

Research projects permitted in 2016 included a variety of activities aimed at monitoring coral reef ecosystem health, studying the foraging ecology of seabirds and the characterization of Monument Moray eel or puhi (*Muraenidae sp.*) populations, among others. While eight new research permits were issued in 2016, 14 permits were issued in prior years and remained valid. Of these, 8 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 2016.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Species Inventory Update and Abundance Determination of Alien Marine Invertebrates Associated With Natural and Man Made Habitats Within the Monument	• None recorded	<ul style="list-style-type: none"> • 1 <i>Herdmania pallida</i> • 1 rough sea squirt (<i>Styela canopus</i>) • 1 <i>Polycarpa aurita</i> • 1 <i>Ascidia syndneiensis</i> • 1 <i>Ascidia archaia</i> • 1 <i>Didemnum perlucidum</i>
Assessing Health and Community Structure of Corals on Shallow-water Reefs	• 61 10-square meter transects at French Frigate Shoals, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll and Kure Atoll	• None recorded
Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology	• 25 50-square meter transects on closed circuit rebreathers at French Frigate Shoals, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll and Kure Atoll • 250 photoquadrats on closed circuit rebreathers at French Frigate Shoals, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, Midway Atoll and Kure Atoll	<ul style="list-style-type: none"> • 250 samples of alga or limu • 2 Obama fish (<i>Tosanoides obama</i>) • 6 orange margin butterflyfish or kikākapu (<i>Prognathodes basabei</i>) • 4 Struhsaker's damselfish (<i>Chromis struhsakeri</i>)



» **Table 6 Continued.** Observational, catch and release and collection activities that occurred in 2016.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling	<ul style="list-style-type: none"> • 150 hrs, 23 minutes of video transects via deep submersible at Pioneer Bank, Bank 11 and SE Hancock • 11 CTD casts from 0-1640 meters depth at Pioneer Bank and Bank 11 • 31 L of seawater • 4 samples of sponges or hu'akai • 4 samples of mollusks • 5 samples of 3-5 gram clippings of sponges • 22 whole invertebrates associated with corals • 11 samples of non-coralliid corals • 95 samples of 3-5 gram coral clippings red coral or ko'a (<i>Hemicorallium lauuense</i>) • 10 red coral or ko'a (<i>Hemicorallium lauuense</i>) • 14 deceased red coral or ko'a (<i>Hemicorallium lauuense</i>) • 3 bamboo coral or ko'a (<i>Isididae</i>) • 12 deceased bamboo coral or ko'a (<i>Isididae</i>) • 1 sample of 1 kg branch of Gold coral or ko'a (<i>Kulamanamana haumeaeae</i>) • 1 3-5 gram clipping of Gold coral or ko'a (<i>Kulamanamana haumeaeae</i>) • 11 deceased Gold coral or ko'a (<i>Kulamanamana haumeaeae</i>) • 37 samples of 3-5 gram clippings of octocorals • 90 samples of 3-5 gram clippings of pink coral or ko'a (<i>Pluerocorallium secundum</i>) • 20 pink coral or ko'a (<i>Pluerocorallium secundum</i>) • 17 deceased pink coral or ko'a (<i>Pluerocorallium secundum</i>) • 30 samples of 3-5 gram clippings of hard corals or ko'a (<i>Scleractinians</i>) • 2 hard corals or ko'a (<i>Scleractinians</i>) • 28 deceased hard corals or ko'a (<i>Scleractinians</i>) 	

ABOVE NOAA scientific divers Jason Leonard and Daniel Wagner descending to a cave at 250 feet at Pearl and Hermes Atoll. Accompanying them are a giant trevally or ulua aukea (*Caranx ignobilis*) and a Galapagos shark or manō (*Carcharhinus galapagensis*). Photo by Richard Pyle/Bishop Museum and NOAA

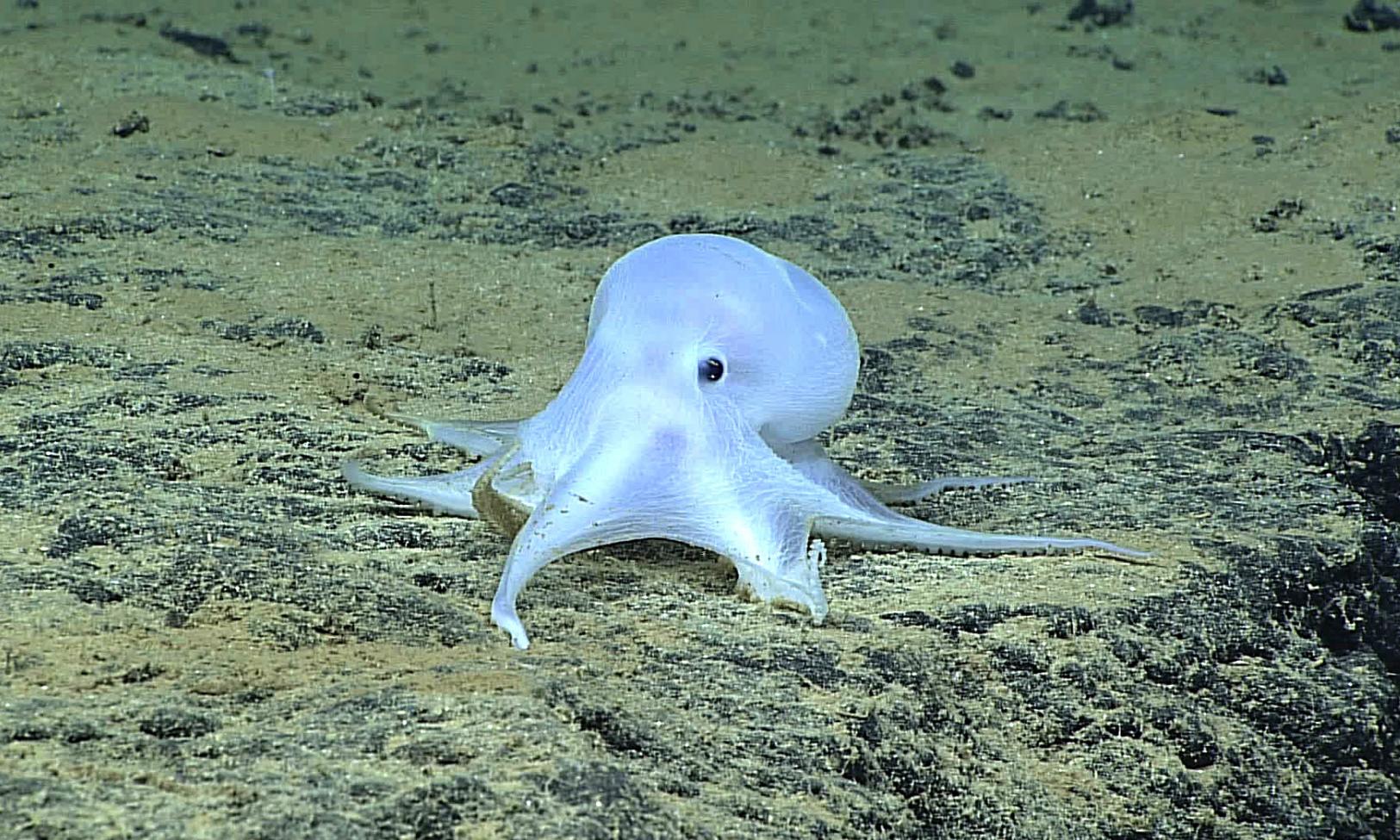
» **Table 6 Continued.** Observational, catch and release, and collection activities that occurred in 2016.

