U.S. NAVY

# MARINE SPECIES MONITORING IN THE MARIANA ISLANDS

*Protecting the Seas through Science*





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## MARINE SPECIES MONITORING PROGRAM

### Navy Marine Species Research and Monitoring Efforts

The U.S. Navy is a world leader in marine species research and monitoring, funding marine research programs, surveys, and data collection efforts since 1992. The Navy partners with government agencies, universities, research institutions, federal laboratories, and private researchers around the world to better understand marine species ecology and physiology.

The monitoring program partners with the Navy's research and development programs. The Office of Naval Research's Marine Mammals and Biology Program conducts basic research, and the Living Marine Resources Program conducts applied research.

Data and reports from scientific research and monitoring help environmental regulators, scientists, the public, and the Navy:

- Build a comprehensive understanding of the abundance, distribution, foraging, reproduction, hearing, sound production, and behavior of marine species, which is necessary to assess effects from military readiness activities.
- Refine methods used to detect and monitor marine species before, during, and after military readiness activities.
- Determine the effects of underwater sound on marine species.
- Improve models used to estimate potential effects of underwater sound on marine species.
- Use adaptive management strategies to establish mitigation guidelines to strengthen protections of marine species.

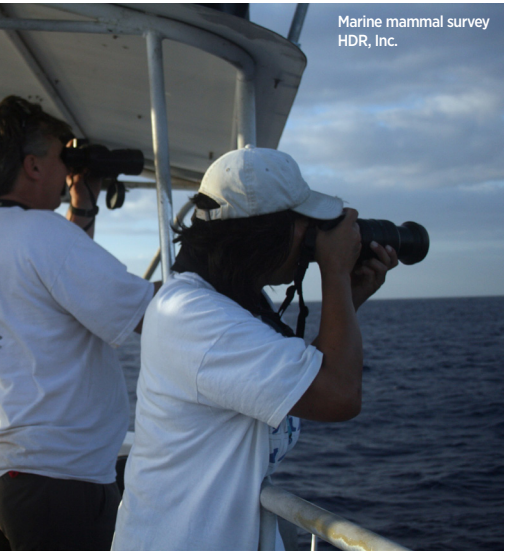
Sea turtle tagging efforts
Dr. T. Todd Jones, NOAA Fisheries
(permit no. 17022 and 15661)


Sperm whale survey
HDR, Inc.

## RESEARCH TECHNIQUES

- Animal Tagging
  - The Navy partners with independent scientists authorized under environmental permits from the National Marine Fisheries Service to use advanced tracking methods, such as satellite tags (tags that transmit animal positioning and other data via satellite) and acoustic recording tags (tags that provide archival recordings for sound and movement). Deploying tags on animals has helped lead to a deeper understanding of marine species movement, dive behavior, foraging behavior, acoustic behavior, and response, if any, to Navy activities.
- Biopsy Sampling and Genetic Analysis
  - Tissue samples can identify species, sex, reproductive status, and stress hormone levels; determine stock origin; identify diet and diet-related contaminants; and answer questions related to population structure.
- Historical Analysis
  - The Navy uses a variety of archived data collected from past field surveys to gain additional insight. The information contributes to more robust, long-term data sets which can better facilitate analysis of potential trends in animal distribution and abundance.

Hydrophones
John Hildebrand, Scripps Institution of Oceanography



Marine mammal survey
HDR, Inc.

- Passive Acoustic Technology/Monitoring
  - The Navy has been collecting and analyzing data via passive acoustic monitoring (a tool used to listen to and record sound in the water) for almost two decades. These data provide information for identifying marine species, recognizing diurnal and seasonal movement patterns, and assessing animal responses to military readiness activities. Passive acoustic monitoring is also an essential tool to evaluate levels of natural and human-made noise that can have negative impacts on marine species. The Navy collects passive acoustic data using various technologies, including Navy-instrumented underwater hydrophone ranges, towed arrays, seafloor-mounted recording devices, and autonomous gliders.
- Photo Identification
  - Matching photos of individual animals from different years or locations allows for the assessment of migration, site fidelity (an animal's tendency to return to a place it previously occupied), residency, social structure, and abundance.
- Visual Surveys
  - Visual surveys conducted via vessels provide information on marine species and seabird occurrences and densities.

