U.S. NAVY

MARINE SPECIES MONITORING IN THE HAWAII RANGE COMPLEX

Protecting the Seas through Science

MARINE SPECIES MONITORING PROGRAM

RESEARCH TECHNIQUES

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MARINE SPECIES MONITORING PROGRAM

Navy Marine Species Research and Monitoring Efforts

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

Additionally, 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 to:

Sperm whale
Vladimir Burkanov, NOAA Fisheries Service

- Build a better understanding of the abundance, distribution, foraging, reproduction, hearing, sound production, and behavior of marine species, which is necessary to assess potential effects from Navy activities.
- Refine methods used to detect and monitor marine species before, during, and after training activities.
- Advance the understanding of the effects of underwater sound on marine species.
- Develop improved tools to model and estimate potential effects of underwater sound on marine species.
- Establish guidelines to mitigate effects of Navy training and testing on marine species.

Short-finned pilot whale
Julie Rivers, U.S. Navy

Minke whale
Wayne Hoggard, NOAA/NMFS

Hawaiian monk seal
NOAA

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

MARINE SPECIES MONITORING PROGRAM

RESEARCH TECHNIQUES

- Animal Tagging
  - The Navy partners with independent scientists authorized under environmental permits from the National Marine Fisheries Service (NMFS) 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 if or how they respond 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.

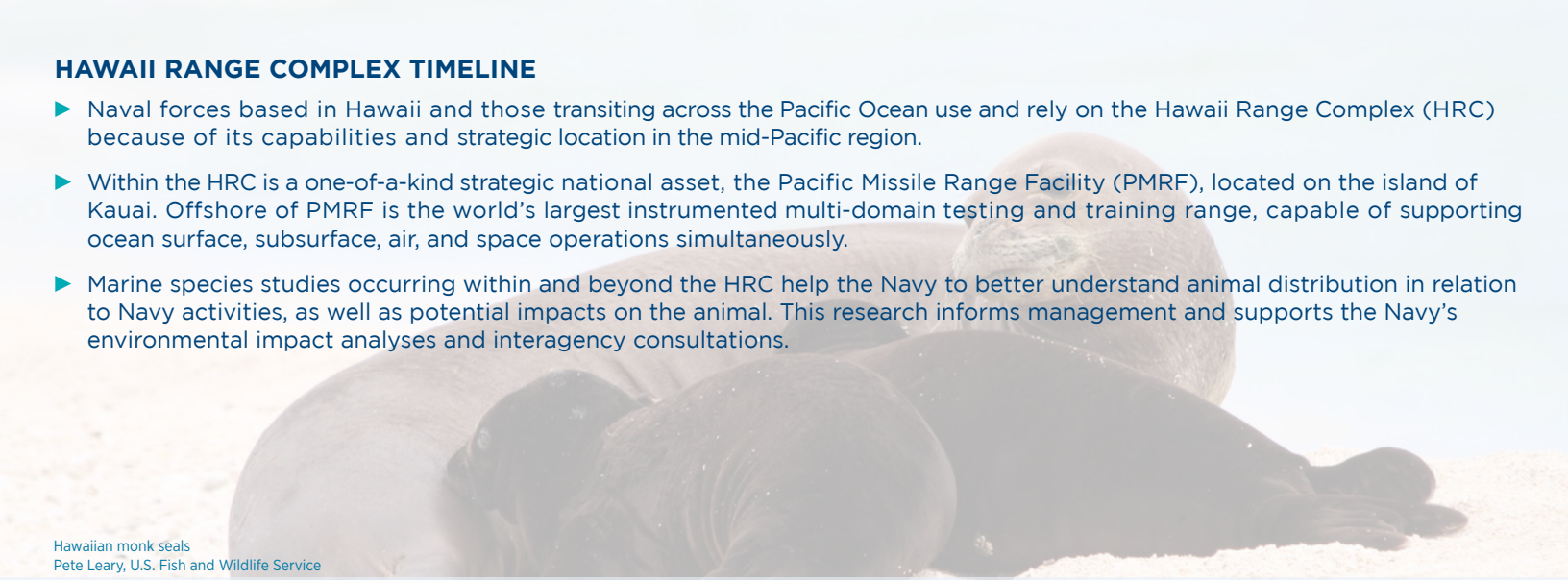
Pilot whale tagging
Ari S. Friedlaender, Duke University Marine Laboratory

Hydrophones
John Hildebrand, Scripps Institution of Oceanography

- 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 vessel provide information on marine species occurrence and density.