PERMITTED RESEARCH PROJECT	CATCH AND RELEASE OR OBSERVATIONAL RESEARCH	BIOLOGICAL OR PHYSICAL SAMPLES COLLECTED
Pacific Reef Assessment and Monitoring Program	<ul style="list-style-type: none"> • 331 transect surveys on SCUBA • 5,460 photoquadrats on SCUBA 	<ul style="list-style-type: none"> • 335 L of seawater • 13 coral fragment samples from French Frigate Shoals, Lisianski Island, Pearl & Hermes Atoll and Kure Atoll
Nearshore Reef Fish Assessments	<ul style="list-style-type: none"> • 36 5-minute timed swim fish surveys • 22 presence/absence fish surveys • 223 depth soundings • 180 photographs from timed swim surveys 	<ul style="list-style-type: none"> • 25 bigscale soldierfish or 'u'u (<i>Myripristis berndti</i>)
Laysan and Black-footed Albatross Monitoring	<ul style="list-style-type: none"> • Deploy and recover 20 Laysan albatross or möli (<i>Phoebastria immutabilis</i>) tags • Deploy and recover 20 Black-footed albatross or ka'upu (<i>Phoebastria nigripes</i>) tags • Deploy 7 Laysan albatross or möli (<i>Phoebastria immutabilis</i>) tags • Deploy 7 Black-footed albatross or ka'upu (<i>Phoebastria nigripes</i>) tags 	<ul style="list-style-type: none"> • 81 body contour feathers from Laysan albatross or möli (<i>Phoebastria immutabilis</i>) • 78 body contour feathers from 26 black-footed albatross or ka'upu (<i>Phoebastria nigripes</i>) • 6.75 ml blood sample from 27 Laysan albatross or möli (<i>Phoebastria immutabilis</i>) Phoebastria nigripes • 6.5 ml blood sample from 26 black-footed albatross or ka'upu (<i>Phoebastria nigripes</i>)
Terrestrial Sampling of Endemic Hawaiian Hyposmocoma Moths in Papahānaumokuākea	<ul style="list-style-type: none"> • None recorded 	<ul style="list-style-type: none"> • 14 moth casings (<i>Hyposmocoma sp.</i>)

Other research activities involved the use of temporary devices to remotely monitor habitat variations, such as temperature, salinity, changes in sedimentation and organism recruitment. These instruments are essential to obtaining long-term ecological data necessary for effective resource management in the face of climate change and other global threats to the Monument. Table 7 describes the temporary instruments installed or deployed in 2016.

» **Table 7.** Remote monitoring instruments installed under research permits in 2016.

PERMITTED RESEARCH PROJECT	INSTRUMENTS INSTALLED FOR REMOTE MONITORING
Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling	<ul style="list-style-type: none"> • TMC-1 current meter and data logger



» Research Highlights

Discovering the Depths of Papahānaumokuākea

In 2016, researchers continued to unlock the deep-sea mysteries of Papahānaumokuākea. Two separate science expeditions aimed to better understand deep-water habitats of the Monument: NOAA Ship *Okeanos Explorer* used its dual-system Remotely Operated Vehicles (ROVs) to explore seamounts and ridges at depths up to nearly 4,000 meters, and the University of Hawaii R/V *Kaimikai-O-Kanaloa* (Hawaiian for “Heavenly Searcher of the Sea”) helped deploy their Hawai‘i Undersea Research Laboratory (HURL) Pisces submersible to investigate the impacts of past trawling events on seamount coral and sponge communities. Combined, these two research cruises resulted in remarkable discoveries.

The *Okeanos Explorer*, dubbed “America’s Ship for Ocean Exploration,” embarked on a 15-day cruise to PMNM and beyond from February 26 to March 12, 2016. Despite rough ocean conditions throughout the cruise, researchers managed to explore many deep sea features. On one dive northeast of Mokumanamana to explore the geology of a ridge, a new species of octopod was discovered. Upon first observing the small white creature, HURL scientist Dr. Chris Kelley said, “I have never, like ever, seen that one.” The octopod or he‘e

ABOVE While exploring at depths of over 4,000 meters northeast of Mokumanamana, scientists aboard NOAA Ship *Okeanos Explorer* encounter this ghostlike octopod or he‘e, which is almost certainly an undescribed species and may not belong to any described genus. Photo by NOAA Office of Ocean Exploration and Research, Hohonu Moana 2016

was discovered at a depth of 4,290 meters and its friendly ghost-like appearance quickly earned it the nickname “Casper” after the well-known children’s cartoon character. Other highlights of the cruise included:

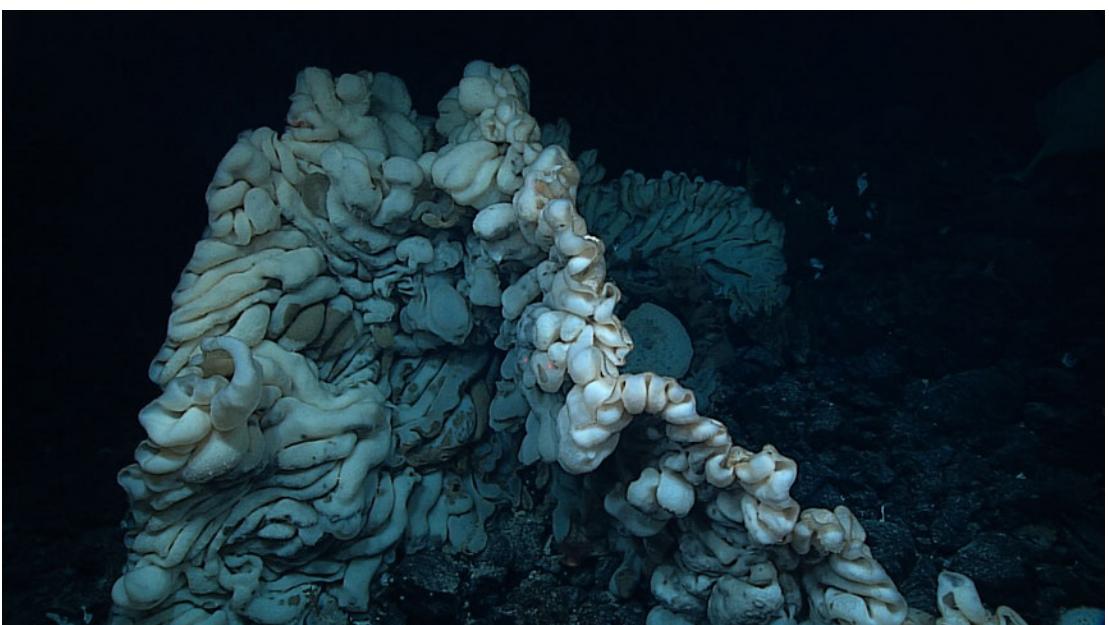
- A total of eight ROV dives amounting to nearly 40 hours of bottom time, surveying almost five kilometers of seafloor at depths ranging from 648 to 4,292 meters.
- Discovery of high-density sponge and coral communities at depths approaching 4,000 meters, including the deepest high-density community documented in PMNM to date.
- A total of 249 different types of organisms observed, the majority which represent undescribed species.

Later in the year, the *Kaimikai-O-Kanaloa* was contracted by Dr. Amy Baco-Taylor of Florida State University to conduct the third year of Dr. Baco-Taylor’s seamount research. The 31-day cruise (October 18–November 17, 2016) studied the impacts of trawling on seamount communities within the original Monument boundaries as well as in the Monument Expansion area. The activity resulted in over 140 hours of video footage of various seamount habitats and 484 samples of coral and other invertebrates, many representing potential new species. Analysis of video footage and sample collections are still on-going, however, this important research will lead to a better understanding of recovery rates for deep coral and sponge communities from the impacts of trawling.

Exploration of deep-sea habitats, much of which has yet to be mapped nor seen by man, will be critical in characterizing the resources within the new boundaries of Papahānaumokuākea.

