



PAPA HĀNAUMOKUĀKEA

Marine National Monument



PERMITTED ACTIVITIES

2009 ANNUAL REPORT





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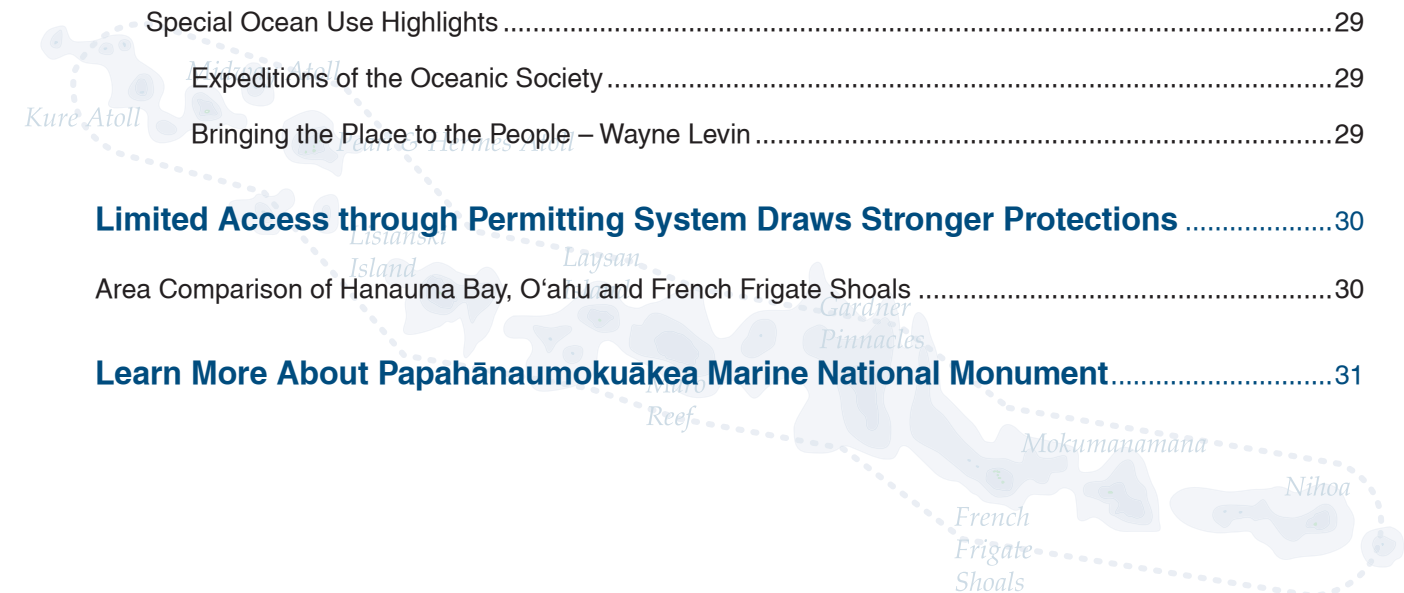
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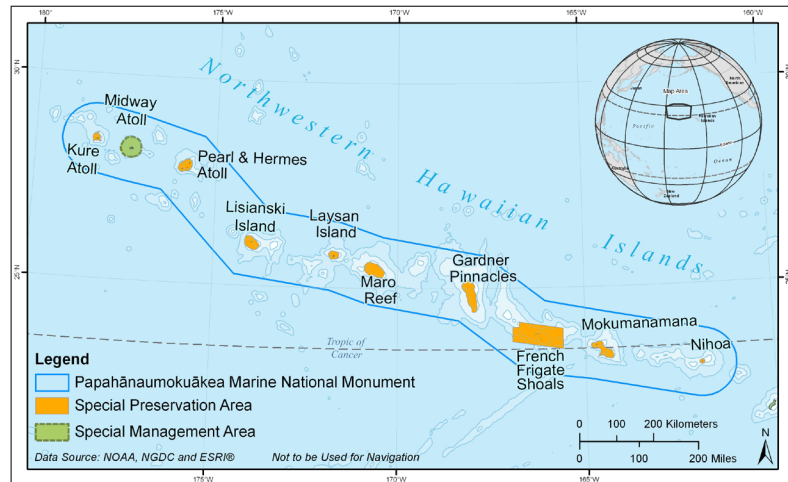
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INTRODUCTION



Covering a distance of 1,200 miles and totaling an expanse of 140,000 mi², Papahānaumokuākea Marine National Monument is home to 23 federally threatened and endangered species, 8 of which are found only in the Northwestern Hawaiian Islands. Terrestrial habitat continues to be a critical foothold for over 14 million seabirds representing 21 different species. Recent research conducted in many deep sea habitats in the Monument are yielding new species to science and a greater understanding

of our oceans. In addition to this richness, 89 archaeological sites have been identified on Nihoa and 52 on Mokumanamana, making these islands within Papahānaumokuākea some of the most concentrated prehistoric cultural sites in Hawai'i. The vast Monument area includes the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, Northwestern Hawaiian Islands State Marine Refuge, Midway Atoll National Wildlife Refuge / Battle of Midway National Memorial, Hawaiian Islands National Wildlife Refuge, and the Kure Atoll Seabird Sanctuary.

Despite the Monument's isolation in the Pacific, significant threats to habitats and wildlife arise from human activities occurring beyond Monument boundaries. Issues such as global climate change, sea level rise, ocean acidification, wildlife / fishery interactions, and marine debris are major concerns. On land, impacts from the introduction of alien species represent the most immediate threat. 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 of activities to evaluate and mitigate cumulative impacts.

The Monument is administered jointly by three Co-Trustees - the Department of Commerce through the National Oceanic and Atmospheric Administration, the Department of the Interior through the U.S. Fish and Wildlife Service, and the State of Hawai'i through the Department of Land and Natural Resources (collectively, the Co-Trustees). In addition, the Co-Trustee agencies work in close collaboration and consultation with the Office of Hawaiian Affairs to ensure that both cultural and natural resources are protected in a manner in line with and with reverence to the Native Hawaiian host culture. This unique management partnership of Papahānaumokuākea allows for the protection of its entire ecosystem, from remote sub-tropical islands to the deep sea.

This report, produced annually since 2007, highlights the Monument's joint permitting process, summarizes all permitted activities that have occurred in 2009, and their benefit to managing the resources of Papahānaumokuākea. Where applicable, data from previous years are provided as a comparison to the current reporting year.



Past Human Activities Affecting Present Day Ecosystem Protections in the Northwestern Hawaiian Islands

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Photo: James Watt

Although activities in the Northwestern Hawaiian Islands have been managed through the Monument permitting process since 2006, differing levels of human presence and various activities have occurred historically. Many of these historical uses have influenced the activities that are currently permitted in Papahānaumokuākea. Other historical uses have brought on the need for specific protections that are now in place to conserve the unique natural and cultural resources of the Northwestern Hawaiian Islands.

Traditional chants, stories, and artifacts on Nihoa and Mokumanamana indicate that Native Hawaiians inhabited these islands as long ago as 1000 A.D. While Mokumanamana was likely visited occasionally for ceremonial purposes, the island of Nihoa may have supported permanent populations of up to 175 people. Today, studies of the cultural sites throughout the Monument help to pass traditional knowledge from one generation to the next, and they tie past pilgrimages and ceremonies to present-day cultural and spiritual practices.

Military presence in the Northwestern Hawaiian Islands began in the early 1900's, with U.S. Navy and Marine exercises providing training and military readiness during the years leading up to World War II. After successfully defending the area from the Imperial Japanese Navy at the Battle of Midway in 1942, the U.S. Navy maintained a presence at Midway through the end of the last century. The Naval facility at French Frigate Shoals was decommissioned in 1946 but was soon replaced by a U.S. Coast Guard Long Range Aids to Navigation (LORAN) Station, which was manned by a crew of 25 to serve the central Pacific through 1979. The final contingent of Navy personnel departed Midway Atoll in 1997. The U.S. Coast Guard continues to provide logistical and emergency response support when needed.

