Ahu Kupanaha iā Hawai‘i ʻimi loa.
Pursuing new knowledge brings bountiful rewards.
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Introduction

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

Papahānaumokuākea Marine National Monument ("PMNM" or "Monument") is administered jointly by three Co-Trustee agencies: the Department of Commerce through the National Oceanic and Atmospheric Administration (NOAA), the Department of Interior through the U.S. Fish and Wildlife Service (USFWS), and the State of Hawai‘i through the Department of Land and Natural Resources (DLNR) (collectively, the "Co-Trusters"). The Co-Trustee agencies work in close collaboration and consultation with the Office of Hawaiian Affairs (OHA) to ensure that both cultural and natural resources are protected in a manner aligned with Native Hawaiian resource management best practices. The day-to-day management of the Monument is overseen by a seven-member Monument Management Board (MMB) comprised of two sub-agencies of each Co-Trustee, plus the Office of Hawaiian Affairs. This unique management partnership of PMNM allows for the protection of the entire ecosystem, from remote sub-tropical islands to the deep sea, including areas of cultural significance.

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

Inscription of the Monument as a UNESCO World Heritage site in 2010 as the only mixed natural/cultural site in the United States added to the genealogy of protection and recognition of the NWHI. This honor is the culmination of over one hundred years of safeguarding the area, starting with protections of Midway Atoll in 1903, when President Theodore Roosevelt sent the U.S. Marines to stop the slaughter of seabirds at Midway Atoll (see timeline of protection, pg. 8-9).
Ua pa'a nā inoa kahiko

Ancient Names Remembered*

Mai kahi mai, ua ho‘opua ‘ia nā inoa moku no kēina pae ‘uīna ma ka mo‘olelo a me nā mele kūhōmua, a ke kahi o nā inoa, ua pa‘a ka inoa, a ua po‘ina 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.

Hōlāniki, Moku‘apapa (Kure Atoll)

Hōlāniki, meaning “braiding forth heavens,” 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 Kamalani, Nāmaka‘eha, and Wānui. Moku‘apapa 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.

Kualehi‘alani, Pihemanu (Midway Atoll)

Kualehi‘alani, meaning “the backbones 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 onto the sky. Pihemanu means “loud din of birds” and refers to the loud chatter of the millions of birds that come to this atoll each year.

Manawai, Holokauaua (Pearl and Hermes Atoll)

Manawai, which means “warped, depressed or bent in,” provides the imagery of the spiritual process of bending reward to reveal the unchanging nature of one’s true underlying spirit. It can also be defined as “branching water.” Wai can also refer to “water” or “spirit.” This interpretation focused on the water’s natural element. The name Holokauaua celebrates the Hawaiian monk seals that haul out and rest here. Holokauaua directly relates to the word “wai,” which literally translates to “the quadrupled running in the rough seas.”

Kapou, Papa‘apo ho‘o (Li‘i‘i‘i‘i 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‘apo ho‘o 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.

Kamokukamoaloha‘i, Ko‘anako‘a, Na‘ulukākala (Maro Reef)

Kamokukamoaloha‘i means “the island of Kamoku‘ai,” referring to Pua’s brother Kamoku‘ai, 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. Na‘ulukākala describes surf that arrives in swells, such as the surf that froths over shallow reefs.

Ohūnui, Ohūniki, Pāhāhōnu (Gardner Pinnacles)

Ohūnui means “large protrusion” and is a variant of the name Unuma, which refers to a large ala. Ohūniki means a “small protrusion.” Both names correspond to the large and small rock protruberances that make up Gardner Pinnacles and, with the reference to alae, may also allude to their role in bringing forth the northwest rains. Pāhāhōnu 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, Moku‘apapa (French Frigate Shoals)

The word lalo means “down, downward, low, lower, below, depth, or forward.” Lalo is closely associated with the direction of po (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 Moku‘apapa refers to an island, or islands, northwest of Ni‘ihau. The nearest shoal-like place is French Frigate Shoals, an atoll of reefs, low sand ridges, and the 120-foot-high La Périou Pinnacle. Moku (islet) combined with papa (low, flat, expansive reef) means “islets with low-lying reefs.” It is said that on this low, flat sand island, Pē‘e (the volcano goddess) left one of her brothers, Kānemiloha‘i, as a guardian during her first journey to Hawai‘i from Tahiti.

Mokumananamana, Hā‘ena (Necker Island)

Mokumananamana is often translated as “branchhead” 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 mokua (island) relates to the spiritual significance of the island, given the 33 shrines along its kua (spine) and the Hawaiian axies 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. Hanakau‘oume, meaning “two nights,” 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 Kāʻa Alaha Polohiwa a Kāne or “The Dark Shining Path of Kāne,” often used as a metaphor for the path to the afterlife.

Nihoa, Nihoa-Kukuihu‘u‘one, 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. Kukuihu‘u‘one was sometimes added in chants, referring to the priests who specialized in the construction planning of heiau. Moku Manu means “bird island,” refers to its having one of the largest populations of petrels and noddy birds in the Hawaiian Islands. The name Hanaka‘ue‘i 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.
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. 1019, creating the Hawaiian Islands Bird Reservation around islands from Nihoa to Kure Atoll to further protect these islands and their resources.