LEFT This massive sponge, about the size of a minivan, was discovered at 7,000 feet during a remotely-operated vehicle dive on a ridge extending from a seamount south of Pearl and Hermes Atoll within Papahānaumokuākea in 2015. Scientists from NOAA’s Office of National Marine Sanctuaries, NOAA’s Office for Exploration and Research and the University of Hawai‘i described the sponge after a year of study. Photo by NOAA Office of Exploration and Research, Hohonu Moana 2015

BELLOW A HURL Pisces manned submersible collects a sample from a *Corallium regale* colony that had been damaged by a trawling net. Photo by HURL



Seabird Foraging Research Informs Breadth of Marine Debris in the North Pacific

Research led by Dr. David Hyrenbach of Hawai‘i Pacific University focuses on the ecology and conservation of seabirds by studying how they use the marine ecosystem and overlap with human threats. Over the past decade, he has conducted research in PMNM, home to 19 seabird species, including the largest breeding population of Laysan albatross or mōlī (*Diomedea immutabilis*) and black-footed albatross or ka‘upu (*Diomedea nigripes*) in the world.

Seabirds are top predators in the marine food web, making them good bio-indicators of the health of marine ecosystems. In particular, many Hawaiian seabirds ingest floating plastic, which they feed to their chicks. Between 2006 and 2015, Hyrenbach and his graduate students necropsied 350 opportunistically-sampled seabird specimens from French Frigate Shoals.

Plastic ingestion occurred in 11 of the 16 species sampled (68.75%), with size of ingested plastic ranging from < 1 mm (in Tristram’s storm petrel) to a few cm (in albatrosses). (Picture 1) This research also documented one new instance of plastic ingestion in a previously unknown species: the brown booby or ‘ā (*Sula leucogaster plotus*). Plastic incidence (percent of specimens with plastic) ranged from 0% to 100%, with no differences across foraging guilds³. Overall, four species had very high percentages of plastic (> 90% of chicks containing plastic): Tristram’s storm petrel, Bonin petrel, Laysan albatross and black-footed albatross.

Analysis of the boluses (packages of regurgitated indigestible materials similar to owl pellets) of black-footed and Laysan albatross chicks at the end of the

BELOW Examples of plastic items ingested by seabirds, highlighting the variety of fragment colors and sizes, ranging from < 1 mm in the Tristram’s Storm-petrel (A) to a few cm in the Laysan Albatross or mōlī (*Diomedea immutabilis*) (B). Note the 10 mm grid scale, used for reference. Photo by Dan Rapp/ Hawai‘i Pacific University

RIGHT Two black-footed albatross or ka‘upu (*Diomedea nigripes*) watch over their chick at French Frigate Shoals. Photo by Mark Sullivan/NOAA Fisheries



³ A guild is a group of species that exploit the same resources.



breeding season revealed widespread plastic ingestion across four study sites (Kure Atoll, Midway Atoll, Tern Island and Laysan Island), with 100% of the boluses containing plastic. Kure Atoll boluses contained the highest loads, with plastic accounting for 60% of the bolus mass, on average. Analysis of the ingested plastic fragments according to the resin codes used by the Society of Plastic Industry revealed that the majority of the ingested fragments are from plastics not commonly recycled, such as containers, toothbrushes, lighters, etc., which are most persistent in the marine environment.

Tracking of breeding black-footed albatrosses using satellite-linked transmitters and archival tags has revealed that, unlike the birds from Tern Island, Kure Atoll birds do not commute to the West Coast of North America during the breeding season. Instead, they forage in oceanic waters of the Northwestern Pacific, and repeatedly visit the seamounts of the Emperor Chain.

Hyrenbach continues to research seabird ingestion of plastic to increase public awareness of the impacts of marine debris on seabird populations and the marine ecosystem. Currently, studies are focusing on petrels and albatrosses, with the aim of understanding individual and population-level effects of marine debris, determining the origin of plastics found in the marine environment and investigating whether color preferences or association with natural prey influence seabird ingestion of plastic. Research such as Hyrenbach’s is important to the continued health of the Monument and to the seabird colonies within its protected waters.

ABOVE Seabird monitoring at French Frigate Shoals. Photo by Dan Rapp and Sarah Youngren/ Hawai‘i Pacific University



Exploring the Mesophotic Coral Reefs of Papahānaumokuākea

Every year since 2009, Dr. Randall Kosaki, the Monument's NOAA Deputy Superintendent for Research and Field Operations, has led efforts to investigate and document the biodiversity of Papahānaumokuākea within unexplored mesophotic ecosystems – deep coral reefs between 150-300 feet depth. The annual research expeditions typically uncover new biological records and species, and monitor for invasive fish and algae species such as roi (peacock grouper, *Cephalopholis argus*) and red algae or limu ‘ē (*Hypnea musciformis*). Using advanced diving technology involving closed-circuit rebreathers and trimix (oxygen, nitrogen and helium) gas mixes, Dr. Kosaki and colleagues from the Bernice Pauahi Bishop Museum and the University of Hawai‘i have been able to access mesophotic depths outside the range of conventional SCUBA. Deep coral reefs at depths of 150 to 500 feet, also known as the mesophotic or “coral reef twilight zone,” are among the least explored of all marine ecosystems. Deeper than most SCUBA divers can venture, and shallower than most submersible-based exploration, these reefs represent a new frontier for coral reef research.

ABOVE A male Hawaiian pigfish (*Bodianus bathycapros*) at 320 feet, Kure Atoll. This species has not previously been seen by divers, and the male color form was completely unknown (males and females have different coloration). Deep reefs at Kure Atoll were discovered to have the highest levels of endemism known from any marine ecosystem on Earth. Photo by Richard Pyle/Bishop Museum and NOAA

“Most coral reef research to date has been conducted in less than a hundred feet of water, yet coral reef habitat extends well below 300 feet,” explained Dr. Kosaki. “Using deep-diving technology, we are the only scientists to document first-hand the biodiversity of Hawai‘i’s northernmost deep coral reefs.”

To date, the list of the accomplishments that have resulted from exploring the Monument’s deep reefs include:

- Documenting the highest levels of endemism recorded from any marine ecosystem on Earth
- Discovery of three new fish species
- Increased the number of fish species known from PMNM by 25%
- One new starfish record
- Over seventy new species of algae collected (to date, four of these have been described)
- Over 600 dives recorded
- Over 9 km² of mesophotic habitat surveyed
- Over 10 scientific papers published

Although research expeditions have been going to PMNM to explore deep reefs for the last eight years, there is still much more to discover. The annual cruises are limited to only 25-30 days, which only allows researchers to scratch the surface when it comes to documenting the vast mesophotic areas within PMNM. Given the largely unexplored areas of PMNM, the future looks bright for discovery and new insights into deep coral reefs.



BELOW LEFT NOAA scientist Dr. Randy Kosaki dives on a closed-circuit rebreather at 280 feet, Laysan Island. Photo by Richard Pyle/Bishop Museum and NOAA

BOTTOM LEFT An unidentified species of sea anemone on a deep reef at Midway Atoll, 300 feet. Photo by Richard Pyle/Bishop Museum and NOAA

BELOW RIGHT A school of Elegant Anthias (*Caprodon unicolor*), one of the most common fishes at 320 feet, Kure Atoll. These are Hawaiian endemic fishes (not known from anywhere else on Earth except Hawai‘i). Photo by Richard Pyle/Bishop Museum and NOAA