Prior to military presence, scientists aboard the converted World War I minesweeper *USS Tanager* conducted terrestrial surveys and collections that resulted in the discovery of many of the species valued as endemic today, including the Nihoa *Schiedea verticillata*, Nihoa millerbird, and Laysan finch. These expeditions also resulted in the only existing video footage of the now extinct Laysan rail and Laysan 'apapane, landbird species that were extirpated following the introduction of rabbits to Laysan Island by guano miners in the early 1900s. Current scientific research continues to build upon past efforts in order to protect and conserve the unique resources of Papahānaumokuākea.



Timeline of Ecosystem Protections

► 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 Reservation around islands from Nihoa Island to Kure Atoll, to further protect these islands, reefs, and their resources.

► 1940

President Franklin D. Roosevelt signs Presidential Proclamation No. 2416 changing the name of the Hawaiian Islands Reservation to the Hawaiian Islands National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service.

► 1988

The U.S. Navy and U.S. Fish and Wildlife Service enter into a Cooperative Agreement establishing Midway Atoll National Wildlife Refuge on the land and water areas managed as a Naval Air Facility.

► 1993

The State of Hawai'i Board of Land and Natural Resources designates Kure Atoll a State Seabird 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 and Wildlife Service.

► 2000 and 2001

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

► 2005

Hawai'i State Governor Linda Lingle signs regulations establishing all state waters extending three miles seaward from any coastline beginning and including Nihoa and Kure Atoll, but excluding Midway Atoll, as the NWHI Marine Refuge. 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, and overlaid with the Hawai'i State NWHI Marine Refuge. This designation is the first step towards coordinated management of the unique resources within the NWHI region.



JOINT PERMITTING PROCESS

The permitting process is administered to manage access and monitor human uses in Papahānaumokuākea. Under Proclamation 8031 all activities are prohibited, with limited exception, unless by Monument permit. Applications for permitted activities are reviewed by managers, scientists, and other experts within the Co-Trustee agencies and by Native Hawaiian cultural reviewers. In addition, permit applications are posted for public notification, and all applications for activities in State waters must be reviewed by the State of Hawai'i Board of Land and Natural Resources.

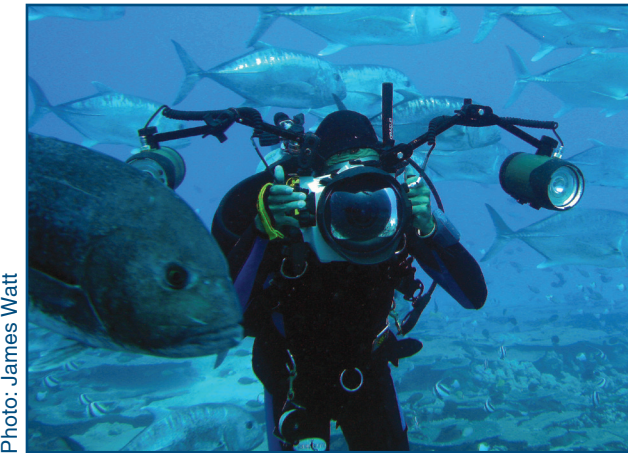


Photo: James Watt

In order for any project to be permitted, it must meet both federal National Environmental Policy Act (NEPA) and State of Hawai'i Environmental Policy Act (HEPA) requirements. Permitted activities must also meet all Findings of Presidential Proclamation 8031 that established the Monument, prior to undergoing the Monument review process.

In addition to the permit requirements of the Monument, other federal and state permits and/or consultations may be required for work conducted in the Northwestern Hawaiian Islands. For example, all personnel working with threatened

or endangered species must have an endangered species permit. Anyone proposing to handle bird species must obtain one or more permits from the U.S. Fish and Wildlife Service Division of Migratory Bird Management. Scientists working with marine mammals must obtain one or more permits from the NOAA National Marine Fisheries Service Office of Protected Resources. Proposed activities near potential or known historic or cultural sites require a concurrence of no adverse effect with the State of Hawai'i Historic Preservation Division and consultations with the Office of Hawaiian Affairs, and other interested Native Hawaiian individuals and organizations, pursuant to the National Historic Preservation Act (NHPA). Consultations may also be necessary under the U.S. Endangered Species Act (ESA) or Environmental Protection Agency (EPA) regulations.

Following the Monument review process, 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 and Monument regulations, and that comply with Monument Management Board agency mandates and policies. These include but are not limited to requirements for compliance with quarantine protocols to avoid introduction of alien invasive species, and prohibitions on the disturbance of cultural or historical artifacts or sites. Special Conditions may also be applied to particular permits, placing additional restrictions on activities in order to minimize impacts to Monument resources.

Information on Monument permit application procedures is available at:
<http://papahanaumokuakea.gov/resource/permits.html>



Findings of Presidential Proclamation 8031

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According to Presidential Proclamation 8031 of June 15, 2006 the following criteria must be met before a Monument permit may be issued:

- ▶ 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.

Types of Permits Issued

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Permit applications are approved in one of six permit categories, if Co-Trustees find that the activity: 1) is research designed to further 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 Papahānaumokuākea's resources and activities and improve resource management decision-making. Priority is given to research proposals that help to meet the management needs of the Monument Co-Trustee agencies. The types of activities that may be conducted under research permits include biological inventories, ecosystem-based research, habitat characterization, restoration investigations, and terrestrial and marine archaeological research.

Education

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

Conservation and Management

Conservation and Management permits are for activities that make up the general management of Papahānaumokuākea. This may include activities such as 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 enabling 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 detections.



Photo: Rob Shallenberger

Native Hawaiian Practices

Native Hawaiian Practice permits are for activities that constitute Native Hawaiian cultural practices. Activities under this permit must be noncommercial, deemed appropriate and necessary by traditional standards, benefit the Northwestern Hawaiian Islands and Native Hawaiian community, perpetuate traditional knowledge, and restrict the consumption of harvested resources from the Monument. Examples of permitted activities include the entry of vessels for the purpose of applying and transferring knowledge of traditional navigation techniques and conducting ceremonies at historic cultural sites on Nihoa or Mokumanamana. Permit conditions and guidelines are developed by the Co-Trustees and the Office of Hawaiian Affairs in consultation with the Native Hawaiian Cultural Working Group and the Native Hawaiian community.



Special Ocean Use

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

Recreation

Recreation permits are for activities conducted for personal enjoyment, such as snorkeling, wildlife viewing, and kayaking. Recreation activities must not result in the extraction of monument resources or be involved in a fee-for-service transaction, and are authorized only within the Midway Atoll Special Management Area.

Exempted Activities



Photo: J. Breeden

Other activities that do not require a permit to enter the Monument are activities necessary to respond to emergencies threatening life, or activities necessary for law enforcement purposes. All activities and exercises of the 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.

Any vessel or persons passing through Papahānaumokuākea without interruption, are not required to obtain

a permit, however following the Monument's codifying regulations in 50 CFR Part 404, domestic vessel notification must be provided prior to entering and leaving the Monument. In 2008, the International Maritime Organization (IMO) designated Papahānaumokuākea as a Particularly Sensitive Sea Area (PSSA) allowing for the implementation of a ship reporting system (CORAL SHIPREP) requiring all transiting vessels with the intent to enter a U.S. port or place to participate in the reporting system; other international transiting vessels are recommended by the IMO to avoid Papahānaumokuākea waters or participate in the reporting system. More information on the PSSA ship reporting requirements is available at http://papahanaumokuakea.gov/resource/ship_reporting.html.



OVERVIEW OF 2009 PERMITTED ACTIVITIES

Permits Issued in 2009

Table 1 presents information on the number of Monument permits granted by permit type for 2009, with data from previous years provided as a comparison. Although 60 permit applications were received in 2009, a total of 51 Monument permits were issued. Some applicants withdrew their application at different stages of the permitting process, due to a variety of reasons ranging from logistics to financial constraints. As the Monument's permitting system continues to be refined, the number of permits issued within each permit type each year may reflect changes in the permitting process, rather than changes in the number of activities conducted.

The number of research permits granted in 2009 was lower than in previous years (36 and 37 in 2007 and 2008 respectively, versus 28 issued in 2009), and 19 of the 28 research permits were for ongoing or long-term projects. Six conservation and management permits were issued in 2009, including 4 permits consisting of long-term monitoring or management activities conducted by Monument Co-Trustee agencies.