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.

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

The State of Hawaii Board of Land and Natural Resources designates Kure Atoll a State Seabird Sanctuary, now the Kure Atoll State Wildlife Sanctuary.

The tripartite agreement among the State of Hawaii, 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 Hawaii 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 Hawaii at Manoa in 1979 and 1983. The proceedings of these symposia contain the results of more than 100 research projects.

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.

President William Clinton 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.

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.
PMNM’s permitting program is designed to manage and minimize human impact, ensuring the protection of the Monument’s natural, cultural and historic resources. In accordance with Presidential Proclamation 8031 and codifying regulations in 50 CFR Part 404, all activities in the Monument, with limited exceptions, require a permit. Activities are either prohibited (not allowed), exempted (no permit is needed), or regulated (must be considered through the Monument’s joint permitting process).

**Prohibited activities include:**

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

**Exempted activities include:**

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

Any vessel or person passing through PMNM without interruption does not constitute a permitted activity. However, domestic vessel notification must be provided prior to entering and upon leaving the Monument. For U.S. flag vessels with onboard e-mail capability, notification is required upon entering and exiting the reporting area (area extending 10 miles out and entirely around the Monument boundary). For domestic vessels less than 300 gross tons without e-mail capability, entry must be provided at least 72 hours, but not more than one month, prior to entering PMNM, and notification of departure from the Monument must be provided within 12 hours of leaving. For more information regarding the Monument’s ship reporting requirements, please see [http://www.papahanaumokuakea.gov/resource/ship_reporting.html](http://www.papahanaumokuakea.gov/resource/ship_reporting.html).

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

All other activities not prohibited or exempted must be authorized by a Monument permit signed by all three Co-Trustee agencies. Permit applications are reviewed by managers, scientists and other experts within the Co-Trustee agencies and by Native Hawaiian cultural specialists through an agency review process. In order to inform the public about activities proposed within the NWHI, permit applications are posted on the Monument website (http://www.papahanaumokuakea.gov/permit/applicationrev.html) for public review. In addition to agency review, all permit applications must meet applicable findings (i.e., permit criteria) listed in the Proclamation in order to be approved by the Monument Co-Trustees. For a list of all Findings in the Proclamation, please see the inset box on the next page. For activities proposed within the NWHI State Marine Refuge, permit applications must also be approved by the State of Hawai‘i Board of Land and Natural Resources.

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

Permitting Criteria

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

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

In addition to the ten general Findings above, there are additional specific Findings that are required for special ocean use, Native Hawaiian practices and recreation permit applications.
Types of Permits

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

Research

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

Education

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

Conservation and Management

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

Native Hawaiian Practices

Native Hawaiian Practices permits are for activities that constitute Native Hawaiian cultural practices. Activities under this permit must be noncommercial, deemed appropriate and necessary by traditional standards, benefit the NWHI and Native Hawaiian community, perpetuate traditional knowledge, and restrict the consumption of harvested resources from the Monument. Examples of permitted activities include application of traditional non-instrument navigation techniques on Native Hawaiian voyaging canoes and conducting ceremonies at historic cultural sites on Nihoa and Mokumanamana. Permit conditions and guidelines are developed by the Co-Trustees and OHA in consultation with the Native Hawaiian Cultural Working Group and the broader Native Hawaiian community.

Special Ocean Use

Special Ocean Use permits are for activities related to commercial uses, including ecotourism or documentary filmmaking. Special ocean use is defined as any activity or use of the Monument to generate revenue or profits for one or more of the persons associated with the proposed activity, and will not destroy, cause the loss of, or injure Monument resources.

Recreation

Recreation permits are for activities conducted for personal enjoyment and are limited to occur only within the Midway Atoll Special Management Area. Recreation activities must not result in the extraction of Monument resources or be involved in a fee-for-service transaction. Examples of activities that may be permitted include snorkeling, wildlife viewing and kayaking. Restrictions may be placed on recreation permits in accordance with the MANWR Visitor Services Plan.
2015 Permitted Activities

In 2015, 30 permit applications were received and 21 permits were issued. All permit applications must complete a rigorous process of environmental and cultural review and documentation of meeting the applicable permitting criteria, which include the Findings in Proclamation 8031. As permit applications are reviewed and processed, individual applicants may elect to withdraw a permit application. This year, seven applications were withdrawn and two were not issued. Figure 1 displays a comparison of the number of permits by type, issued from 2010-2015.

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

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

Maritime Heritage

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

Deep Ocean Discoveries

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

Cultural Practices

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

Increased Diversity

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

Permits Issued in 2015

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

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

Levels of Human Presence

Human presence is necessary to carry out resource management objectives and conduct necessary scientific and cultural research. Effectively tracking Monument permits and the associated number of permitted aircraft and vessel entries within the Monument allows for accurate reporting of levels of human presence. The level of human presence in the Monument is strictly managed and continually evaluated to monitor and mitigate for cumulative impacts.

Currently, the only location equipped to accept aircraft within the Monument is Midway Atoll. Funding constraints and other infrastructure limitations closed the airstrip at Tern Island within French Frigate Shoals in 2011. Since 2010, there has been a 57 percent decrease in flights to and from the Monument.

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.