Understanding Movement of Large Marine Predators in the Monument

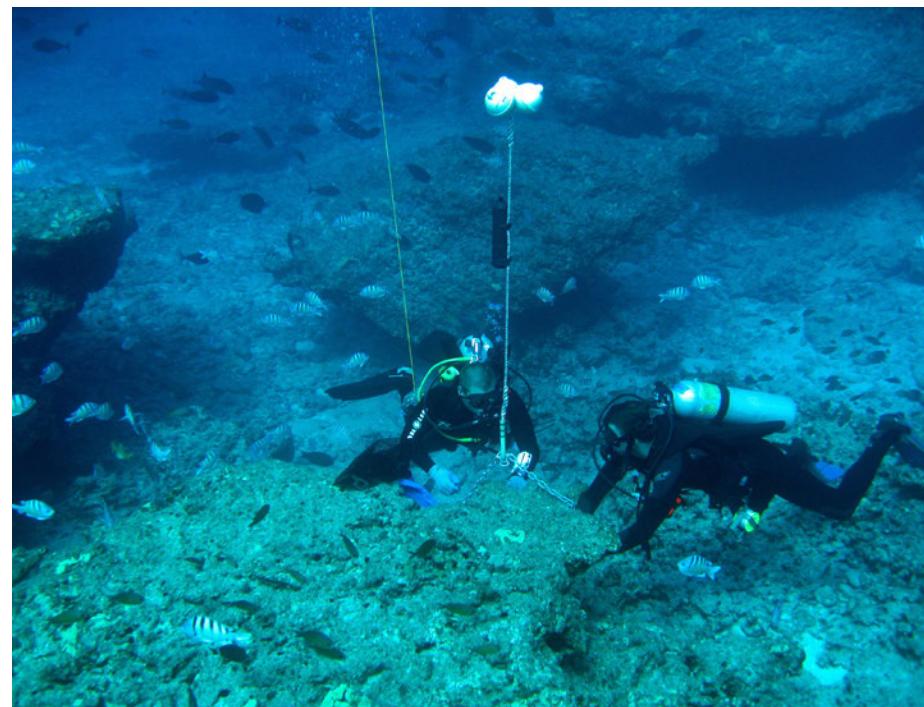
BELow A large female tiger shark or manō (*Galeocerdo cuvier*) is rolled onto her back to place her in tonic immobility (a trance-like state). When in tonic immobility, sharks remain calm and docile, allowing researchers to measure and tag them. Photo by Luis Rocha

RIGHT Divers Carl Meyer and Christian Clark install an acoustic receiver on the reef at Midway Atoll. Underwater acoustic receivers listen out for fishes and sharks tagged with ultrasonic transmitters. Photo by Kevin Flanagan

Marine protected areas such as Papahānaumokuākea aim to protect species by conserving their preferred and critical habitats. However, they can only effectively provide protection when animals remain within the boundaries, which are not recognized by the creatures they seek to protect. In order to effectively manage and conserve natural resources, managers need to understand how far animals travel and which habitats they prefer.

Research on marine predators in Papahānaumokuākea conducted by Carl Meyer of the UH-Mānoa's Hawai'i Institute of Marine Biology began with very simple questions about movements. How far do they travel? How predictable are their movements? Which species move between atolls, and which swim further afield to the Main Hawaiian Islands or beyond into open ocean?

After a decade of study, Meyer found that most large marine predators in the Monument are highly resident at their "home" atolls and very rarely move between islands or further afield. Highly resident predators include large fishes like giant trevally or ulua aukea (*Caranx ignobilis*) and snapper or uku



(*Lutjanus sp.*) and also reef sharks or manō. Although highly site-attached to their home atolls or islands, most of these species move extensively within these locations, with some of these movements synchronized by season and moon phase. For example, ulua from all over French Frigate Shoals congregate at the southwest edge of the atoll during summer full moons, most likely for spawning.

Although tiger sharks or manō (*Galeocerdo cuvier*) also favor a "home" atoll, they move far more extensively than reef sharks and ulua. Tiger sharks routinely move between islands, between the Monument and the Main Hawaiian Islands and far out into the open ocean. Meyer's research suggests that adult female tiger sharks residing in Monument waters may migrate to the Main Hawaiian Islands to give birth. In fact, small (<8 ft) tiger sharks appear to be very uncommon in the Monument, whereas individuals of this size are common in the Main Hawaiian Islands. Meyer suspects that Monument tiger sharks are reliant on the Main Hawaiian Islands for reproduction and, in the future, hopes to conduct additional tiger shark tagging throughout the Monument to better understand this phenomenon.

ABOVE Diver Jon Dale releases an endemic Hawaiian grouper or hapu'upu'u (*Hoporthodus quernus*) after tagging. Hapu'upu'u are captured and tagged underwater by SCUBA divers to prevent swim bladder over-inflation that occurs when these fish are brought to the surface. Photo by Rachel Rounds



» EDUCATION

There were two applications received for education permits in 2016. One brought groups of youth to the Monument on a Sailing School Vessel (SSV), *Makani 'Olu*, practicing traditional Polynesian wayfinding as part of a Native Hawaiian culturally-based vocational program. The other education permit was not issued in 2016 and is currently being processed for activities to occur in 2017. While there was only one education permit issued, efforts have continued in support of the development of long distance, field-to-classroom learning opportunities. Several live Google Video Chat sessions were held between students on O'ahu and scientists conducting work at Midway Atoll NWR. 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. The sessions also helped organizers collect questions from the students to send to scientists on the ships in preparation for the actual live sessions. Over the course of the year, 3 separate Google video chats were held, reaching approximately 60 students and teachers.

» Table 8. Affiliations of Special Ocean Use permittees and permitted projects in 2015.

SPECIAL OCEAN USE PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED SPECIAL OCEAN USE PROJECTS
Marimed Foundation	1	• Kailana Maritime Educational Program Voyage to Nihoa and Mokumanamana

ABOVE The SSV *Makani 'Olu* rests in calm waters off Nihoa. Photo by Brad Ka'alelo Wong/OHA

» Education Highlights

High-Risk Youth Experience the Healing Seas of Papahānaumokuākea

An innovative program for high-risk Hawai'i adolescents uses ocean-oriented experiential therapy and education, and takes its name from two Hawaiian words - kai and lana, which together means "calm seas." The Kailana program, run by the Marimed Foundation, focuses on developing a deep sense of responsibility to community and strengthens cultural ties by weaving together traditional Polynesian wayfinding, Native Hawaiian protocol, environmental stewardship and maritime seamanship skills.

In 2016, thirty cadets prepared to sail to the Monument on two separate "epic" voyages as a culmination of their time in the Kailana program. The youths spent months practicing various cultural protocols and studying traditional wayfinding, a method of maritime navigation that uses no modern instrumentation and instead relies on the world around them to chart and maintain their course. In order to meet the prerequisites for the voyage, they had to learn two star lines that would be visible in the night sky, demonstrate proficiency in seamanship, show and live with a sense of community, and develop a plan toward positive self-advancement. In addition, they had to learn and report on the natural history of the Monument, and identify and write about five different fish, bird and coral species.

Preparation was conducted in the classroom and on the ship prior to entering the Monument to make sure all participants were ready to receive such an honor. As part of the 12-day voyage, the group sailed around O'ahu and Kaua'i in order to verify that everyone had done their "homework," to solidify their understanding of Nihoa and the Monument and to get grounded and centered.

Using the knowledge of their ancestors, they then headed toward Nihoa. During this leg, Kapena Kalei Velasco noticed the cadets step into the role of young men and leave their "boyish" tendencies behind. They displayed respect toward everything around them – ship, mate, self, place. This positive shift in attitude made for smooth and enjoyable sailing. When they "pulled" Nihoa out of the ocean, their faces lit up with excitement and accomplishment. They then performed the cultural ceremony and protocols.

"I was amazed and so happy to observe the cadets display deep reverence for Nihoa, focused concentration on their oli and conscious awareness of themselves, their attitudes and their intentions for being there. This was a major accomplishment for the cadets. Now it was time for them to get real. By taking all they had learned up to this point and facing the hard facts of their realities to plot a new course for their journey in life."
-Kapena Kalei Velasco, Master SSV *Makani Olu*

The trip helped to nurture a sense of stewardship and kuleana (responsibility and privilege) in these Native Hawaiian youth, strengthened their knowledge of their ties to their cultural heritage and instilled a brighter hope for their future.