HAWAII RANGE COMPLEX TIMELINE

- Naval forces based in Hawaii and those transiting across the Pacific Ocean use and rely on the Hawaii Range Complex (HRC) because of its capabilities and strategic location in the mid-Pacific region.
- Within the HRC is a one-of-a-kind strategic national asset, the Pacific Missile Range Facility (PMRF), located on the island of Kauai. Offshore of PMRF is the world's largest instrumented multi-domain testing and training range, capable of supporting ocean surface, subsurface, air, and space operations simultaneously.
- Marine species studies occurring within and beyond the HRC help the Navy to better understand animal distribution in relation to Navy activities, as well as potential impacts on the animal. This research informs management and supports the Navy's environmental impact analyses and interagency consultations.



Hawaiian monk seals
Pete Leary, U.S. Fish and Wildlife Service

The Navy is a world leader in marine species research, investing over $20 million in research each year. The Navy is dedicated to protecting the marine and coastal environments of Hawaii. This timeline highlights some of the Navy-funded efforts in support of the Navy's Marine Species Monitoring Program in the waters of Hawaii. The Navy has conducted various types of studies, with some lasting for a few years and others still ongoing.

2006
Establishment of Marine Species Monitoring Program

2007
Aerial visual surveys and vessel visual surveys in the HRC

2010 – 2013
Hawaiian monk seal tagging

2010 – 2022
Study to determine effectiveness of trained Lookouts on Navy ships in detecting marine species

2010 – Present
Satellite tagging of toothed whales off Oahu and Kauai

2013 – Present
Studies to estimate received levels of mid-frequency active sonar and behavioral responses of marine mammals at PMRF

2014
Passive acoustic monitoring using gliders to investigate spatial and temporal distribution of baleen whales

2015 – Present
Analysis of decades-long acoustic dataset of marine mammals recorded using PMRF instrumented range

2016 – 2020
North Pacific humpback whale tagging

2016 – Present
Marine mammal monitoring at PMRF to improve understanding of occurrence

2017 – 2022
Pacific Marine Assessment Program for Protected Species surveys

2018 – Present
Pacific Island comprehensive stranding investigations

HAWAII RANGE COMPLEX PROGRAM HIGHLIGHTS

Beaked Whale Monitoring

Partners: Naval Undersea Warfare Center Newport and Naval Information Warfare Center Pacific

Marine mammal monitoring at PMRF improves the understanding of long-term trends in the occurrence of marine mammals, with a focus on beaked whales.

- The Navy validated acoustic recordings of many species and confirmed species' identity.
- Recordings of beaked whales allowed for analysis of long-term trends related to population abundance and distribution.
  - The mean number of detections increased across years for both Blainville's and Cuvier's beaked whales at PMRF.
  - Seasonal detection patterns were identified.

Estimation of Received Levels of Mid-Frequency Active Sonar and Behavioral Response of Marine Mammals at PMRF

Partners: Naval Information Warfare Center Pacific, Cascadia Research Collective, Southall Environmental Associates, and HDR, Inc.

Monitoring questions include: 1) what is the occurrence and estimated received levels of mid-frequency active sonar on various whale and dolphin species, including beaked and pilot whales, within the PMRF instrumented range, and 2) what, if any, are the short-term behavioral responses of these species when exposed to different sound levels and conditions?

- Satellite tagged odontocetes showed large variations in movements, with some individuals moving towards and others moving away from sound sources.

Acoustic Monitoring

Partner: Naval Information Warfare Center Pacific

Long-term acoustic monitoring of marine mammals at PMRF improves the understanding of long-term trends in the occurrence and abundance of marine mammals and examines what, if any, acoustic and physical behavioral responses occur in response to Navy activities at PMRF.