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

Another metric to account for the level of human presence is the number of people on land. Due to the fragility and remote nature of these islands and atolls, any human presence has the potential to impact resources. Table 3.1 indicates the minimum, maximum and average number of people recorded on land per day on each island or atoll in the Monument from 2010-2015. The total number of person-use days measures individual presence per island or atoll in the Monument and is shown in Table 3.2. Person-use days are calculated based on data presented in all tables and figures reflecting only information from permit reports submitted to PMNM upon completion of a PMNM access and/or project. Not all permit reports have been received for activities that occurred in 2015 at the time of publication.
on the number of individuals on site each day. For example, five authorized personnel staying for three nights on Nihoa would equal 15 total person-use days at Nihoa. Midway Atoll continues to have the highest level of human presence, sustaining an average population of 51 individuals necessary to operate Midway facilities and contract workers for environmental remediation.

Table 3.1. The minimum, maximum and average person-use days at each island and atoll in 2010-2015.

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<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Mokumanamana</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>French Frigate Shoals</td>
<td>1</td>
<td>16</td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Laysan Island</td>
<td>6</td>
<td>18</td>
<td>8</td>
<td>4</td>
<td>15</td>
<td>7</td>
<td>6</td>
<td>27</td>
<td>8</td>
<td>0</td>
<td>27</td>
<td>5</td>
<td>0</td>
<td>14</td>
<td>1</td>
<td>0</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Lisianski Island</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Pearl and Hermes Atoll</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Midway Atoll</td>
<td>69</td>
<td>88</td>
<td>79</td>
<td>59</td>
<td>77</td>
<td>68</td>
<td>66</td>
<td>97</td>
<td>76</td>
<td>43</td>
<td>69</td>
<td>55</td>
<td>41</td>
<td>48</td>
<td>43</td>
<td>43</td>
<td>60</td>
<td>51</td>
</tr>
<tr>
<td>Kure Atoll</td>
<td>0</td>
<td>13</td>
<td>3</td>
<td>0</td>
<td>20</td>
<td>5</td>
<td>6</td>
<td>28</td>
<td>6</td>
<td>6</td>
<td>13</td>
<td>7</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>17</td>
<td>7</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Island / Atoll</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nihoa</td>
<td>79</td>
<td>99</td>
<td>102</td>
<td>91</td>
<td>110</td>
<td>39</td>
</tr>
<tr>
<td>Mokumanamana</td>
<td>26</td>
<td>53</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>French Frigate Shoals</td>
<td>2,669</td>
<td>2,910</td>
<td>2,631</td>
<td>1,283</td>
<td>472</td>
<td>1,045</td>
</tr>
<tr>
<td>Laysan Island</td>
<td>3,114</td>
<td>2,622</td>
<td>3,139</td>
<td>1,850</td>
<td>446</td>
<td>321</td>
</tr>
<tr>
<td>Lisianski Island</td>
<td>160</td>
<td>269</td>
<td>141</td>
<td>86</td>
<td>113</td>
<td>251</td>
</tr>
<tr>
<td>Pearl and Hermes Atoll</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Midway Atoll</td>
<td>29,133</td>
<td>25,066</td>
<td>28,119</td>
<td>20,254</td>
<td>17,421</td>
<td>18,518</td>
</tr>
<tr>
<td>Kure Atoll</td>
<td>1,225</td>
<td>2,121</td>
<td>2,452</td>
<td>2,797</td>
<td>2,558</td>
<td>2,773</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Permit Type</th>
<th>Number of People Permitted</th>
<th>Actual Number of People Who Performed Permitted Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>153</td>
<td>78</td>
</tr>
<tr>
<td>Education</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Conservation &amp; Management</td>
<td>549</td>
<td>260</td>
</tr>
<tr>
<td>Native Hawaiian Practices</td>
<td>61</td>
<td>55</td>
</tr>
<tr>
<td>Special Ocean Use</td>
<td>164</td>
<td>1</td>
</tr>
<tr>
<td>Recreation</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>928</td>
<td>394</td>
</tr>
</tbody>
</table>

Locations of Permitted Activities

The map in Figure 4 indicates locations at which permitted activities occurred in 2015. Of the 60 active permits, many authorized activities at multiple locations. Thus, for example, a single permit may have allowed activities only at French Frigate Shoals, or a permit may authorize activities at all islands and atolls.
RESEARCH

A total of nine research permits and two amendments to a 2014 research permit were issued in 2015. Research permits were issued to Co-Trustee agency personnel, university researchers and other research organizations in Hawai‘i to conduct work on fish, corals, marine mammals, algae and ocean areas within PMNM. Information gained from annual research cruises continues to inform scientists, managers and others on the NWHI terrestrial and ocean ecosystems and their inhabitants and aids in overall management and evaluation of ecosystem health. Table 5 lists research permits issued for each organization or institution, together with project titles.

Table 5. Affiliations of Research permittees and permitted projects in 2015.