Special ocean use activities permitted in 2009 rose from two in 2008, to ten in 2009. Two education permits were issued in 2009, similar to previous years. The number of Native Hawaiian practice permits increased by three in 2009, as several were a continuation of previous projects. Specific information on the projects permitted in 2009 is given in the Permitted Activities by Permit Category section of this report.

Table 1. Number of Monument permits issued by permit type in 2007, 2008, and in 2009.

Permit Type	2007 Permits	2008 Permits	2009 Permits
Research	36	37	28
Conservation and Management	6	6	6
Education	2	3	2
Native Hawaiian Practices	1	1	4
Recreation	1	1	1
Special Ocean Use	5	2	10
TOTAL	51	50	51



Figure 1 shows the number of new versus renewal Monument permits granted in 2009. In order for a permit application to be considered a renewal, the requested activities must have been previously permitted to the same specific individual or agency. New and renewal applications both undergo the same rigorous joint review process.

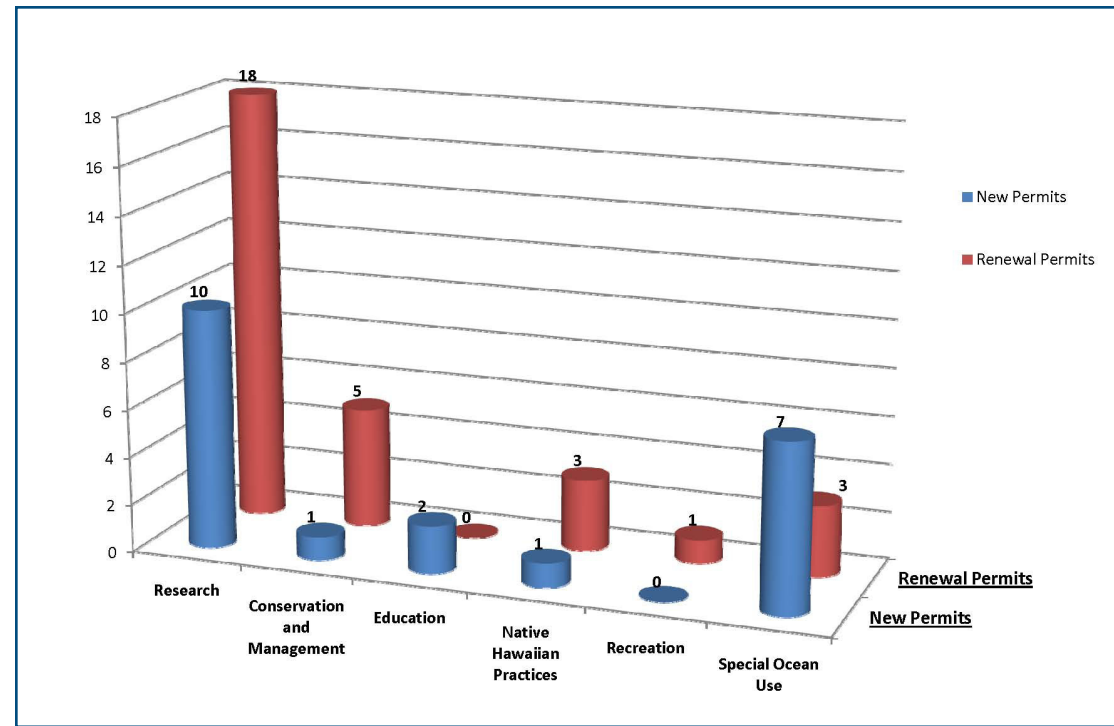


Figure 1. Comparison of 2009 new versus renewal permits by permit category.

Levels of Human Presence

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The overall level of human presence in the Monument in 2009, compared to previous years, is indicated in the number of vessel cruises and flights (Table 2). Midway Atoll National Wildlife Refuge operates a small functioning airport, and Tern Island within French Frigate Shoals, contains a small airstrip. These two areas within Papahānaumokuākea are the only locations equipped to accept aircraft. In 2009, only four individual vessels were utilized to support permitted activities and transport people and supplies.

Table 2. The number of vessel cruises and flights permitted to and from the Monument, in 2007 through 2009.

	2007	2008	2009
Vessel Cruises	18	15	13
Flights			
French Frigate Shoals	13	13	13
Midway Atoll	86	99	87



In addition to tracking the number of flights and vessel cruises entering the Monument, the individual number of people on land is also recorded throughout the year. The minimum, maximum, and average number of people recorded on land per day on each island or atoll in the Monument in 2008 and 2009 is presented in Table 3. Due to very low numbers of people on land per day throughout the reporting year, data in Table 3 are in decimal form and are not rounded to the nearest whole number. Midway Atoll continues to have the highest concentration of human presence, sustaining an average human population of 76 individuals necessary to operate Midway facilities.

Table 3. The minimum, maximum, and average number of individuals on land per day on each island or atoll in 2008 and 2009.

Island / Atoll	2008			2009		
	Min	Max	Average	Min	Max	Average
Nihoa	0	3	0.03	0	9	0.17
Mokumanamana	0	2	0.04	0	11	0.12
French Frigate Shoals	2	26	6.47	1	11	3.25
Laysan Island	7	14	8.63	0	6	1.61
Lisianski	0	6	0.81	0	2	0.48
Pearl and Hermes Atoll	0	5	0.22	0	3	0.74
Midway Atoll	68	209	85.05	58.29	78.57	70.36
Kure Atoll	0	14	2.28	0	5	0.28
TOTAL			103.53			77.01



Photo: James Watt



Permitted Versus Actual Visitation Records

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Often the number of individuals permitted to access the Monument and conduct activities is not reflective of the actual number of people who conducted work in the Monument. For example, conservation and management permits authorize personnel with qualifications necessary to conduct activities; however the actual number of individuals who worked in the Monument to complete the conservation and management activity is often less than the number permitted. In other instances, special ocean use permittees may have visitor cancellations, further lowering the number of people who actually enter the Monument. 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 in 2009 permitted, compared to the actual number of people who conducted permitted activities in Papahānaumokuākea by permit type.

Permit Type	Number of People Permitted	Actual Number of People Who Performed Permitted Activities
Research	184	144
Conservation & Management	234	146
Education	31	23
Native Hawaiian Practices	35	20
Recreation	50	13
Special Ocean Use	330	79
TOTAL	864	425