## MARIANA ISLANDS RANGE COMPLEX TIMELINE

The Navy is dedicated to avoiding, minimizing, or mitigating effects of military readiness activities in the offshore and coastal environments of the Mariana Islands. To ensure those mitigation efforts are effective, the Navy establishes, maintains, and invests in the marine species monitoring program. This program is essential for collecting data on marine species and habitat health over the long-term to inform the development and optimization of mitigation standards implemented during activities. In addition, research publications and technical reports generated under this program are made available to the public and the wider scientific community.

The timeline highlights a subset of the Navy-funded research accomplishments and ongoing monitoring efforts, spanning more than 20 years.

Visit **www.navymarinespeciesmonitoring.us** for more information on the Navy's Marine Species Monitoring Program and to access public reports.

Humpback whale
Joseph Mobley, HDR, Inc.
(NOAA permit no. 642-1536-03)

**Naval forces based in the Mariana Islands and transiting across the Pacific Ocean rely on the Mariana Islands Range Complex (MIRC) for its capabilities and strategic location in the west-Pacific region.**

**Marine species studies occurring within and beyond the MIRC help the Navy and scientific community better understand marine species distribution in relation to Navy activities, as well as potential impacts on the species. This research informs management and supports the Navy's environmental analyses and interagency consultations.**

### 2006
Establishment of Marine Species Monitoring Program

### 2007
Mariana Islands Sea Turtle and Cetacean Survey

*Systematic sea turtle and marine mammal survey*

### 2010–2019
Small Vessel Visual Surveys in the MIRC

*Nearshore surveys focused on photo-identification, biopsy and genetic analysis, satellite tagging, and acoustic recording*

### 2013–2016
Passive Acoustic Monitoring Glider Surveys in the Mariana Islands

*Acoustic surveys for whale species*

### 2013–2023
Sea Turtle Tagging in the MIRC

*Comprehensive sea turtle survey and tagging study around Guam and Tinian*

### 2014–2016
Guam Shore-Based Visual Surveys

*Evaluation of a shore-based platform as an alternative approach for surveying marine mammals and sea turtles*

### 2015
Pilot Study for Shore-based Humpback Whale Surveys in Saipan

*Survey for humpback whale presence*

### 2017, 2022, present
Coral Survey at FDM

*Five-year periodic benthic (bottom) survey to assess ESA-listed corals in nearshore areas adjacent to land-based training activities on FDM*

### 2018–present
Pacific Islands Comprehensive Stranding Investigations

*Comprehensive examination into stranded marine mammals, investigating causes of death and providing long-term stranding records to examine patterns*

### 2019
Historical Data Analysis for Humpback Whales in the Mariana Islands

*Analysis of archival acoustic recordings from 2009-2010 nearshore to Pagan and Maug for humpback whale vocalizations*

### 2019–2020
Pilot Survey for Humpback Whales at FDM

*Survey for humpback whale presence*

### 2021
Pacific Marine Assessment Program for Protected Species Survey

*Periodic large-vessel line-transect surveys for marine mammals and sea turtles*

### 2021–2026
Passive Acoustic Monitoring and Density Estimation of Beaked Whales along the West Coast of Guam

*Use of passive acoustic monitoring to produce acoustic density estimates of beaked whales*

### 2023
Impacts of Military Testing and Training on Reef Fish Contaminant Bioaccumulation, Human, and Ecological Impacts in the Mariana Islands

*Literature review focusing on the impacts of at-sea explosives and other military byproducts*

### 2025
Beaked Whale Summary of Current Knowledge in the Mariana Islands

*Compilation of available information about the occurrence, distribution, and abundance of beaked whales*

Acronyms:
ESA = Endangered Species Act
FDM = Farallon de Medinilla
MIRC = Mariana Islands Range Complex