<table>
<thead>
<tr>
<th>Research Permitter Affiliation</th>
<th>Number of Permits Issued</th>
<th>Permitted Research Projects</th>
</tr>
</thead>
</table>
• Pacific Reef Assessment and Monitoring Program |
| Texas A&M University - Corpus Christi & University of Hawai‘i, Hawai‘i Institute of Marine Biology | 1 | • Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs  
• Coral Reef and Sponge Communities Impacted by Trawling |
| Hawai‘i Pacific University | 1 | • Analysis of Carbonate Chemical Make-up of Waters Surrounding Arvill Systems |
| University of Hawai‘i, Hawai‘i Institute of Marine Biology | 5 | • Assessing Health and Community Structure of Corals on Shallow-waters Reefs  
• Documenting the Movements and Ecology of Top Predators  
• Bleached Coral Recovery Assessment  
• Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems  
• Assessing Coral Reef Herbivorous Fish Ecology |
| Florida State University | 2 | • Amendments to 2014 Permit for Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling  
(1) additional locations  
(2) additional equipment and location depths |

Research projects permitted in 2015 included a variety of activities aimed at monitoring coral reef ecosystem health, studying the genetic connectivity of marine organisms, and tracking the movements of top predators. While nine new research permits were issued in 2015, 20 permits were issued in prior years and remained valid. Of these, 18 involved collection activities. Collection activities requiring the removal of whole specimens (as opposed to extracting tissue and leaving the organism in situ) utilized the minimum sample size necessary in order to complete the project and satisfy statistical significance. Table 6 describes these observational, catch and release, and collection activities.

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

<table>
<thead>
<tr>
<th>Permitted Research Project</th>
<th>Catch and Release or Observational Research</th>
<th>Biological or Physical Samples Collected</th>
</tr>
</thead>
</table>
| Quantifying the Movements and Ecology of Top Predators | None recorded | • 14 manta ray gonophores or maxos (Parsipar mitis)  
• 20 millisecond butterflyfish or lamellibranch (Cheilostomata)  
• 11 bleached butterflyfish or kikikapu (Glaucostomata)  
• 2 orange-check surgeonfish or na‘ena‘e (Amblyhirus ocellatus)  
• 8 giant trevally or ulua nākea (Caranx ignobilis) |
| Bathymetric Mapping in Papahānaumokuākea Marine National Monument | • Deployed 39 XBTs (Expendable Bathymetographs)  
• 36 CTD (Conductivity, Temperature, and Depth) casts occurred  
• 146 Hours of in-water high resolution video recording  
• 29,923 km² of multibeam mapping occurred  
• 807 files of single-beam sonar surveys  
• 807 files of sub-bottom profiler surveys  
• 14 manybar goatfish or moano (Paraparvus multifasciatus)  
• 100 lizardfish or ‘ahuhi (Enchelyopus cyclocephalus)  
• 10 samples of glass sponge or hurahua (Ectenodiscus spp.)  
• 2 sea lily (Comatulida)  
• 2 sea urchin (Echinometra mathaei) |
| Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling | None recorded | • 170,837 photos taken during  
• 36 CTD (Conductivity, Temperature, and Depth) casts occurred  
• 29,923 km² of multibeam mapping occurred  
• 2 amphibious or ‘uakai (Amphipods)  
• 3 barnacle (Stetosiphonidae)  
• 4 samples of black coral or koa (Cuprophyllia pacifica)  
• 20 milletseed butterflyfish or lauwiliwili (Chaetodon miliaris)  
• 11 bluestripe butterflyfish or kīkākapu (Chaetodon frenigli)  
• 1 ctenophore (Lampyridae)  
• 2 seastar or pe‘ape‘a (Ophiuropodia)  
• 10 samples of glass sponge or hurahua (Ectenodiscus spp.)  
• 1,707 files of single-beam sonar surveys  
• 4 squat lobster or ula (Lophozoa sp.)  
• 31 manganese-crust basalt rocks weighing (0.5 - 9.4 kg)  
• 3 barnacle (Scalpellidae)  
• 3 hydrozoa  
• 1 shrimp (species unknown)  
• 3 longjawed blenny (Lepidocyclus sp.)  
• 4 squid (Gonatus spp.)  
• 3 worms or koa (Polychaeta) |
| Understanding Recovery Potential for Deep-sea Coral and Sponge Communities Impacted by Trawling | None recorded | • 170,837 photos taken during  
• 36 CTD (Conductivity, Temperature, and Depth) casts occurred  
• 29,923 km² of multibeam mapping occurred  
• 807 files of single-beam sonar surveys  
• 807 files of sub-bottom profiler surveys  
• 14 manybar goatfish or moano (Paraparvus multifasciatus)  
• 20 millisecond butterflyfish or lamellibranch (Cheilostomata)  
• 11 bleached butterflyfish or kikikapu (Glaucostomata)  
• 2 orange-check surgeonfish or na‘ena‘e (Amblyhirus ocellatus)  
• 8 giant trevally or ulua nākea (Caranx ignobilis) |

Papahānaumokuākea Marine National Monument
### Table 6 Continued. Observational, catch and release, and collection activities that occurred in 2015.