"This life-changing experiential therapy sailing around our island home offers clarity and peace to many of our Kailana youth. Our classroom is the training ship and the Monument is an incredible environment to learn about themselves, their surroundings and proper stewardship for future generations."

-Jodie Yim, Director of Maritime Operations, Marimed Foundation

"I'm glad I got to go and see things I've never seen in my life. The water helped me find myself. I am thankful for the experience and the people that taught me new things."

-Marimed Kailana Program Cadet

BELOW SSV *Makani 'Olu* Master Kapena Kalei Velasco gazes at the seascape while approaching Nihoa. Photo by Brad Ka'alelo Wong/OHA





» CONSERVATION AND MANAGEMENT

A total of nine conservation and management permit applications were submitted in 2016 of which one was withdrawn by the applicant (Table 9).

» Table 9. Affiliations of conservation and management permittees and permitted projects in 2016.

CONSERVATION AND MANAGEMENT PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED CONSERVATION AND MANAGEMENT PROJECTS
Monument Co-Trustees ⁴	1	• Monument Co-Trustees
NOAA, Office of Marine and Aviation Operations (OMAO)	2	<ul style="list-style-type: none"> • Support for permitted activities aboard NOAA Ship <i>Oscar Elton Sette</i> • Support for permitted activities aboard NOAA Ship <i>Hi'ialakai</i>
NOAA, National Marine Fisheries Service, Pacific Islands Regional Office & Pacific Islands Fisheries Science Center	2	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Support for Permitted Activities Using the R/V <i>Kilo Moana</i> and <i>Pisces IV</i> and <i>V</i>
Element Environmental, LLC	1	• Kure Atoll Salvage Operations
Hawaiian Sealife Inc.	1	• Search for Missing Sailor Aboard SV <i>Stardust</i>

ABOVE A Laysan albatross or mōlī (*Diomedea immutabilis*) examines a collection of lighters and other plastics at Midway Atoll. Photo by David Slater/NOAA Fisheries

⁴ See Table 10 (next page) for a detailed list of activities that occurred under the 2016 Co-Trustees Permit.

Table 10 below outlines activities that occurred in 2016, 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 10. Activities conducted under the conservation and management Monument Co-Trustee permit in 2016, for NOAA, USFWS and DLNR.

CO-MANAGING AGENCY	ACTIVITIES CONDUCTED
USFWS, Hawaiian and Pacific Islands National Wildlife Refuge Complex	<ul style="list-style-type: none"> • Management, operation and maintenance of Midway Atoll facilities • Demobilization of Laysan Island and facilities • Laysan botanical collections • <i>Verbesina</i> removal at Midway Atoll • Habitat restoration activities • Bulky dump restoration at Midway Atoll • Lead-based paint remediation at Midway Atoll • Seabird Tissue Archiving and Monitoring Project (STAMP) • M/V <i>Kahana</i> field support missions • M/V <i>American Contender</i> field support missions • Translocation of Black-footed Albatross chicks from Midway Atoll National Wildlife Refuge (NWR) to James Campbell NWR • Transfer of Lisianski core samples to Bernice Pauahi Bishop Museum • Documentation of Midway Atoll NWR operations and wildlife by Palikū Documentary Films • Environmental Protection Agency and USFWS site visit at Tern Island, French Frigate Shoals • Marine debris removal • Monitor wildlife populations
USFWS, Pacific Islands Fish and Wildlife Office	<ul style="list-style-type: none"> • Nihoa Millerbird population monitoring at Laysan Island and Nihoa • M/V <i>Searcher</i> field support missions • SSV <i>Makani 'Olu</i> field support missions
NOAA, National Marine Fisheries Service	<ul style="list-style-type: none"> • Marine debris removal • Sea turtle monitoring at French Frigate Shoals • Monk seal field camps/population assessment • Removal of State of Hawai'i Fish Aggregating Device (FAD) buoy at French Frigate Shoals
NOAA, Office of National Marine Sanctuaries	<ul style="list-style-type: none"> • Vessel support for conservation and management activities aboard M/V <i>Searcher</i> • Recovery of National Data Buoy Center (NDBC) buoy grounded at Neva Shoal • Collection of invasive algae species from Lisianski
State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife	<ul style="list-style-type: none"> • Management, operation and maintenance of Kure Atoll facilities • Hawai'i State Historic Preservation Office visit to Historic Midway Atoll • Removal of polychlorinated biphenyl (PCB) from Kure Atoll • Removal of <i>Verbesina</i> • Habitat Restoration efforts • Monitor Seabird and Laysan duck populations
Office of Hawaiian Affairs	<ul style="list-style-type: none"> • Collection of hulu manu in partnership with the NOAA, NMFS, Hawaiian monk seal field camps • Archaeology expedition to Nihoa



» Conservation and Management Highlights

President Obama Visits Midway Atoll National Wildlife Refuge and Battle of Midway National Memorial

"I created the world's largest marine preserve—quadrupling the size of our Monument at Papahānaumokuākea...I'm going to travel to the Midway Atoll to see it for myself. Seven thousand species live in its waters, a quarter of which are not found anywhere else in the world. Ancient islanders believed it contained the boundary between this life and the next. Hundreds of brave Americans gave their lives there in defense of the world's freedom. So this is a hallowed site, and it deserves to be treated that way. And from now on, it will be preserved for future generations." —President Barack Obama.

ABOVE President Barack Obama overlooks Turtle Beach at Midway Atoll National Wildlife Refuge. Official White House Photo by Pete Souza

In September 2016, President Barack Obama visited Midway Atoll National Wildlife Refuge and Battle of Midway Atoll National Memorial in the newly expanded Papahānaumokuākea Marine National Monument. The President traveled to Papahānaumokuākea "to mark the significance of this Monument

designation and highlight firsthand how the threat of climate change makes protecting our public lands and waters more important than ever."

While the President was on Midway, he visited the memorials to honor the courage and sacrifice of those who fought in the Battle of Midway, one of the most decisive battles in World War II. "Amazing courage," President Obama said, "Had it not been for the courage and bravery of those airmen, we might not have seen the tide turn."

President Obama toured the Refuge by golf cart, one of the most efficient ways to get around the car-less island. The President was able to observe habitat restoration sites and important wildlife management projects. The President also received an underwater snorkeling tour, where he got to view various marine life. Without the work of the Monument co-managers, and the protection of the National Wildlife Refuge System and Marine National Monuments, Midway Atoll would have long been lost to human alteration and taken over by invasive plants and animals, pushing out native species and wildlife that rely on this special place.

In his remarks from Turtle Beach, President Obama said that it is "critically important for us to examine the effects that climate change are taking here in the Pacific Ocean, the world's largest body of water...There are enormous effects on the human presence in the ocean that creatures are having to adapt to and, in some cases, cannot adapt to." Indeed, there are many small sandy islets within the Monument that provide haul out areas for turtles and monk seals; these islets are at risk from disappearing under rising sea levels.

"This is going to be a precious resource for generations to come," Obama said, "Twenty years from now, 40 years from now, 100 years from now, this is a place where people can still come and see what a place like this looks like when it's not overcrowded or destroyed by human populations."



TOP Surrounded by nesting albatross, the IMMF/Kelly Ensign Memorial on Midway Atoll commemorates the courageous men that halted one of the most powerful naval forces in history. Photo by Dan Clark/USFWS

ABOVE President Barack Obama visits the Battle of Midway Memorial with USFWS' Matt Brown on Midway Atoll, Sept. 1, 2016. Official White House Photo by Pete Souza

LEFT President Barack Obama tours Midway Atoll aboard a golf cart driven by Matt Brown, PMNM Superintendent for USFWS. The trees in the background are non-native, invasive ironwoods (*Casuarina equisetifolia*) planted before Midway Atoll was a Refuge. USFWS is working to remove these trees and minimize their impact to wildlife. Official White House Photo by Pete Souza

He pu'u kolo i Nihoa – Crawling the Cliffs of Nihoa

From August 18 to August 28, the Office of Hawaiian Affairs sponsored a huaka'i (trip or voyage) to the island of Nihoa aboard SSV *Makani 'Olu* in collaboration with The Nature Conservancy and the U.S. Fish and Wildlife Service. The team joined the crew of *Makani 'Olu* and were tasked with helping to sail the vessel to Nihoa, a different experience for some of the researchers used to chartered vessels. Everyone was up to the task and enjoyed the lightheartedness of the regular *Makani 'Olu* crew, and the reprieve from the hustle and bustle of noisy O'ahu to laugh and get to know one another and the elements.