## MARIANA ISLANDS RANGE COMPLEX RESEARCH HIGHLIGHTS

- **Mariana Islands Sea Turtle and Cetacean Survey**
  *Partners: SRS-Parsons Joint Venture; Geo-Marine, Inc.; Bio-Waves, Inc.*
  - Establish first study of Endangered Species Act (ESA)-listed species offshore, encompassing approximately 584,800 kilometers (km).
  - Determine marine mammal and sea turtle species presence, populations, and estimated distributions and densities.
  - Use standard line-transect surveys and passive acoustic monitoring technology to track marine life.
- **Small Vessel Visual Surveys in the Mariana Islands Range Complex**
  *Partner: National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service Pacific Islands Fisheries Science Center (NMFS-PIFSC) Cetacean Research Program*
  - Identify species of beaked whales, odontocetes (toothed whales), baleen whales, and sea turtles.
  - Develop reference library of visually validated acoustic recordings of marine mammals using visual surveys, photo-identification, biopsy and genetic analysis, satellite tagging, and opportunistic acoustic recordings during sightings.
  - Monitor marine mammal and sea turtle abundance, distribution, diversity in nearshore waters during key seasons (summer and winter), movement patterns, habitat use, and potential changes in behavior that may be associated with military activities.
- **Passive Acoustic Monitoring Glider Surveys in the Mariana Islands**
  *Partners: Oregon State University; University of Washington*
  - Identify acoustically distinct species of beaked, odontocetes, and baleen whales.
  - Improve understanding of marine mammal distribution, habitat use, and abundance.
- **Pacific Islands Comprehensive Stranding Investigations**
  *Partner: University of Hawaii Stranding Laboratory*
  - Collect baseline data on marine mammal health and threats by investigating stranded or deceased animals.
  - Study patterns of stranding and mortality of marine mammals in the Pacific Islands (with emphasis on Hawaiian and Mariana Island chains).
  - Perform necropsies, collect and archive samples, test for diseases, conduct genetic analyses, and review historical data to understand trends.
- **Historical Data Analysis for Humpback Whales in the Mariana Islands**
  *Partner: Oceanwide Science Institute*
  - Determine if humpback whales were present in archival acoustic recordings from 2009-2010 nearshore to Pagan and Maug.
- **Pacific Marine Assessment Program for Protected Species Survey**
  *Partners: NOAA NMFS-PIFSC; NMFS-Southwest Fisheries Science Center*
  - Conduct 8,700 km of line-transect surveys and estimate density for cetaceans, sea turtles, and seabirds within Guam and the Commonwealth of the Northern Mariana Islands.
  - Use visual and passive acoustic monitoring techniques to monitor for marine species presence, distribution, movement patterns, diversity, habitat use, and population dynamics in offshore waters.
  - Streamline marine mammal monitoring and survey methodologies by compiling and archiving visually validated acoustic recordings.
- **Sea Turtle Tagging in the Mariana Islands Range Complex**
  *Partner: NOAA NMFS-PIFSC Marine Turtle Biology and Assessment Program*
  - Determine occurrence, habitat use, and population structure of sea turtles, focused on Guam, Tinian, and Saipan.
  - Determine potential exposure and impacts on sea turtles from military readiness activities.
- **Guam Shore-Based Visual Surveys**
  *Partner: HDR, Inc.*
  - Evaluate a shore-based platform as an alternative approach for surveying marine areas for marine mammals and sea turtles.
- **Surveys for Humpback Whales at Farallon de Medinilla and Saipan**
  *Partners: NOAA NMFS-PIFSC Cetacean Research Program; HDR, Inc.; Naval Facilities Engineering Systems Command (NAVFAC) Pacific*
  - Conduct boat-based surveys near and around FDM to determine habitat use and photo-identify humpback whales from the western North Pacific distinct population segment.
  - Conduct visual surveys of humpback whales and other species in coastal areas from elevated shore stations around Saipan.
- **Coral Survey at Farallon de Medinilla**
  *Partner: Naval Information Warfare Center Pacific Scientific Diving Services*
  - Conduct ESA-listed coral surveys every 5 years.
  - Use underwater visual surveys to track changes in coral species, distribution, and abundance.
  - Monitor factors that may affect reef health, including water quality, physical disturbance, disease, and predator presence.
- **Passive Acoustic Monitoring and Density Estimation of Beaked Whales along the West Coast of Guam**
  *Partner: Cornell University*
  - Use passive acoustic monitoring to detect and identify beaked whale species present.
  - Produce acoustic density estimates of beaked whale species with enough detections.
  - Identify sonar use in the area and any co-occurrence with beaked whale detections.
- **Impacts of Military Testing and Training on Reef Fish Contaminant Bioaccumulation, Human, and Ecological Impacts in the Mariana Islands**
  *Partner: EA Engineering, Science, and Technology, Inc., PBC*
  - Evaluate existing studies on the impacts of explosives and other contaminants from military activities on sediments, water quality, and ecological and human health.
  - Conduct generic ecological and human risk assessment based on available data.
  - Consider evidence presented to affirm conclusions presented in Navy environmental analyses.
- **Beaked Whale Summary of Current Knowledge in the Mariana Islands**
  *Partners: HDR, Inc.; Naval Information Warfare Center; Naval Undersea Warfare Center; NAVFAC Pacific*
  - Compile available information about the occurrence, distribution, and abundance of beaked whales, including regional stranding events and potential causes.
  - Review available information about behavioral responses of beaked whales to anthropogenic disturbance.
  - Present regional oceanographic and bathymetric conditions known to be potential contributing factors to beaked whale strandings.