<table>
<thead>
<tr>
<th>Permitted Research Project</th>
<th>Catch and Release or Observational Research</th>
<th>Biological or Physical Samples Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documenting the Biodiversity and Ecology of Nearshore Basaltic Reefs (continued)</td>
<td>• 88 rapid mapping surveys conducted</td>
<td>• 48 snail or pipi piʻi kōlea (Littoraria pinatula)</td>
</tr>
<tr>
<td></td>
<td>• 24 transect surveys conducted</td>
<td>• 48 snail or pipi piʻi (Nerita pica)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 11 snail or pipi piʻi (Pupa picea)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 285 black-foot limpet or ʻōpia makaiauli (Callista marvata)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 271 yellow-foot limpet or ʻōpia ʻālihina (Callista undulicostata)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 15 sponge echinoid or kāʻuleʻakeʻake (Coloboconostus atrobas)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 43 thin-shelled rock crab or ʻoʻama (Grapsus transectatatus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 13 intermediate drape or pipi awa (Thais intermedia)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 8 bubble shell (Mangapuialii calydata)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 24 sported drape or mokaua (Drupes ruina)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 48 Hawaiian periwinkle or pipi piʻi (Elsomellotexta hawaiiensis)</td>
</tr>
<tr>
<td>Incidence and Amount of Plastic Digestion in Five Petrel Species and Relation to Geographic Location, Age Classes, and Life-history Characteristics</td>
<td>None recorded</td>
<td>• 68 Bonin petrel (Pterodroma hypoleuca)</td>
</tr>
<tr>
<td>Species Inventory Update and Abundance Determination of Alien Marine Invertebrates Associated With Natural and Man Made Habitats Within the Monument</td>
<td>None recorded</td>
<td>• 3 tunicate or ʻupi (Avicida sp.)</td>
</tr>
<tr>
<td>Assessing Health and Community Structure of Corals on Shallow-water Reefs</td>
<td>• 214 transect surveys conducted</td>
<td>None Recorded</td>
</tr>
<tr>
<td></td>
<td>• 1265 transect survey photos documented</td>
<td>• 550 manta tow survey photos documented</td>
</tr>
<tr>
<td></td>
<td>• 39, 3D surveys conducted</td>
<td>• 39, 3D surveys conducted</td>
</tr>
<tr>
<td>Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems</td>
<td>None recorded</td>
<td>• 63 masked angelfish (Centropyge loreto)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 63 Hawaiian dascyllus or ʻōkālina (Dascyllus ahlstroemi)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 52 threespot chromis (Chromis semicauda)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 53 goldring seagrassfish or kule (Chromisstrasseris strasseri)</td>
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<tr>
<td></td>
<td></td>
<td>• 44 padders angelfish (Centropyge paddersi)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 35 yellowspotted squirrelfish or ʻākähi (Novaculichthys westernrae)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 30 yellowish soldierfish or ʻū (Myripristis chryseres)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 30 Hawaiian chromis (Chromis strassleri)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 21 redbar parrotfish or lulo (Sparisoma polka)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 20 soldierfish or ʻū (Myripristis amboinensis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 13 pacific gregory (Stegastes fuscocauda)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 9 whitetail chromis (Chromis lunaris)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 4 yellow-threaded goatfish or ʻū (Parupeneus rubescens)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 4 chocolate-dipped chromis (Chromis haluan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 3 butterfish (Pseudobalistes pilchardus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 2 Hawaiian longfin anemias (Pseudanthias hawaiiensis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 Hawaiian gregory (Stegastes marginatus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 ace-eye hawkfish or piʻikoʻikoʻi (Paracirrhites forsteri)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Permitted Research Project</th>
<th>Catch and Release or Observational Research</th>
<th>Biological or Physical Samples Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documenting the Biodiversity of Deep Reefs Using Conventional and Technical SCUBA Diving Technology</td>
<td>None recorded</td>
<td>• 130 samples of ~20 cm ʻaga or limu</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 6 samples of ~10 cm ʻopilai (Pseudeleotris sp. and Stylosia carteri)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~20 cm ʻopilai (Chelengus sp.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 6 samples of ~20 cm ʻapu (Entacmaea)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 3 samples of ~10 cm ʻopu (Mitra sp.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 brittle star or peʻa (Ophiolepis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~10 cm black coral or koʻa (Antipathes griggii)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sea star or peʻa (Pentaceracta sammondsii)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 seaweed or lilo (Holothuria sp. &amp; stylipectis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~10 cm ʻupi (entacmaea)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 Zoanthid (Polythyla carinata)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~10 cm ʻonathid (Parazoanthus sp.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~20 cm coral or koʻa (Lepthocrinus hawaiiensis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~10 cm coral or koʻa (Laptevocirca and Coccinacea)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1 sample of ~20 cm ʻānani (Litoraria sp.)</td>
</tr>
<tr>
<td>Monitoring of Laysan and Black-footed albatross from Midway Atoll, French Frigate Shoals and Layus Island</td>
<td>• 21 GPS tags deployed</td>
<td>• 90 feathers from Laysan albatross or möli (Phoebastria immutabilis)</td>
</tr>
<tr>
<td></td>
<td>• 14 GLS tags recovered</td>
<td>• 99 feathers from black-footed albatross or kaʻupa (Phoebastria nigripes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 samples of 1 mL blood from Laysan albatross or möli (Phoebastria immutabilis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 samples of 1 mL blood from black-footed albatross or kaʻupa (Phoebastria nigripes)</td>
</tr>
<tr>
<td>Bleached Coral Recovery Assessment</td>
<td>None recorded</td>
<td>• 152 L of seawater</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 372 samples of 4 cm rice core or koʻa (Montereypupau)</td>
</tr>
<tr>
<td>Maintenance and Operation of a Radionuclide Aerosol Sampler/Analyzer (RASA) on Midway Atoll to Monitor the Comprehensive Test Ban Treaty</td>
<td>None recorded</td>
<td>• 36 air samples</td>
</tr>
<tr>
<td>Terrestrial Sampling of Endemic Hawaiian Hypomussa Moths in Papahānaumokuākea</td>
<td>None recorded</td>
<td>• 9 moth larvae or ipu (Hypomussa nui)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 11 moth larvae or ipu (Hypomussa monachus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 15 moth larvae or ipu (Hypomussa kokolu)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 5 moth larvae or ipu (Hypomussa sp.)</td>
</tr>
<tr>
<td>Other research activities involved the use of temporary devices to remotely monitor habitat variations, such as temperature, salinity, changes in sedimentation, and organism recruitment. These instruments are essential to obtaining long-term ecological data necessary for effective resource management in the face of climate change and other global threats to the Monument. Table 7 describes the temporary instruments installed or deployed in 2015.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Permitted Research Project</th>
<th>Instruments Installed for Remote Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathymetric Mapping of Papahānaumokuākea Marine National Monument</td>
<td>Installed 39 XBIs (Expendable Bathythermographs)</td>
</tr>
<tr>
<td>Deployment of High-Frequency Acoustic Recording Packages (HARPs) for Year-Round Cetacean Monitoring</td>
<td>1 High-Frequency Acoustic Recording Package (HARP) recovered and redeployed</td>
</tr>
<tr>
<td>Quantifying the Movements and Ecology of Top Predators</td>
<td>24 acoustic receiver moorings recovered</td>
</tr>
</tbody>
</table>
"As a result of the advanced technologies and capabilities aboard Okeanos Explorer, we have the opportunity to investigate scientific questions in much more detail than was possible," said Daniel Wagner, Ph.D., PMNM research specialist with NOAA’s Office of National Marine Sanctuaries and expedition science co-lead. "The high definition cameras of the Okeanos Explorer’s underwater vehicles allow us to see what deep-sea organisms look like in their natural environments."