- Changes in vocalization behavior of large whales have been linked to changes in ocean noise levels.
- Beaked whale detections have been used to estimate density for some species, as well as determine spatial and temporal patterns of occurrence.
- Algorithms for automated detection, classification, and localization of several species have been developed and improved, resulting in the ability to track vocalizing individuals across the range and examine call and movement behaviors.

Advancing Monitoring Capacity in Hawaii

Partner: University of Hawaii at Manoa, Marine Mammal Research Program

The Navy is seeking to ground truth, expedite, and disseminate information related to triaxial accelerometers, Customized Animal Telemetry Tags, and other biologging devices used to obtain biomechanical and energetic data that can be used to inform biological baselines for various marine mammal species of interest.

- This work will build capacity in Hawaii and advance the Navy's goals related to understanding the long-term health of protected marine mammal species within the Hawaiian Islands.
- Through the collection of novel data and the expansion of existing datasets, this work will provide answers to questions of relevance to the Navy and other organizations that are tasked with monitoring and management of protected species (i.e., response).

Humpback Whale Tagging

Partners: Oregon State University and Naval Information Warfare Center Pacific

The Navy funded a multi-year humpback whale tagging study in the North Pacific Ocean, which used a combination of satellite-tracking technology (tags), genetic sampling, and photo-identification analysis.

- The project's objective was to conduct a comprehensive characterization of humpback whale movements during breeding, migration, and feeding periods using data from animals tagged in breeding and feeding areas.
- Genetic analysis of biopsy samples provided valuable information on the mixing of Distinct Population Segments in feeding areas.
- The project provided the longest continuous record of a male-female humpback whale pair on breeding grounds and provided detailed information on dive behavior at night.

Pacific Marine Assessment Program for Protected Species

Partners: NMFS and Bureau of Ocean Energy Management

The Navy, in collaboration with the National Oceanic and Atmospheric Administration (NOAA), has funded a collaboration of large ship systematic line-transect surveys with the goal of updating marine species density estimates to be used for modeling impacts.

Pacific Islands Comprehensive Stranding Investigations

Partner: University of Hawaii Health and Stranding Lab

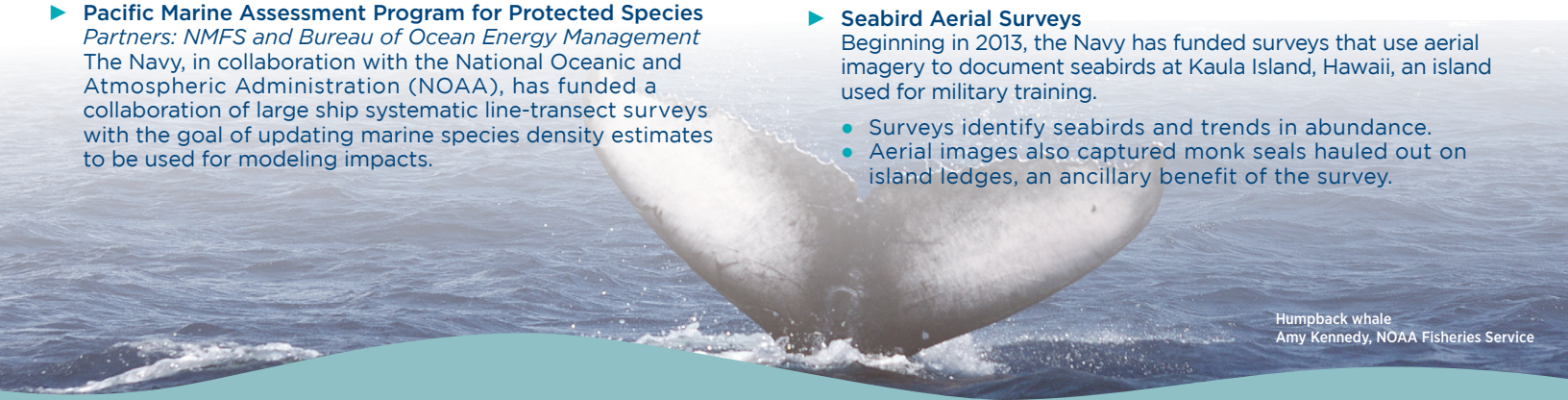
The University of Hawaii Health and Stranding Lab is the only entity in the Pacific Islands region that responds to strandings, conducts necropsy and cause-of-death investigations, archives tissues, and performs research to identify and evaluate threats to Pacific Island cetaceans.