Coral reef in Apra Harbor, Guam

Sperm whale
Joseph Mobley, HDR, Inc.
(NOAA permit no. 642-1536-03)

## MARINE SPECIES PROTECTIVE MEASURES

The Navy is committed to avoiding, minimizing, or mitigating effects on the marine environment from at-sea activities and for more than 20 years has mitigated impacts from its activities throughout the Mariana Islands. Protective measures are established and adhered to with the aim of reducing effects on resources. The Navy's existing protective measures include, but are not limited to:

- Protective Measures Assessment Protocol
  - Using the Protective Measures Assessment Protocol (PMAP) before training and testing to comply with mitigation requirements and protect marine resources. PMAP is a web- and Geographic Information System (GIS)-based mapping tool that serves as the Navy's comprehensive data source for at-sea mitigation.
- Activity-Based Mitigation Zones
  - Establishing activity-based mitigation zones. If there is an indication that a protected marine species is present within the mitigation zone, military readiness activities are ceased until the animal exits the zone or other activity recommencement criteria are met. The size of a mitigation zone is unique to each activity.
- Navy Marine Species Lookouts
  - Posting trained lookouts to help ensure a safe distance between vessels and marine species. In the Mariana Islands, lookouts observe for marine mammals, sea turtles, manta rays, and hammerhead sharks before an activity starts. For some activities, lookouts may be required to look for additional biological resources, such as flocks of seabirds, jellyfish aggregations, or floating vegetation, which may indicate the presence of protected marine species.

Spinner dolphin
U.S. Navy

- Geographic Mitigation Areas
  - Implementing geographic mitigation areas with seasonal, monthly, or year-round restrictions. In the Mariana Islands, the Navy employs seasonal and year-round restrictions on the use of sonar and explosives to protect marine mammals and sea turtles within Agat Bay and the Chalan Kanoa and Marpi reefs.
- Regulatory Coordination and Consultations
  - Coordinating and consulting with regulatory agencies as required by applicable laws and regulations and consulting with agencies to identify agreed-upon mitigation measures to minimize adverse effects on species.

Goose-beaked whale
NOAA Fisheries

Humpback whale
NOAA Fisheries


Coral reef on Guam
NOAA Fisheries

## For More Information:

U.S. Navy Marine Species Monitoring Program
**www.navymarinespeciesmonitoring.us**

U.S. Navy Stewards of the Sea
**www.nepa.navy.mil/SOTS/**

U.S. Navy Stewards of the Sea Facebook Page
**www.facebook.com/USNavyStewardsoftheSea**

U.S. Navy Living Marine Resources Program
**exwc.navfac.navy.mil/Products-and-Services/Environmental-Security/LMR/**

Office of Naval Research Marine Mammals and Biology Program
**https://www.onr.navy.mil/organization/departments/code-32/division-322/marine-mammals-and-biology**

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Humpback whale, NOAA Fisheries
Pilot whale and bottlenose dolphin
Green sea turtle, U.S. Navy
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