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

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

Research Highlights

Exploring the Deep-Water Habitats of Papahānaumokuākea

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

Researchers used NOAA’s two-body remotely operated vehicle (ROV) system to conduct 18 dives, some as deep as 4,829 meters – which is almost 16,000 feet, or 3 miles down. These dives, which totaled 95 hours of bottom time, included the deepest dive ever conducted inside the Monument. Many of the ROV surveys focused on identifying and characterizing vulnerable deep-water marine environments, particularly high-density communities of deep-sea corals and sponges. The dives discovered seven new high-density communities inside PMNM and extended the depth and geographic range of three previously known ones.
The team was the first to dive on several open-ocean seamounts in the Monument, which were first mapped using high resolution multibeam sonar in 2014 and 2015. These underwater mountains rise from the floor of the ocean in 14,000 feet of water and summit within 200 to 300 feet of the surface.

Scientists collected specimens and photographs of new records of marine life from the seamounts, including potential new species of seahorse and a sea star not previously found in Hawai'i.

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

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

A 28-day research expedition in September 2015 aboard NOAA Ship Hi'ialakai to explore the deep coral reefs within Papahānaumokuākea yielded numerous species of marine life never before seen, including a possible new species of seahorse and a sea star not previously found in Hawai'i.
On a positive note, bleaching levels had dropped, likely due to the fact that the regions were not experiencing thermal stress so early in the season, and a number of reefs showed positive signs of recovery, with many vibrantly colored corals in areas that were previously bleached in 2015.

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

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

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

Researchers Follow up on Major Coral Bleaching Event in Papahānaumokuākea

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

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

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

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

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

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

The discoveries of new *Hyposmocoma* moth species and their case types in the NWHI provide important ecological information about species found on the main Hawaiian Islands. Using the age of the species and their case types, researchers can confirm that the species in the main Hawaiian Islands originally evolved in the NWHI. Similarly, the case types provide their specific ecologies which reveal what the general forest structure and streams would have looked like on the islands. These *Hyposmocoma* moths serve as an important indicator species of evolution in the Hawaiian Islands. Each discovery of a new moth species provides one more piece of the puzzle.
While no education permits were issued in 2015, efforts continued to grow the development of field-to-classroom learning opportunities. To this end, several live Google Video Chat sessions were held between students on O‘ahu and scientists aboard NOAA research ships conducting work in the Monument. The sessions were preceded by an in-classroom presentation by PMNM staff on O‘ahu in the weeks prior to the chat to introduce students to the different types of work being done in the Monument and to collect questions from the students to send to scientists on the ships to prepare for the actual live sessions. In the fall, three separate Google Video Chats were held on two separate research expeditions (the Monk Seal Field Team Deployment cruise and the RAMP cruise), reaching approximately 200 students and teachers. In some cases, these sessions were followed up by another in-classroom presentation by scientists back from the cruises that answered more questions and provided hands-on educational activities. This ‘distance learning’ concept is being further developed by PMNM staff and partners and will continue to grow in 2016.