Photo: Jill Zamzow

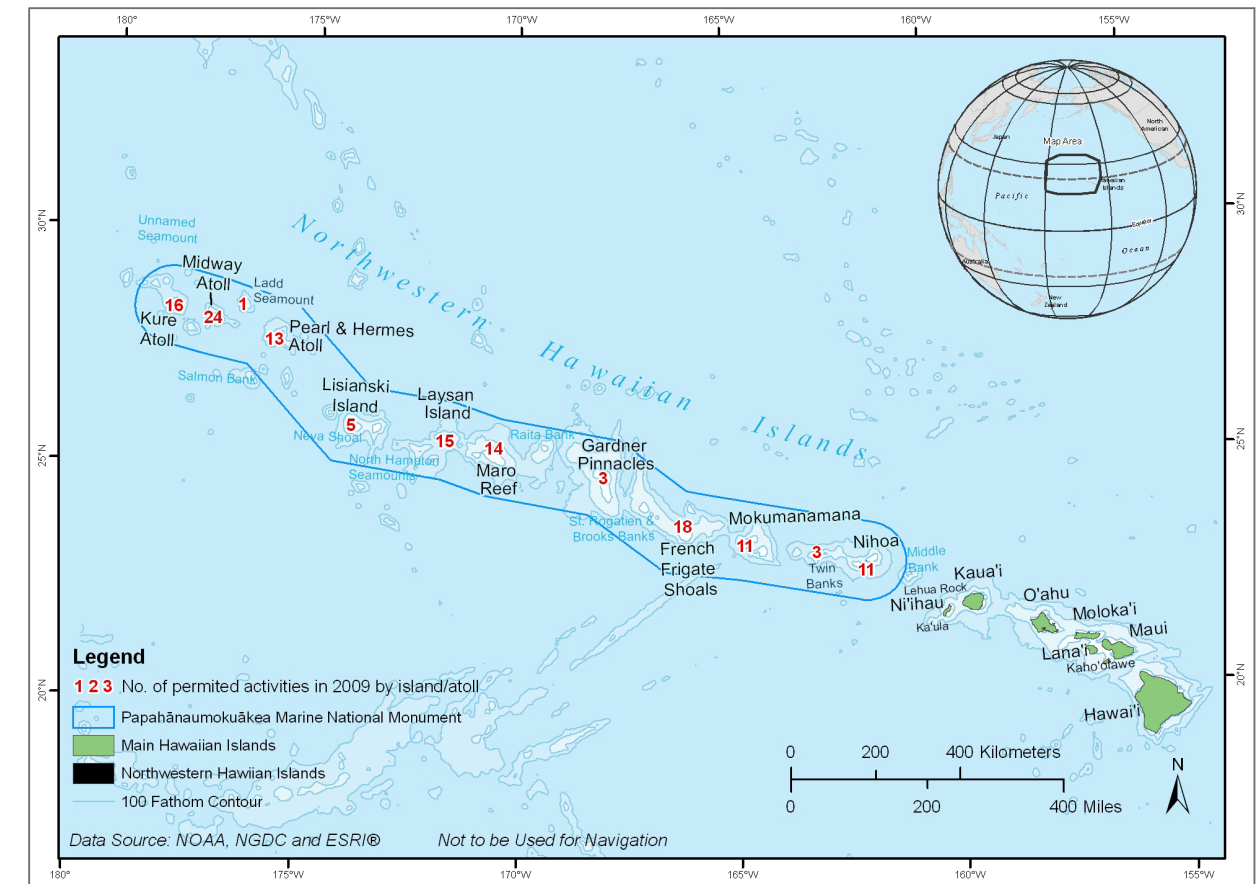


Locations of Permitted Activities

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The map in Figure 2 indicates locations at which permitted activities occurred in Papahānaumokuākea in 2009. Of the 51 permits issued, many allowed for work to be conducted at multiple locations. Thus, for example, a single permit may have included work only at French Frigate Shoals, or it may have allowed for visits to all islands and atolls.

Figure 2. Locations of 2009 permitted activities. The number of permitted projects at each island or atoll is indicated in red.





2009 PERMITTED ACTIVITIES BY PERMIT CATEGORY

Research

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Summary of Research Activities

A total of 28 research permits were issued in 2009. Table 5 lists the number of research permits issued for each organization or institution, together with project titles. Research permits were issued to Co-Trustee agency personnel, university researchers, and non-governmental organizations to conduct work on seabirds, fish, corals, lobsters, marine mammals, algae, and terrestrial insects; as well as work involving archaeology and submersible diving technology.

Islands and atolls with the highest levels of permitted research projects in 2009 included Midway Atoll, French Frigate Shoals, Pearl and Hermes Atoll, and Kure Atoll. Non-emergent banks and reefs, including Brooks Banks and Twin Banks, saw the lowest levels of research projects, while Lisianski Island and Gardner Pinnacles had the fewest number of research project activities conducted on emergent lands.

Table 5. Affiliations of Research permittees and permitted projects in 2009.

Research Permittee Affiliations	Number of Permits Issued	Permitted Research Project Titles
NOAA National Marine Fisheries Service Pacific Islands Fisheries Science Center	3	<ul style="list-style-type: none"> Hapu'upu'u (<i>Epinephelus quernus</i>) Growth Studies on Kure Atoll and Midway Atoll Lobster and Bottomfish Monitoring Activities in Federal Waters at Mokumanamana and Maro Reef Juvenile Hawaiian Monk Seal Enhancement Activities
NOAA National Ocean Service Office of National Marine Sanctuaries	2	<ul style="list-style-type: none"> Northwestern Hawaiian Islands Reef Assessment and Monitoring Program Use of Conventional and Technical SCUBA Diving Technology to Document the Biodiversity and the Presence or Absence of Alien/Invasive Species in Deep Reef Areas
University of California, Santa Cruz	3	<ul style="list-style-type: none"> Study on the Foraging Ecology of Red-footed and Masked Boobies at Tern Island, French Frigate Shoals and Midway Atoll Research and Monitoring of Hawaiian Albatrosses from Tern Island, French Frigate Shoals and Midway Atoll National Wildlife Refuge Investigations of Black-lipped Oyster (<i>Pinctada margaritifera</i>) Recruitment and Abundance at Midway Atoll



Research Permittee Affiliations	Number of Permits Issued	Permitted Research Project Titles
University of Hawai'i Departments of Oceanography, Plant and Environmental Protection Sciences, Botany, and Anthropology	4	<ul style="list-style-type: none"> Algal Baseline Characterization Activities Collection of Adult and Larval <i>Hyposmocoma</i> Moths to Conduct Species Descriptions and DNA Analysis of Their Evolutionary Relationships Characterization of Large Deep-sea Scavenging Fauna, General Habitat Associations and Their Relationship to Water Depth Within the Monument Documentation and Assessment of Cultural Sites on Mokumanamana and Nihoa Islands
University of Hawai'i Hawai'i Institute of Marine Biology (HIMB)	9	<ul style="list-style-type: none"> Quantifying the Movements of Sharks at French Frigate Shoals Coral Genetics Research of Temperature in Coral Health and the Physical Environments of Coral Reefs at French Frigate Shoals and Pearl and Hermes Atoll Coral Endosymbiont Research Quantifying the Movements of Top Predators Within Papahānaumokuākea Support for Activities to Quantify Shark Movements at French Frigate Shoals Comparison of the Biological Community Structure and Diversity of Maritime Heritage Resource Sites with Surrounding Areas Reef Fish Genetic Survey Research Reef Invertebrate Genetic Survey Research Collection of Life History Data for 'Āweo'weo (<i>Priacanthus meeki</i>) and 'Ū'ū (<i>Myripristis berndti</i>)*
University of Hawai'i Hawai'i Undersea Research Laboratory (HURL)	2	<ul style="list-style-type: none"> Support for Permitted Activities Using the Pisces IV and Pisces V Submersibles and RCV-150 Remotely Operated Vehicle Multi-beam Mapping, Deep Water Surveys, and Voucher Specimen Collection in Papahānaumokuākea Marine National Monument
Hawai'i Pacific University	3	<ul style="list-style-type: none"> Investigations of Impacts of Plastic Ingestion by Albatross at Midway Atoll and French Frigate Shoals* Quantification of the Amount and Types of Marine Debris Ingested by Albatross Species at French Frigate Shoals, Midway Atoll, and Kure Atoll Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems within Papahānaumokuākea Marine National Monument
University of Lisbon, Portugal	1	<ul style="list-style-type: none"> Genetics Comparison of Pacific and Atlantic Bulwer's Petrels

* Permitted research project was not conducted in 2009.



Observational, Physical, or Sample Collection Activities in 2009

The research projects permitted in 2009 included a variety of activities: four of the research permits issued were for work that did not involve the study of organisms (Table 6), including marine debris research at Midway Atoll, land-based marine debris surveys and removal, analysis of the water chemistry make-up surrounding atoll systems, and assessment of Native Hawaiian cultural sites at Nihoa and Mokumanamana. Approximately one-fourth of research projects that involved the study of organisms consisted of observational work, not requiring biological or other samples to be collected. Observational work included activities such as surveying, population monitoring, and satellite or acoustic tagging of animals.