As the crew approached the island on the morning of the third day of sailing, *Makani 'Olu* was greeted with a misty rain which blanketed the island and vessel. The morning sunlight peered through the clouds as the squall passed by and gave everyone a sense of calm and a feeling of welcome as ānuenue (rainbow) began to appear around the island.

BELow Archaeologist 'Io Kauhane surveys one of the many cultural sites located on Nihoa.
Photo by Brad Ka'aleleo Wong/
OHA

RIGHt Cultural practitioners Kapena Kalei Velasco and Kahiau Pilaloha-Hong begin their huaka'i (trip or voyage) on Nihoa. Photo by Brad Ka'aleleo Wong/OHA



The team would spend five days on island, doing various research which included archaeological surveys of select sites and adjacent features, Nihoa millerbird or ulūlu (*Acrocephalus familiaris kingi*) and Nihoa finch or palihoa (*Telespiza ultima*) surveys and counts, invasive plant removals and nearshore fish surveys. “With all the diverse projects and individuals, one of the goals of the trip was for everyone to get to know each other and the work they were doing. This ended up being a tremendous success as we had great teamwork all around and an amazing time on island and at sea,” said Brad Wong of OHA.

Every participant on the trip was able to learn a little bit more about the wahi pana of Nihoa and spent the last night on the ship discussing their findings under a starry cloudless sky, drinking 'awa and playing music. More trips to Nihoa are being planned in the future in order to familiarize community and agency staff with the island and its many resources and features.

ABOVE The crew aboard the SSV *Makani 'Olu* gaze silently under a misty rain as they arrive at Nihoa.
Photo by Brad Ka'aleleo Wong/
OHA



Hawaiian Monk Seals: 40 years of Protection Under the Endangered Species Act.....

The Hawaiian monk seal or 'ilioholoikauaua (*Neomonachus schauinslandi*) is one the world's rarest marine mammal species, with a current population of approximately 1,400 individuals. Although the precarious nature of its existence has been known since the 1950s, it wasn't until the 1970s that legal protection in the form of the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973 was afforded to them. Then, in 1975, the National Marine Fisheries Service (NMFS) proposed to designate the species as depleted. The Hawaiian monk seal was eventually listed as endangered under the Endangered Species Act in 1976.

ABOVE Juvenile Hawaiian monk seal or 'ilioholoikauaua (*Neomonachus schauinslandi*) near Trig Island, French Frigate Shoals. Photo by Mark Sullivan/NOAA Fisheries

Early conservation efforts were directed at filling in information gaps about monk seal biology and population size, and in developing a recovery plan for the species. Since 1997, NMFS has engaged in a variety of actions for monk seal recovery, including pre-weaning and translocating pups, predator deterrents and targeted fishing activities to remove sharks preying on juvenile monk seals.

Recent efforts to protect and conserve the Hawaiian monk seal have primarily come from the NOAA Fisheries Pacific Islands Fishery Science Center's Hawaiian Monk Seal Research Program (HMSRP) and their partners, which had been doing research and conservation since the early 80's, but stepped up efforts in 2007, completing a significant revision to the monk seal recovery plan and making a conscious effort to go "all in" in terms of conservation activity. In the intervening 10 years, the program dramatically expanded its conservation tools and is now the most proactive marine mammal recovery program on the planet. The overarching goal of the HMSRP is to achieve an optimal and sustainable monk seal population. The program accomplishes its goal through research and conservation initiatives in the following areas: population assessment and enhancement; foraging and fisheries interaction; survival enhancement; health, disease and emergency response; and genetics.

With the majority of the monk seal population residing in the NWHI, the focus of the HMSRP activities has been in this area, where the population suffers from low birth rates combined with poor survival of juvenile seals to reproductive age. Other threats include food limitations for juveniles, shark predation on juveniles, entanglement in marine debris, male seal aggression on females and juveniles and shoreline habitat loss.

Actions taken to increase chances of survival include: translocation of aggressive males to other islands within the NWHI or MHI as necessary, mitigation of shark predation by removing Galapagos sharks or manō (*Carcharhinus galapagensis*) preying on seals and treating seals found to be infected with parasites (tapeworms, etc.). At least 28% of the Hawaiian monk seals alive today have benefited directly or are the offspring of a seal that benefited from an action taken by the HMSRP.

LEFT A weaned Hawaiian monk seal pup or 'ilioholoikauaua (*Neomonachus schauinslandi*) encounters a turtle hatchling at Tern Island, French Frigate Shoals. Photo by Mark Sullivan/NOAA Fisheries



BELLOW Juvenile Hawaiian monk seal or 'ilioholoikauaua (*Neomonachus schauinslandi*) rests next to marine debris that washed ashore at Tern Island, French Frigate Shoals. Photo by Mark Sullivan/NOAA Fisheries



Several strategies have been developed to aid in the species' recovery, including:

- Ensure natural population growth and reduce human-seal interactions. Actions include establishing a response network to strandings and haul-outs by seals in areas near the public, engaging local communities through outreach events, distributing educational materials and providing community support and performing foraging surveys to understand seal diet and dietary needs.
- Prevent and mitigate disease and build seal healthcare capacity. Actions include performing health screening and disease surveillance, which include collection and analysis of samples and performing necropsies to determine causes of deaths, developing a captive care facility for sick and injured seals and delivering vaccinations to prevent disease.
- Administer recovery program for maximum effectiveness, integration and partnerships. Actions include forming new partnerships with Federal, state and local agencies and organizations and (based on budget availability) increase staff to ensure recovery actions are implemented effectively.

Even with all of HMRSP's efforts, the Hawaiian monk seal population remains in a precarious state. A healthy population in the NWHI is crucial to preventing the species' extinction. Researchers estimate a recovery population of 2,900 seals is needed in the NWHI to safely avoid genetic bottlenecks and allow the population to overcome year-to-year population changes.

To offset the threats described above, and to address other threats such as habitat loss caused by climate change, the HMRSP will not only need to continue those actions that have proven effective in reducing mortality and increasing health and vitality of the species, but will also need to develop new strategies and associated actions that will offset the changing conditions both within (such as population changes) and outside (such as climate change) of the species.



RIGHT Hawaiian monk seals or 'ilioholoikauaua (*Neomonachus schauinslandi*) rest on the rocky shores of Mokumanamana. Photo by Kekuewa Kikiloi/University of Hawai'i-Manoa



NOAA Vessels – Over a Decade of Mission Support and Monument Conservation and Management

The National Oceanic and Atmospheric Administration (NOAA) operates a wide assortment of hydrographic survey, oceanographic research and fisheries survey vessels, two of which are based in the Hawaiian Islands. The NOAA Marine Operations Center - Pacific Islands (MOC-PI) serves as a homeport for two NOAA research and survey ships, the *Hi'ialakai* and the *Oscar Elton Sette*, which are run by a combination of NOAA commissioned officers and wage mariner civilians. The wage marine personnel include licensed masters, mates and engineers and unlicensed members of the engine, steward and deck departments. In addition, survey and electronics technicians operate and/or maintain the ship's mission, communication and navigation equipment. The ship's officers and crew provide mission support and assistance to embarked scientists from various NOAA laboratories as well as the academic community.