**CONSERVATION AND MANAGEMENT**

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

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

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

*See Table 9 (next page) for a detailed list of activities that occurred under the 2015 Co-Trustees Permit.*
On August 3, 2015, during the annual month-long Reef Assessment and Monitoring Program (RAMP) cruise, a four-person maritime heritage team discovered the remains of a World War II-era U.S. Navy tanker, USNS Mission San Miguel, which sank nearly 60 years ago after running aground on Maro Reef. At 523 feet in length, it is the largest ship reported lost in the Monument. Mission San Miguel was used to deliver petroleum products across the globe during WWII. On October 1, 1957, she departed Apra Harbor, Guam in the Mariana Islands, bound for Seattle, Washington, and ran aground on October 8, 1957, while running at full speed and carrying only ballast water. The Navy safely evacuated the 42-member crew, but the exact location of the wreck site was unknown due to poor LORAN (long range navigation) reception and bad weather.
Following thoughtful study of the historic records of the loss event, along with analysis of the course the ship was running prior to running aground on the reef, the Maritime Heritage Field Team, led by Jason Raupp, Ph.D., Research Fellow in the Department of Archaeology at Flinders University in Australia, headed to Maro Reef in hopes of relocating this enormous shipwreck site that had been eluding maritime archaeologists for years. The ship was found lying on its side at a depth of 80 feet on Maro Reef, an intricate maze of reef with murky visibility. With barely any emergent land, it can often be a cryptic place to work.

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

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

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

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

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

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

Hōlanikū is managed by the State of Hawai‘i’s DLNR’s Division of Forestry and Wildlife (DOFAW). It lies at the northernmost end of the Hawaiian archipelago within the Monument. Since 1993, a dedicated crew of DLNR technicians and volunteers have worked to restore Hōlanikū’s habitats by clearing invasive plants, reintroducing native plants, eradicating rats, hauling nets and marine debris off the reefs and beaches, and monitoring the health of the atoll’s plant and animal populations. Field crews spend six months at a time living and working on the atoll. Activities at Hōlanikū provide field crews with the opportunity to integrate cultural practices into the adaptive management approach.
Several years ago, one of Andrade’s former students, Hāwane Rios, joined the field crew. With support, she successfully introduced the team to the Huli’ia process. Since then, the written and photographic documentation of observations has become part of field crews’ daily activities. Field crew members observe, photograph and discuss many topics – everything from weather events to fruiting plants to seabird behavior – in order to capture visual changes across time and seasons. Hōlanikū field camp leaders Matthew Kanaa Saunter and Naomi Worcester agreed that the crews will utilize the seasonal calendar to adapt their restoration activities.

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

The project team will update the calendar as needed to better care for the place according to the needs and signs from the ecosystem. The other three communities in the Huli’ia seasonal calendar series, Kawaihae and Ka‘u‘pulehu on Hawai‘i Island and Hā‘ena on Kaua‘i, will document community engagement interactions such as the intricacies of fishing, farming, education, sailing, paddling, restoration, hunting, recreation and more.

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

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

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

Results from the latest annual nesting albatross census on Midway Atoll National Wildlife Refuge confirm that Midway continues to host the largest nesting albatross colony in the world. Nineteen volunteers systematically covered the entire surface of the atoll’s three small islands counting active nest sites from each of two species – Laysan (mōlī) and black-footed albatross (ka‘upu) – from December 11, 2014 through January 2, 2015. Their final count resulted in over 1.39 million individual birds, assuming two adults per nest, for both species combined.
This year (hatch year 2015) far surpassed any previous documented year for nesting Laysan albatross on Midway Atoll, with 666,044 pairs recorded. The current year count for Laysan albatross represents a 52% increase over the average number from hatch years 2010 to 2014. Black-footed albatross nesting pairs came in at 28,610, also a new record, up 18% from the 2010–2014 average. The previous high year for Laysan albatross was 2006 with 487,527, and 2011 for black-footed albatross, with 28,581.

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

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

**NATIVE HAWAIIAN PRACTICES**

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

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

<table>
<thead>
<tr>
<th>Native Hawaiian Practices Permittee Affiliation</th>
<th>Number of Permits Issued</th>
<th>Permitted Native Hawaiian Practices Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nā Maka o Papahānaumokuākea &amp; Conservation International</td>
<td>1</td>
<td>• Using Traditional Ecological Knowledge to Examine Nearshore Ecosystems</td>
</tr>
<tr>
<td>Polynesian Voyaging Society</td>
<td>1</td>
<td>• Mālama Honua Worldwide Voyage, Sail to Papahānaumokuākea</td>
</tr>
<tr>
<td>Edith Kanaka’ole Foundation</td>
<td>1</td>
<td>• Summer Solstice Cultural Research and Native Hawaiian Practices on Mokumanamana (Necker) Island</td>
</tr>
<tr>
<td>University of Hawai‘i, Center for Hawaiian Studies and Nohopapa Hawai‘i</td>
<td>1</td>
<td>• Documentation and assessment of cultural sites on Mokumanamana (Necker) and Nihoa Islands</td>
</tr>
</tbody>
</table>