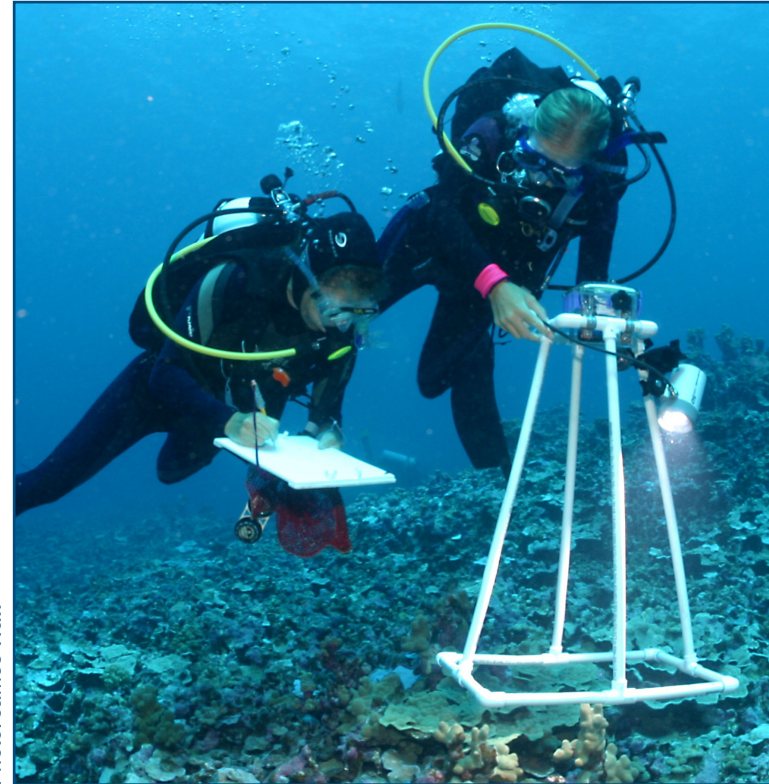


Photo: James Watt

The remaining research projects also involved collection of physical samples, such as sediment or soils, or biological samples, including feathers, blood, blubber biopsies, fin clips; or, in few projects, whole specimens or invertebrate organisms were necessary to provide a baseline and foundation to avoid subsequent collections of the same species.

Sample collections for all projects are listed in Table 6. Although some sample collections were conducted at single islands or atolls, such as albatross feather and blood samples taken at French Frigate Shoals, sample collections for most projects were taken from multiple locations throughout the Monument and from multiple species within each taxonomic group.



Table 6. The following table indicates the type of research conducted, and specifies any physical or biological sample collections in 2009.

Permitted Research Project	Observational / Other Research Conducted	Physical Samples Collected	Biological Samples Collected
Algal Baseline Characterization Activities			<ul style="list-style-type: none"> • 256 partial pieces of coralline algae and underlying rock
Study on the Foraging Ecology of Red-footed and Masked Boobies at Tern Island, French Frigate Shoals and Midway Atoll	<ul style="list-style-type: none"> • 11 Red-footed Boobies tagged • 19 Masked Boobies tagged 		<ul style="list-style-type: none"> • 33 Red-footed Booby feathers • 57 Masked Booby feathers
Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems within Papahānaumokuākea National Marine Monument		<ul style="list-style-type: none"> • 486,750 ml seawater 	
Characterization of Large Deep-sea Scavenging Fauna, General Habitat Associations and Their Relationship to Depth Within Papahānaumokuākea Marine National Monument			<ul style="list-style-type: none"> • 71 whole fishes
University of Hawai'i at Mānoa, Hawai'i Institute of Marine Biology, Coral Genetics Research	<ul style="list-style-type: none"> • Installed temperature loggers 		
University of Hawai'i at Mānoa, Hawai'i Institute of Marine Biology, Biological Studies on Maritime Heritage Sites	<ul style="list-style-type: none"> • 8 transects • 180 photographs 		<ul style="list-style-type: none"> • 135 coral biopsies (each 1 mm²)
Documentation and Assessment of Cultural Sites on Mokumanamana (Necker) and Nihoa Islands	<ul style="list-style-type: none"> • Site observations 		
University of Hawai'i at Mānoa, Hawai'i Institute of Marine Biology, Reef Fish Genetic Survey Research	<ul style="list-style-type: none"> • 17 monk seal sightings 		<ul style="list-style-type: none"> • 1,474 whole fish
Hapu'upu'u (<i>Epinephelus quernus</i>) growth studies on Kure Atoll and Midway Atoll	<ul style="list-style-type: none"> • No Hapu'upu'u observed 		
Research and Monitoring of Hawaiian Albatrosses from Tern Island, French Frigate Shoals and Midway Atoll National Wildlife Refuge			<ul style="list-style-type: none"> • 50 Laysan Albatross blood and stomach oil samples • 50 Black-footed Albatross blood and stomach oil samples



Permitted Research Project	Observational / Other Research Conducted	Physical Samples Collected	Biological Samples Collected
Juvenile Hawaiian Monk Seal Enhancement Activities			<ul style="list-style-type: none"> • 140 bacterial & viral swabs on eyes, nose, mouth, rectal, and genitals • 42 vials of blood (approx. 60-80 ml per seal) • 28 blubber biopsies • 22 worming medication treatments • 173 fecal sample • 13 regurgitate samples
University of Hawai'i at Mānoa, Hawai'i Institute of Marine Biology, Coral Endosymbiont Research			<ul style="list-style-type: none"> • 161 coral biopsies (<1 cm)
Investigations of Black-lipped Oyster (<i>Pinctada margaritifera</i>) Recruitment and Abundance at Midway	<ul style="list-style-type: none"> • 549 black-lipped pearl oyster photographed 		
Collection of Adult and Larval Moths to Conduct Species Descriptions and DNA Analysis of Their Evolutionary Relationships			<ul style="list-style-type: none"> • 20 caterpillar cases collected
Use of Conventional and Technical SCUBA Diving technology to document the biodiversity and the presence/absence of alien/invasive species of the Northwestern Hawaiian Islands' deep reef areas.	<ul style="list-style-type: none"> • 31 transects surveyed 		<ul style="list-style-type: none"> • 12 whole fishes



Photo: James Watt

Research Highlights

► Partnerships Allow for Submersible Exploration

Submersibles operated by the Hawai'i Undersea Research Laboratory (HURL) and supported by the National Oceanic and Atmospheric Administration again uncovered new and dramatic species of corals and sponges during deep sea dives in Papahānaumokuākea Marine National Monument. During December 2009 and operating off University of Hawai'i research vessel *Ka'imikai-o-Kanaloa*, scientists conducted dives off Middle Bank and Twin Banks near Nihoa, just within the Monument's eastern boundary. The dives were to depths of nearly one mile. During this project, researchers completed the multibeam mapping of the entire submerged Twin Banks area. This was the first time the HURL program used High Definition (HD) video cameras to capture images of deep ocean research work. The quality of the HD video is so remarkable that scientists may be able to identify some animals from the video alone, rather than having to collect actual specimens. Researchers note HD is a fabulous tool and provides such outstanding detail that you can see individual polyps on corals. In addition to its research value, HD video brings the deep sea experience to a wide range of people.

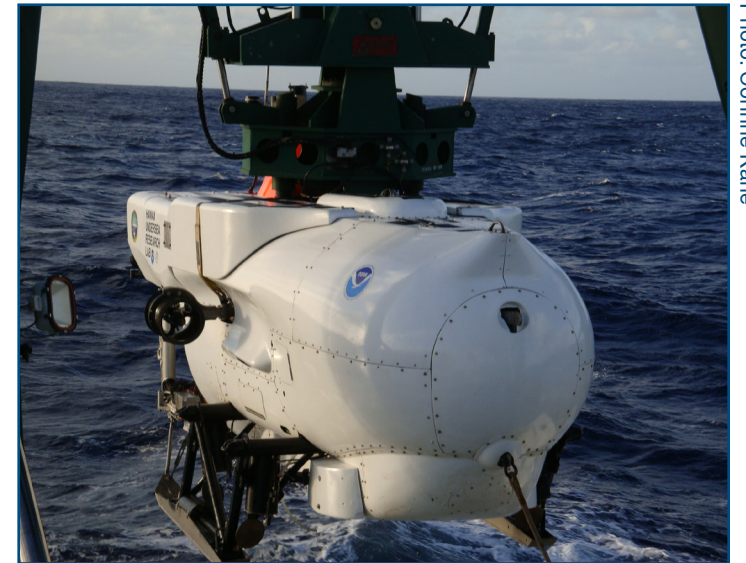


Photo: Corinne Kane

► Advanced Diving Technology Gets Researchers Deeper



Photo: Greg McFall

Over the course of a month, 111 dives to depths of 275 feet showed the safety and utility of using trimix (oxygen, nitrogen, helium) diving technology for deep reef exploration. Research divers working off NOAA ship *Hi'ialakai* in August and September 2009 demonstrated the application of this technology for scientific diving in Papahānaumokuākea Marine National Monument. The primary goal was to demonstrate the tremendous increase in our understanding of deep coral reefs that can result from the use of advanced diving technologies. Scientists found at least a

dozen new records of fishes in the Northwestern Hawaiian Islands, collected an undescribed species of butterfly fish and documented previously unknown deep-water nursery habitats for reef fishes that live in the mesophotic zone. Monument staff hope that in the future the use of closed-circuit rebreathers will provide additional efficiency and safety.