Serving as a home away from home, the NOAA vessels house and provide the amenities necessary for the scientists, researchers, cultural practitioners,

ABOVE NOAA Ship *Oscar Elton Sette* loaded with 50.7 tons of derelict fishing gear and two potential Japan tsunami derelict vessels en-route back to Ford Island, Pearl Harbor. Photo by Kyle Koyanagi/NOAA Marine Debris Program

educators and managers that work in and study the Monument. Some of these amenities include onboard laboratories and wireless internet as well as recreational facilities such as a small gym and common room for watching movies. As Commander Michael F. Ellis, former Commanding Officer of the *Hi‘ialakai* once put it, “[these ships] provide the base ‘mother ship’ for small boat, diving, mapping, cultural and other activities approved by the Monument Co-Trustees and the NOAA fleet allocation process. Without ship support, these activities would not be possible.”

These are not the only vessels that operate in and around the Monument; some vessels are permitted while others are conducting uninterrupted transit through the Monument. The NOAA vessels serve as eyes and ears in the Monument by monitoring other vessel traffic in the vicinity and reporting any and all suspicious movements to the NOAA Office of Law Enforcement.

The officers and crew of NOAA Ships *Hi‘ialakai* and *Oscar Elton Sette* are dedicated to studying and protecting the Papahānaumokuākea Marine National Monument through the support of the many permitted research, educational, conservation and management activities that they enable. For over a decade they have carried out NOAA’s mission of understanding the earth’s environment and managing marine resources to meet our nation’s economic, social and environmental needs in the Monument and they look forward to doing so for many more years to come.



RIGHT NOAA Ship *Hi‘ialakai* at Pearl and Hermes Atoll. Photo by Greg McFall/NOAA Sanctuaries



» NATIVE HAWAIIAN PRACTICES

In 2016, there was one Native Hawaiian Practices permit issued and an amendment to a previously issued permit. The Kānehūnāmoku Voyaging Academy continued to strengthen cultural ties to Papahānaumokuākea as the program’s youth navigated from the Main Hawaiian Islands into the Northwestern Hawaiian Islands via traditional wayfinding. The amendment supported the use of traditional ecological knowledge to examine nearshore ecosystems in a project that is in its eighth continuous year of research.

» **Table 11.** Affiliations of Native Hawaiian Practice permittees and permitted projects in 2016.

NATIVE HAWAIIAN PRACTICES PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED NATIVE HAWAIIAN PRACTICES PROJECTS
Kānehūnāmoku Voyaging Academy	1	• Ola I Ke Au A Kanaloa Voyage and Maritime Vocation Program
Nā Maka o Papahānaumokuākea & Conservation International	1 Amendment	• Amendments to 2015 Permit for Using Traditional Ecological Knowledge to Examine Nearshore Ecosystems for Collections of Additional Intertidal Marine Invertebrates

ABOVE Cultural practitioners and researchers approach Mokumanamana for intertidal surveys. Photo by Kanoe Morishige



LEFT Survey participants collect shingle urchin or hā'uke'uke (*Colobocentrotus atratus*) for gonad analysis at Mokumanamana. Photo by Brad Ka'aleleo Wong/OHA

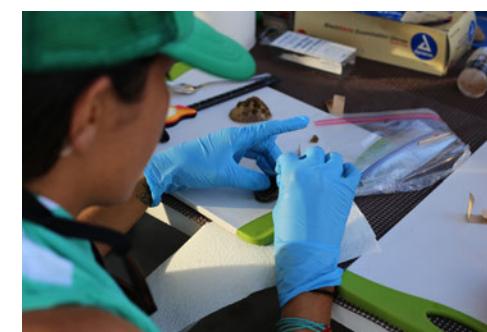
Team members had roughly two days to survey the intertidal areas at each island or pinnacle, engaging in a wide range of protocol addressing natural and cultural health and wellness. The team also supported a study of rare moths, conducting collections for Dr. Daniel Rubinoff of UH-Mānoa at French Frigate Shoals and Gardner Pinnacles for the first time in eight years, and collected reef fish at Nihoa for an ongoing ciguatera study.

The team utilized Huli'ia, a collaborative method to collect detailed, holistic observations based on traditional knowledge systems that build intimate understanding of the surrounding environment, drawing connections between dominant patterns in the atmosphere, land and ocean. It strengthens place-based knowledge and re-establishes healthy relationships between people and nature. This allows us to adjust behaviors and activities to complement and support natural productivity within our communities working towards 'āina momona: a healthy and abundant place.



BELow 2016 Intertidal Monitoring team conducts end-of-the-day dissections aboard the M/V *Searcher* off Gardner Pinnacles. Photo by Kanoe Morishige

BOTTOM PhD candidate Haunani Kāne dissects limpet or 'opihi (*Cellana sp.*) for genetic and gonad analysis. Photo by Brad Ka'aleleo Wong/OHA



» Native Hawaiian Practices Highlights

'Opihi Partnership Returns to Papahānaumokuākea for Annual Intertidal Surveys

This year marks the eighth annual intertidal monitoring expedition, which integrates cultural knowledge and practices with western science to assess and better understand the shorelines and shallow waters of high islands within PMNM. Participants surveyed Nihoa, Mokumanamana, La Perouse Pinnacle at French Frigate Shoals and Gardner Pinnacles. This ongoing research, led by members of the 'Opihi Partnership, a public-private collaborative partnership, continues to inform communities across Hawai'i about the development of sustainable harvesting protocols, establishment of rest areas and important baseline information about the rocky intertidal shorelines of Hawai'i.

ABOVE 2016 Intertidal Monitoring team conducts rapid transect surveys at Gardner Pinnacles. Photo by Tia Brown/NOAA Sanctuaries

The dual focus of western science and traditional knowledge has served as a platform in which cultural practitioners and scientists can engage and inform each other in a space that is neutral and welcoming. In 2016, two Native Hawaiian PhD candidates studying at UH-Mānoa participated in intertidal surveys in addition to conducting their own research. Ms. Haunani Kāne, studying sea level rise at UH-Mānoa's Geology and Geophysics Department, conducted visual surveys at all the islands. Ms. Kim Kanoe'ulalani Morishige continued her work comparing data on shingle urchin or hā'uke'uke (*Colobocentrotus atratus*) from the Main Hawaiians Islands to PMNM.

"I am thankful for the opportunity to experience Papahānaumokuākea through ancestral connections and science," said Kim Kanoe'ulalani Morishige, PhD candidate at UH-Mānoa. "We have been collecting information on the life histories of intertidal species like hā'uke'uke and limpet or 'opihi (*Cellana sp.*) that can feed into recommendations for sustainable harvesting practices back home. It is important to me to connect my research to on-going monitoring with local communities. This is a truly humbling opportunity to expand our understanding of intertidal ecosystems and how we can maintain healthy relationships with them."



RIGHT Guano (bird poop) from thousands of seabirds makes these high rocky peaks at Gardner Pinnacles look frosted. Photo by Tia Brown/NOAA Sanctuaries



» SPECIAL OCEAN USE

In 2016, six Special Ocean Use (SOU) permit applications were received and processed. Of the six received; four were issued, one was withdrawn and one was rolled over to continue processing in 2017. Two of the SOU permitted activities brought members of the media to the Monument to produce stories in our ongoing mission to bring the place to the people; covering ongoing research and conservation efforts of scientists, cultural practitioners and managers alike and the threats to this remote ecological gem. Another permit was for glass etching artist April Surgent, who has also served as a field researcher for the NOAA NMFS Hawaiian Monk Seal Research Program. Finally, there was the SOU permit to document the voyage and growth of the students of the Kānehūnāmoku Voyaging Academy.

» **Table 12.** Affiliations of Special Ocean Use permittees and permitted projects in 2016.