**Native Hawaiian Practices Highlights**

**Science and Culture Come Together in First Joint Expedition to Papahānaumokuākea**

With the Polynesian double-hulled voyaging canoe Hikianalia back in Hawai‘i after a year and a half of sailing the South Pacific, the first destination on their Hawai‘i sail plan was the island of Nihoa. This voyage was meant to give a younger generation of leaders an opportunity to voyage alone, with Polynesian Voyaging Society Kaleo Wong at the helm for the first time.
The sail was a difficult one given the weather. The tradewinds had disappeared the week before the scheduled departure date in late June, which left the navigators questioning if the canoe would make it to Nihoa. After leaving the Marine Education Training Center in Honolulu, the crew spent over two days coaxing the canoe with only light breezes across Ka’ie’ie Waho (the channel between O’ahu and Kaua’i) as well as Kaulakahi (the channel between Kaua’i and Ni’ihau). At one point, a large school of baitfish congregated under the wa’a and slowly followed along as the canoe inched across the ocean.

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

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

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

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

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

The expedition was sponsored by the Office of Hawaiian Affairs, NOAA’s Office of National Marine Sanctuaries, Polynesian Voyaging Society, Texas A&M University, University of Hawai’i-Hilo, The Nature Conservancy, Conservation International Hawai’i, Kīpahulu ‘Ōhana, Nā Mamo o Muole’a, and Nā Maka o Papahānaumokuākea.

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

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

Left Cultural researcher Makani Gregg counts ‘ōpili during a shoreline survey at Nihoa. Photo by Hoku Johnson/NOAA Fisheries
Documenting Cultural Resources and Ancestral Presence at Nihoa and Mokumanamana

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

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

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

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

Celestial and Terrestrial Observations at Mokumanamana

In June 2015, Pua Kanaka‘ole Kanahele, Ph.D., led a group of 10 cultural practitioners to conduct research during Ke Ala Polohiwa a Kāne (the summer solstice) on Mokumanamana which sits on the line depicting the northern limit of which the sun travels, the Tropic of Cancer, also named Ke Ala Polohiwa a Kāne. During two previous summer solstices and a winter solstice, the team recorded measurements and observations of the numerous heiau (shrines) on the island. These heiau are made of large upright stones called manamana, and observation platforms that were used in traditional ceremonies and often correlated with the traveling of the sun, the moon and the stars. The group also researched chants, songs and stories to piece together ancestral knowledge of the place and to reclaim place names specific to the island that may help in understanding its purpose.
This particular expedition focused on star constellations in relationship to the sites, the upright manamana alignments, single manamana and pivot stones located on the various pu‘u (hills) on the island. The measurements were taken during traditional time intervals called Kauila and occurred from sunset till sunrise and validated previous findings regarding celestial and terrestrial alignments on the island.

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

RECREATION

While recreation activities are permitted only in PMNM within Midway Atoll Special Management Area as per federal regulations for Papahanaumokuakea Marine National Monument (50 CFR Part 404), no recreation permits were issued in 2015. Access for general visitation purposes was previously allowed at Midway Atoll National Wildlife Refuge; however, due to reductions in refuge staff and operational capacity, historical and eco-tour access is currently not offered. USFWS is considering visitation options in the future if operational support becomes available.

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

SPECIAL OCEAN USE

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

Above: Mokumanama On-island Research Crew. Photo by Kalei Nu‘uhiwa
**Species Mentioned in the Permitted Activities 2015 Annual Report**

### Invertebrates/Coral

**Scientific**
- Acanthogorgia sp.
- Amphiprion
- Amphiprion perideraion
- Ascidia sp.
- Axonoptilus sp.
- Azinella sp.
- Artedidraco sp.
- Balanophora sp.
- Bathyidea sp.
- Biocellaria sp.
- Boreogorgia sp.
- Bristellastrella sp.
- Bryozoa sp.
- Cadlina sp.
- Calciella sp.
- Callyspongia sp.
- Calliactis parasitica
- Campanularia sp.
- Caridina sp.
- Ctenostoma sp.
- Ctenophora sp.
- Cystoseira sp.
- Decapoda sp.
- Deroceras sp.
- Dendroclathrus sp.
- Didemnum sp.
- Diastereisoma sp.
- Doris sp.
- Echinometra oblonga
- Echinolittorina hawaiiensis
- Echinus sp.
- Echinophyllum sp.
- Echinothrix calycifera
- Echinothuriidae
- Euclypeus sp.
- Eulamellibranchiidae
- Euvergisella sp.
- Fabraea sp.
- Farrea nr occa
- Ficus swгиб.
- Filograna abigibbosa
- Filograna papyracea
- Filograna sp.
- Fortunella sp.
- Galaxea sp.
- Galaxiidae
- Galaxiid sp.
- Goniastrea sp.
- Goniasteridae
- Gorgonacea
- Gorgoniana
- Gorgonidiae
- Gorgonidenidae
- Haliclona sp.
- Halimeda sp.
- Halocaridae
- Heliolimnium sp.
- Heliopqrion sp.
- Heliozoa sp.
- Hemiuridae
- Hemimyidae
- Hemprichia sp.
- Herpetosiphon sp.
- Heterobranchia
- Heterosclerophora sp.
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Pursuing new knowledge brings bountiful rewards.