Conservation and Management

Summary of Conservation and Management Activities

Six conservation and management permits were issued in 2009 (Table 7). Two permits were issued for the operation of NOAA vessels, *Oscar Elton Sette* and *Hi'ialakai*; and one was issued to the NOAA Office of National Marine Sanctuaries to carry out annual surveys and monitoring of maritime heritage sites in the Monument. One conservation and management permit was issued to the University of Hawai'i's Marine Center to support individually permitted research activities aboard research vessel *Ka'imikai-o-Kanaloa*. The permit issued to NOAA National Marine Fisheries Service Office of Protected Resources authorized deterrence activities to lessen the amount of shark predation on Hawaiian Monk Seal pups and allowed researchers to monitor these populations using remote cameras.

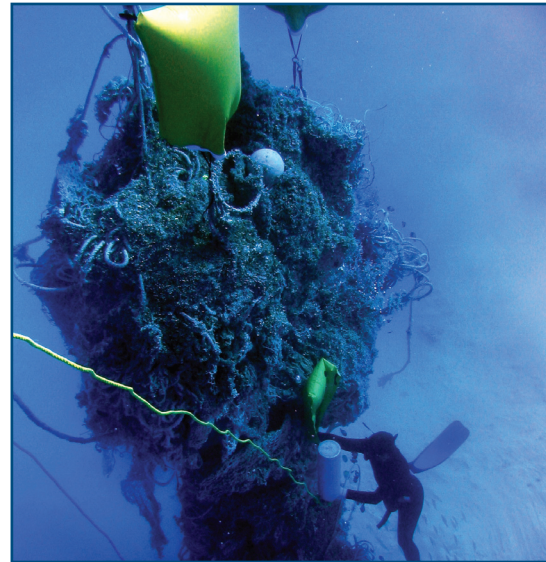


Photo: Amy Hall

Table 7. Affiliations of Conservation and Management permittees and permitted projects in 2009.

Conservation and Management Permittee Affiliation	Number of Permits Issued	Permitted Conservation and Management Projects
Monument Co-Trustees	1	• Co-Trustee conservation and management activities
NOAA Office of Marine and Aviation Operations	2	• Support for permitted activities aboard NOAA Ship <i>Hi'ialakai</i> • Support for permitted activities aboard NOAA Ship <i>Oscar Elton Sette</i>
NOAA National Ocean Service Office of National Marine Sanctuaries	1	• Maritime Heritage Conservation and Management Activities
NOAA National Marine Fisheries Service Office of Protected Resources	1	• Galapagos Shark Predatory Monitoring and Mitigation Efforts on Hawaiian Monk Seal Pups
University of Hawai'i, Marine Center	1	• Support for Permitted Research Activities Using the University of Hawai'i Research Vessel <i>Ka'imikai-o-Kanaloa</i> as a Support Platform

As shown in Table 7, a single conservation and management permit is issued annually, pending a stringent review process, to the Monument Co-Trustee agencies for conservation and management activities conducted within the Monument (including, for example, the operation and maintenance of field stations and camps at Midway Atoll, Laysan, and French Frigate Shoals; marine debris removal activities; and invasive and endangered species monitoring). A conservation and management permit of this nature is necessary



for continued cooperative and effective management of Monument resources. 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. Reports of management activities can be found online at: http://papahānaumokuākea.gov/management/managers_reports.html

Below is a list of all activities conducted under the conservation and management Monument Co-Trustee permit in 2009, for the Department of Commerce, National Oceanic and Atmospheric Administration, the Department of the Interior, U.S. Fish and Wildlife Service, and the State of Hawai'i, Department of Land and Natural Resources:

- Midway Atoll Tide Gauge Maintenance
- Management and Operation of Laysan Island Field Station
- Removal of Invasive Algae at Kure Atoll
- Management and Operation of Midway Atoll Field Station
- Benthic Habitat Mapping
- Management and Operation of French Frigate Shoals, Tern Island Field Station
- Marine Maritime Surveys at Midway Atoll
- Maintenance and Operation of Hawaiian Monk Seal Monitoring Field Stations
- Marine Debris Removal
- Management and Operation of Kure Atoll Field Station



Photo: Lasha-Lynn Salbosa



Conservation and Management Highlights

▶ Restoring Loulu on Laysan Island

In the late 1800s the Loulu palm or *Pritchardia* disappeared from Laysan Island. No one knows why, as it seems to have died out prior to human presence on the island. The single-trunked palm tree with fan-shaped leaves is one of the smaller of the Hawaiian species, reaching heights of up to 15 feet. In 1998, the Laysan Island Ecosystem Restoration Plan was written. Two years later U.S. Fish and Wildlife Service (FWS) technicians began introducing seeds gathered from palms on Nihoa Island to Laysan. While they found the seeds were easy to germinate in nursery conditions, they were difficult to maintain once they were out planted. Over time, technicians identified the best time to gather seeds from Nihoa, and in 2009 the Loulu restoration work on Laysan reached a milestone, when the first flowers were spotted. Later that year, one Loulu fruit was found, suggesting that pollinators for Loulu may be present on Laysan. About 30 plants are now above head high, and it took eight years to get to this point. When Loulu flowers are spotted, field teams stationed on Laysan immediately cover them with netting to protect flowers from Laysan finches. As restoration efforts continue, managers hope to once again have a self-sustaining population of Loulu palms.



Photo: U.S. Fish and Wildlife Service

▶ Maritime Heritage Surveys Bring Shipwrecks to Life



Photo: Kelly Gleason

In June 2009, the maritime heritage team monitored several sites including the *Dunnottar Castle* and *Gledstanes* at Kure Atoll, the *Corsair*, *Carrollton* and *Macaw* sites at Midway Atoll, the *Churchill* and unknown whaling shipwreck site at French Frigate Shoals, and the *Quartette* shipwreck site at Pearl and Hermes Atoll. While surveying the unknown whaling ship at French Frigate Shoals, discovered in August of 2008, the team came across an exciting new portion of the wreck site. In addition to the discovery of a fourth try pot (used for boiling whale blubber down to oil), three blubber hooks (used for peeling the blubber off of the whale), a grinding wheel and a kedge anchor, the team also found four small (40 cm high x 40 cm wide) cast iron pots that resemble small try pots. These may have been used on board in the galley area. The team also came across what appears to be the tip of a whaling harpoon. This artifact represents an exciting discovery because of its potential to identify the date and name of the shipwreck. The identity of this shipwreck remains a mystery to date, as it may be

one of three American whaling ships lost at French Frigate Shoals: the *South Seaman*, wrecked in 1859; the *Daniel Wood*, wrecked in 1867; and the *Two Brothers*, a Nantucket whaler wrecked in 1823. This important archaeological work re-discovering maritime heritage of the NWHI began hundreds, if not thousands, of years ago with Polynesian and Native Hawaiian voyages across the Hawaiian archipelago and beyond.



Education

Summary of Education Activities

Two education permits were issued in 2009. One permit was issued to NOAA Office of National Marine Sanctuaries for the Co-Trustee program entitled Papahānaumokuākea 'Ahahui Alaka'i (PAA) Educator Program at Midway Atoll. Another education permit was granted to the Waikiki Aquarium in affiliation with the University of Hawai'i to gather selected reef fish and coral samples in minimal quantities in order to create an educational exhibit at the aquarium showcasing the unique natural resources of Papahānaumokuākea. (Table 8)

Table 8. Affiliations of Education permittees and permitted projects in 2009.