SPECIAL OCEAN USE PERMITTEE AFFILIATION	NUMBER OF PERMITS ISSUED	PERMITTED SPECIAL OCEAN USE PROJECTS
Kānehūnāmoku Voyaging Academy	1	• Ola I Ke Au A Kanaloa Voyage and Maritime Vocation Program
CNN	1	• Exploring and Documenting the Impacts of Ocean Plastics
Hana Hou! The Magazine of Hawaiian Airlines	1	• Highlighting a Decade of Exploring, Researching, Conserving, and Managing Papahānaumokuākea Marine National Monument
Surgent Glassworks	1	• Photography and Audio/Video Documentation of Conservation Activities and Hawaiian Monk Seal Research Program (HMSRP) Fieldwork in Papahānaumokuākea

ABOVE NOAA Fisheries Hawaiian Monk Seal Research Program field camp leader Sadie Youngstrom removes marine debris at North, Pearl and Hermes Atoll. Photo by April Surgent



She is also making installation-based artworks from marine debris that she and the team collected around the atoll. Final artworks will portray what it is like to live and work in the remote and wild environment of PMNM and discuss the critical value of its conservation. The first of the completed artworks will debut at the Traver Gallery in Seattle, Washington, opening on October 5, 2017 in an exhibit entitled "Of Sea and Sky." The exhibition will include engravings, video and marine debris installations. There will be an accompanying catalog that will feature images of the engravings and pictures from the Monument.

» RECREATION

» Special Ocean Use Revenue Reported

Each permittee with an SOU permit is required to "submit an annual report not later than December 31 of each year that describes activities conducted under that permit and revenues derived from such activities during the year" (50 CFR 404.11.f). In 2016 no SOU revenue was reportedly generated from activities in the Monument.

» Special Ocean Use Highlights

Artist Strives to Raise Awareness and Public Interest in Hawaiian Monk Seal Research

ABOVE A Hawaiian monk seal or 'ilioholoikauaua (*Neomonachus schauinslandi*), green from algae after a long period of foraging at sea, hauled out in a bed of 'akulikuli plants at Southeast Island, Pearl and Hermes Atoll. Photo by April Surgent

RIGHT Disposable lighters found and collected throughout the atoll. Temporarily installed and photographed onsite at Southeast Island, Pearl and Hermes Atoll. Photo by April Surgent

From late April through August, artist April Surgent teamed up with NOAA's Hawaiian Monk Seal Research Program as member of the program's three-person field team at Pearl and Hermes Atoll. April assisted with population assessment and recovery activities benefiting the Hawaiian monk seal and helped with marine debris cleanup around the atoll. She documented the experience through daily drawings, thousands of digital photographs, hundreds of medium format film photographs and audio and video recordings. The long summer of conservation and documentation allowed the artist to intimately learn about the research and fieldwork of the HMSRP and use the experience to inform a didactic body of artwork aimed at bringing awareness to the plight of the Hawaiian monk seal and the conservation efforts happening within PMNM.

"My interest in this research lies in the ideology that the dialogue between artists and scientists is imperative for a most informed and diversified understanding of life," says Surgent. "With science far too often inaccessible and unattainable, the goal of this collaboration is to bring awareness to the plight of the Hawaiian monk seal and the effects of human impact and climate change on vulnerable ecosystems by propagating public interest through art."

Back in her studio in Washington, Surgent is using her photographs and drawings as source materials for creating works of art in cameo engraved glass.

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 2016. 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 not currently 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 USFWS Visitor Services Manager Ann Bell speaks about the historic Cable House to visitors on Midway Atoll. Photo by Alice Silbanuz/OHA

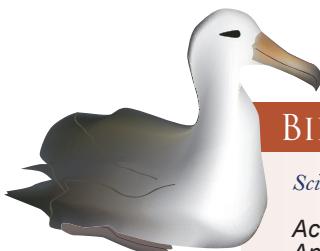
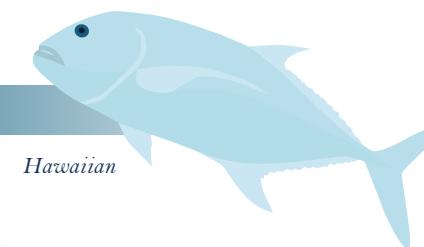


Species Mentioned in the Permitted Activities 2016 Annual Report*



FISH

Scientific	Common	Hawaiian
<i>Bodianus bathycapros</i>	pigfish	ulua/ ulua aukea
<i>Caprodon unicolor</i>	elegant anthias	manō
<i>Caranx ignobilis</i>	giant trevally	
<i>Carcharhinus galapagensis</i>	Galapagos sharks	
<i>Cephalopholis argus</i>	roi	
<i>Chromis struhsakeri</i>	Struhsaker's damselfish	
<i>Galeocerdo cuvier</i>	tiger sharks	
<i>Hyporthodus quernus</i>	Hawaiian grouper	
<i>Lutjanus sp.</i>	snapper	
<i>Muraenidae sp.</i>	moray eel	
<i>Myripristis berndti</i>	bigscale soldierfish	
<i>Prognathodes basabei</i>	orange-margin butterflyfish	
<i>Tosanoides obama</i>	Obama fish	



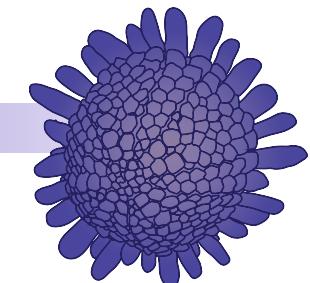
BIRDS

Scientific	Common	Hawaiian
<i>Acrocephalus familiaris kingi</i>	Nihoa Millerbird	ulūlu
<i>Anas laysanensis</i>	Laysan duck	koloa pōhaka
<i>Diomedea immutabilis</i>	Laysan albatross	mōli
<i>Diomedea nigripes</i>	black-footed albatross	ka'upu
<i>Fregata minor palmerstoni</i>	great frigate bird	'iwa
<i>Gygis alba</i>	white tern	manu o ku
<i>Oceanodroma tristrami</i>	Tristram's storm-petrel	
<i>Pterodroma hypoleuca</i>	Bonin petrel	'ā
<i>Sula leucogaster plotus</i>	brown booby	'ā
<i>Sula sp.</i>	boobies	'ā
<i>Sula sula rubripes</i>	red-footed booby	palihoa
<i>Telespiza ultima</i>	Nihoa finch	



MARINE MAMMALS

Scientific	Common	Hawaiian
<i>Neomonachus schauinslandi</i>	Hawaiian monk seal	'īlio holoi kauaua



INVERTEBRATES/CORALS

Scientific	Common	Hawaiian
<i>Ascidia archia</i>	limpet	'opihī
<i>Ascidia syndneiensis</i>	shingle urchin	hā'uke'uke
<i>Cellana sp.</i>		
<i>Colobocentrotus atratus</i>	red coral	ko'a
<i>Corallium regale</i>		
<i>Didemnum perlucidum</i>	Hypasmocoma moth	'ōka'i
<i>Hemicorallium lauuense</i>	bamboo coral	ko'a
<i>Herdmania pallida</i>	gold coral	ko'a
<i>Hypasmocoma sp.</i>	pink coral	ko'a
<i>Isididae</i>	hard corals	ko'a
<i>Kulamanamana haumeaae</i>	rough sea squirt	hu'akai
<i>Pluerocorallium secundum</i>	sponge	
<i>Polycarpa aurita</i>	octopod/octopus	he'e
<i>Scleractinians</i>		
<i>Styela canopus</i>		



PLANTS

Scientific	Common	Hawaiian
<i>Casuarina equisetifolia</i>	Common ironwood	limu 'ē
<i>Hypnea musciformis</i>	red algae	'ākulikuli
<i>Sesuvium portulacastrum</i>	sea purslane	
<i>Verbesina encelioides</i>	golden crown-beard	limu
	algae	

*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*.



» Front cover photo by Jamie Makasobe.
Back cover photo by Kaleomanuiwa Wong.