Education Permittee Affiliation	Number of Permits Issued	Permitted Education Projects
NOAA National Ocean Service Office of National Marine Sanctuaries	1	• Papahānaumokuākea 'Ahahui Alaka'i (PAA) Educator Program at Midway Atoll
Waikiki Aquarium, University of Hawai'i	1	• Selected Reef Fish and Coral Collection Activities to Produce Educational Exhibit

Education Highlights

▶ Fostering an Understanding of Monument Resources from a Grassroots Level

Educators and conservation leaders had an opportunity to more intimately understand Papahānaumokuākea Marine National Monument's wildlife and cultural resources through a workshop on O'ahu and Midway Atoll in 2009. The program, Papahānaumokuākea 'Ahahui Alaka'i, was designed by all Monument management agencies to create a greater understanding of the Monument and to inspire community environmental stewardship at a grassroots level. The first three days were spent on O'ahu preparing and learning the natural and cultural history. The remaining seven days were spent on remote Midway Atoll within the Monument, located 1,250 miles northwest of Honolulu. Participants provided their own transportation to O'ahu as well as lodging and meals during the three days in Honolulu. At Midway Atoll transportation, lodging, and food costs were covered by the workshop. The Papahānaumokuākea 'Ahahui Alaka'i accepted nominations from educators in formal and informal



Photo: Danielle Carter

settings, community leaders, and people in positions that support community change and stewardship. Twelve people were chosen to participate based on their written nominations, their letters of support, and their capacity to fulfill the program's need for a strong variety of skills and abilities. In addition, participants were asked to submit a draft plan for an environmental stewardship project that was modified throughout the workshop to include plans to implement their projects in their communities.



Native Hawaiian Practices

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Summary of Native Hawaiian Practice Activities

Four Native Hawaiian practice permits were issued in 2009. Of these, half were led by Native Hawaiian organizations partnering with research institutions to further both the cultural and western science understanding of resource management. Other permitted projects allowed for the perpetuation and passing down of Native Hawaiian knowledge to the next generation. (Table 9)

Table 9. Affiliations of Native Hawaiian Practice permittees and permitted projects in 2009.

Native Hawaiian Practices Permittee Affiliation	Number of Permits Issued	Permitted Native Hawaiian Practices Projects
University of Hawai'i, Hawai'i Community College; Edith Kanaka'ole Foundation	1	• Winter Solstice Cultural Research and Native Hawaiian Practices on Mokumanamana
Polynesian Voyaging Society	1	• Hawaiian Voyaging Canoe Hōkūle'a Training Sails to Nihoa and Mokumanamana*
NOAA Office of National Marine Sanctuaries; Na Mamo O Mu'olea; The Nature Conservancy	1	• Examination of the Basic Ecology of 'Opihi Populations from a Cultural Perspective within Papahānaumokuākea
NOAA Office of National Marine Sanctuaries; University of Hawai'i, Hawai'i Institute of Marine Biology	1	• Continuation of the Cultural Health Index (CHI) Project within Papahānaumokuākea

* Permitted Native Hawaiian Practices project was not conducted in 2009.



Photo: Kekuewa Kikiloi



Native Hawaiian Practice Highlights

▶ Native Hawaiian Ancestors' Use and Reverence for Mokumanamana

Native Hawaiian practitioners conducted cultural research on Mokumanamana (Necker Island) during the winter solstice. Led by a University of Hawai'i Professor and cultural practitioner, participants spent 10 days in Papahānaumokuākea Marine National Monument. Mokumanamana and its 52 archaeological sites provide a unique window into the relationship of the elementals to Hawaiian ancestors and their need to profoundly acknowledge, accurately, the concept of time and space in which they considered this universe. A previous trip to Mokumanamana established the summer solstice ancestral alignment with the rock uprights of heiau (places of worship). The research involved assigning four groups of two people to each of the pu'u (high points of the island) for two days. By recording shadows cast by the pivotal uprights, the types and shapes of the rocks used, and their placement on the ahu (altar), as well as the east-west movement of the sun, the researchers will gain insights into Native Hawaiian ancestors' use and reverence of Mokumanamana.



Photo: Kekuewa Kikiloi

▶ 'Opihi Research Using Native Hawaiian and Western Science Methods

'Opihi are found clinging to rocks in intertidal splash zones. Commercial catch records indicate a decline from 150,000 pounds of 'opihi harvested in the early 1900s to about 8,000 pounds today. This research project was designed to marry western scientific measurement of 'opihi populations with traditional methods of measuring 'opihi abundance using generations of observational knowledge. During the 2009 Reef Assessment and Monitoring Program (RAMP) cruise to the Northwestern Hawaiian Islands, a traditional knowledge team used the NWHI as a baseline to help determine the reasons for declining

'opihi numbers in the Main Hawaiian Islands. Using traditional and western science approaches, they were able to get a rapid assessment of a wider range of 'opihi habitat, providing a more detailed account of 'opihi abundance. Videos and photographs of the research conducted on Nihoa, Mokumanamana and Gardner Pinnacles will be shared to further aid in the development of guidelines to assess resources using Native Hawaiian science methods.



Photo: Chris Bird



Recreation

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Summary of Recreation Activities

A single recreation permit was issued in 2009, to the U.S. Fish and Wildlife Service National Wildlife Refuge System, to administer the Visitor Services Program at Midway Atoll, in accordance with refuge system requirements (Table 10). Under Monument regulations (Proclamation 8031) recreation activities are permitted in the Monument only within the Midway Atoll Special Management Area. All research permittees that may visit Midway Atoll to resupply are also covered under the FWS recreation permit.

Table 10. Affiliations of Recreation permittees and permitted projects in 2009.

Recreation Permittee Affiliation	Number of Permits Issued	Permitted Recreation Projects
U.S. Fish and Wildlife Service, National Wildlife Refuge System	1	<ul style="list-style-type: none"> Administering the Visitor Services Program at Midway Atoll



Photo: U.S. Fish and Wildlife Service



Special Ocean Use

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Summary of Special Ocean Use Activities

Ten special ocean use permits were issued in 2009 (Table 11). Half of the permittees sought to create television features, multimedia art projects, or photo document unique Monument resources to raise awareness of effects of plastic pollution and further 'bring the place to the people.' The remaining special ocean use projects all provided an opportunity for visitors to experience the extent and beauty of Papahānaumokuākea, and give back to these resources by means of limited and supervised volunteer work on Midway.

Table 11. Affiliations of Special Ocean Use permittees and permitted projects in 2009.

Special Ocean Use Permittee Affiliation	Number of Permits Issued	Permitted Special Ocean Use Projects
Conservation International	1	<ul style="list-style-type: none"> Participation in Wildlife Observation, Photography, Historical Tours, and Limited Recreational Activities on Midway Atoll
Photo Safaris	1	<ul style="list-style-type: none"> Photo Documentary Activities on Wildlife, Cultural, and Historic Features of Midway
Current TV	1	<ul style="list-style-type: none"> Production of a Short Film on Midway About the Effects of Marine Debris on Marine Life and Ecosystems
Oceanic Society	1	<ul style="list-style-type: none"> Educational and Volunteer Activities on Midway Atoll
Military Historical Tours	1	<ul style="list-style-type: none"> Commemoration Activities for the 67th Anniversary of the Battle of Midway*
Freelance Photographer	1	<ul style="list-style-type: none"> Marine and Terrestrial Photography Activities Within the Monument
Chukyo T.V. Broadcasting Co.	1	<ul style="list-style-type: none"> Filming and Photography Activities of the PLASTIKI Sailing Vessel on Midway Atoll
Telluride Institute / Reel Thing Productions	1	<ul style="list-style-type: none"> Filming Activities on Midway to Support a Documentary on the Impacts of Plastic Debris on the Environment
Chris Jordan Photography	1	<ul style="list-style-type: none"> Establishing a Collection of Multimedia Art About Marine Plastic Pollution on Midway Atoll
Amateur Radio Operator	1	<ul style="list-style-type: none"> Filming Ham Radio Activities on Midway Atoll

* Permitted Special Ocean Use project was not conducted in 2009.



Special Ocean Use Highlights

► Expeditions of the Oceanic Society

Since 2008 groups of 15 people at a time have visited Midway Atoll on Oceanic Society natural history and historic preservation expeditions. As the only accessible National Wildlife Refuge in the Monument, Midway Atoll provides what the Oceanic Society calls, “one of the most incredible wildlife spectacles in the world.” Few places on earth allow such close contact with seabirds. Natural history expeditions focus on ecosystem awareness and appreciation with first hand engagement with the environment. The Oceanic Society also recognizes the priority of Native Hawaiian values associated with the Monument and requires visitors to have a respect for and understanding of the Monument’s cultural connections. Under U.S. Fish and Wildlife Service, Refuge System direction, participants removed more than 500 pounds of land-based marine debris and participated in treatment of invasive species at multiple sites. Historic preservation projects engage participants in preserving, restoring, maintaining, and interpreting the buildings, historic structures, and artifacts of the atoll. Many Oceanic Society participants, after returning from Midway, have presented lectures and slide shows to the general public and to wildlife organizations nationwide.



Photo: Wayne Senthman

► Bringing the Place to the People - Wayne Levin

In 2009 the NOAA Office of National Marine Sanctuaries hosted renowned photographer Wayne Levin aboard NOAA Ship *Hi'ialakai* for a month long cruise to photograph the land and seascapes of Papahānaumokuākea. Levin shot thousands and thousands of images – some in color, many in black and white, on land and in the water. Highlights included an end-of-dive encounter with 18 sharks off Kure Atoll and an encounter with a massive school of kawakawa off Mokumanamana. From these photographs he hopes viewers get a sense of his experiences in these special places. “I wanted the whole group of pictures to give a real feeling of the place, to somehow give people an opportunity to get there, to give them a sense of the place.” Through his photographic mastery, he captures the pristine essence of Papahānaumokuākea Marine National Monument. During the summer of 2010 people will be able to see Levin’s work from the Northwestern Hawaiian Islands in a show at the First Hawaiian Center in Honolulu, with plans for a book underway.



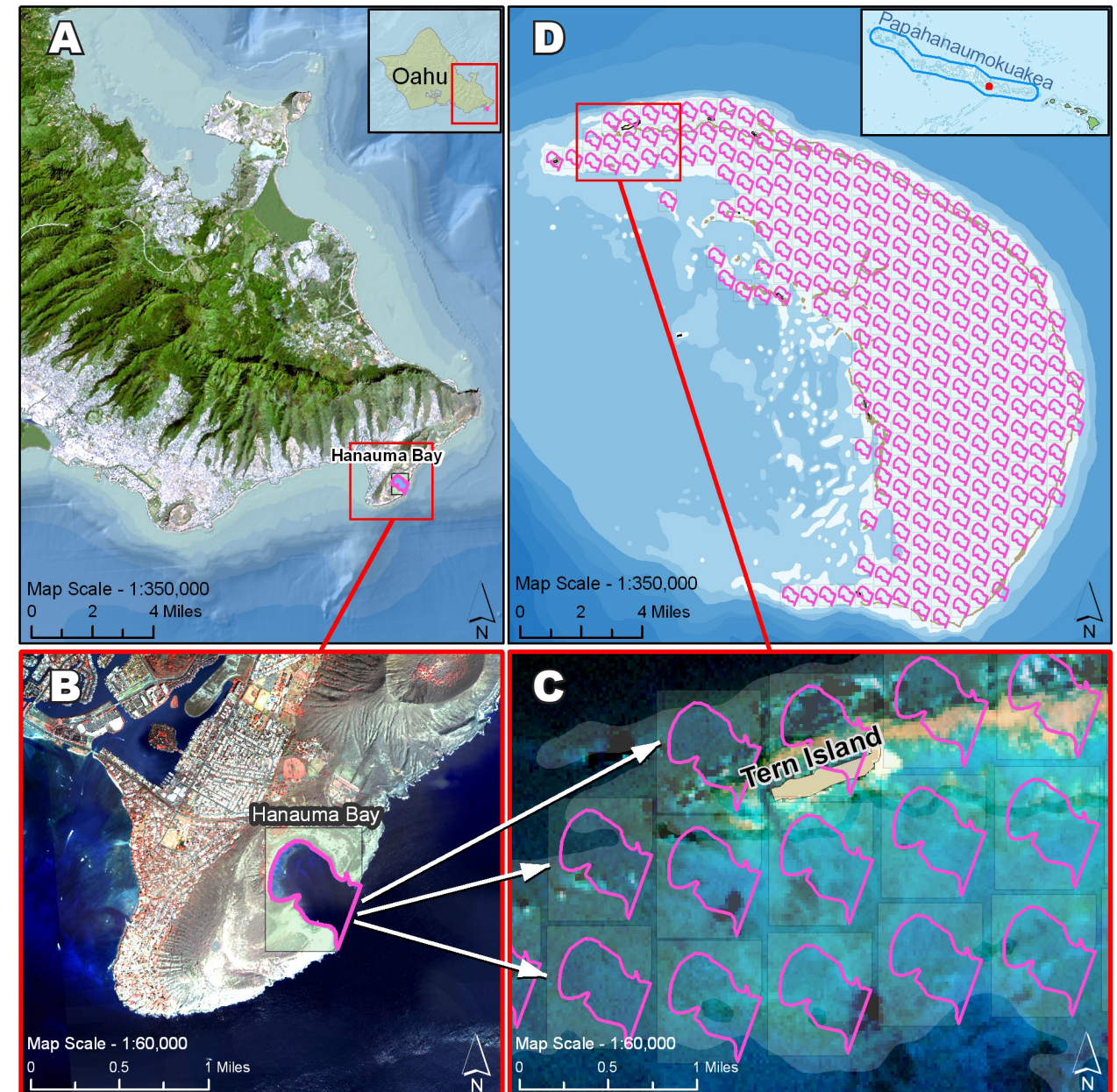
Photo: Wayne Levin



LIMITED ACCESS THROUGH PERMITTING SYSTEM DRAWS STRONGER PROTECTIONS

Area Comparison of Hanauma Bay, O‘ahu and French Frigate Shoals

Figure 3. Map of French Frigate Shoals, NWHI with Hanauma Bay overlay.





In Figure 3, panels A-D provide a comparison and area perspective of Hanauma Bay, O’ahu and French Frigate Shoals. Hanauma Bay Nature Preserve is located along the southeastern tip of O’ahu (A). The area size of Hanauma Bay is approximately 0.5 km², outlined in panel C. Tern Island (D) is located within the northwestern corner of French Frigate Shoals and is approximately 0.3 km²; slightly smaller in size than Hanauma Bay. Panel B illustrates that over 250 grid squares comparable to the area of Hanauma Bay can fit into the 10 fathom contour line (60 ft depth) encompassing French Frigate Shoals.

Access to the vast marine areas of Papahānaumokuākea is extremely limited when compared with other marine protected areas. In 2009 approximately 250 dives (defined as conventional and technical SCUBA and snorkeling) were conducted within French Frigate Shoals Special Preservation Area, while approximately 769,150 dives were conducted in Hanauma Bay (0.5 km² in area) over the same time period (State of Hawai’i, Department of Parks and Recreation). Figure 3(B) on the previous page, shows the area of French Frigate Shoals (approximately 469 km²) within the 10 fathom contour line or 60 ft depth range, a common depth for dives in this area. Given the number of dives, only 0.0533% of French Frigate Shoals was visited in 2009. Limited access combined with a stringent permitting system is a further testament to the strong protections and commitment to cooperative conservation of Papahānaumokuākea Marine National Monument.

LEARN MORE ABOUT PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT

The Monument continues to support further ways in which individuals may learn about our kūpuna islands. In 2009, the Monument released a new web-based tool allowing researchers, managers, and educators access to an extensive citation collection of literature on the Northwestern Hawaiian Islands and Papahānaumokuākea Marine National Monument. For example, a researcher seeking to find the number of articles related to monk seals in the Northwestern Hawaiian Islands over the last 30 years can get the answer quickly through this Web application.

Below is a graphical illustration highlighting the Monument’s new, publicly available, Spatial Bibliography site. For additional information, please see our website at: <http://www.pnmnims.org>