- The Navy has supported comprehensive stranding investigations to obtain baseline information about the health of marine mammals and to understand infectious diseases in the Pacific Islands.
- Investigations have led to increased knowledge of diet and trophic position (an organism's position in the food web) of endangered main Hawaiian Islands insular false killer whales and on characterizing marine debris ingestion by abundance and mass in stranded short-finned pilot whales.

Seabird Aerial Surveys

Beginning in 2013, the Navy has funded surveys that use aerial imagery to document seabirds at Kaula Island, Hawaii, an island used for military training.

- Surveys identify seabirds and trends in abundance.
- Aerial images also captured monk seals hauled out on island ledges, an ancillary benefit of the survey.

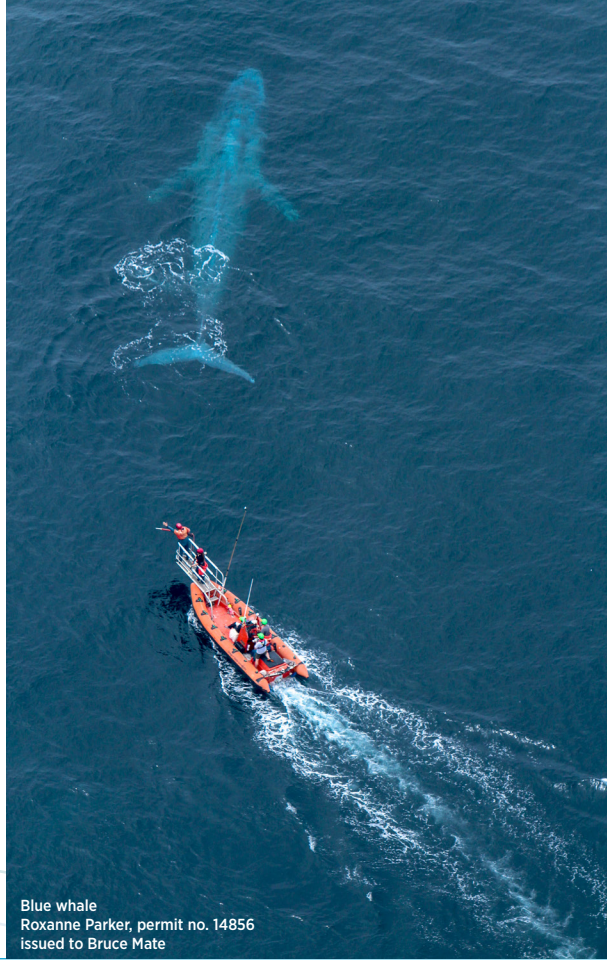


Humpback whale
Amy Kennedy, NOAA Fisheries Service

MARINE SPECIES PROTECTIVE MEASURES

It is important to the Navy to avoid or minimize impacts on marine species from at-sea activities. The Navy follows strict guidelines and employs measures that reduce potential effects on marine species while training or testing. The measures listed here include some, but not all, of the Navy's existing protective measures.

- The Protective Measures Assessment Protocol (PMAP) is a software tool the Navy uses prior to conducting military readiness activities. Based on the location, date, and type of activity being conducted, PMAP generates a report of the specific mitigation measures naval units must implement to protect marine animals and the marine environment and ensure compliance with mitigation requirements.
- Navy environmental staff issue seasonal awareness messages to alert Navy ships to the possible presence of certain marine species to avoid ship strikes.
- Before certain training or testing activities are conducted, the Navy visually scans areas and, when possible, monitors areas acoustically to detect marine mammals and sea turtles.
- Designated Lookouts on Navy ships help spot marine species that may be present during military readiness activities. The Navy may cease or modify its activities to minimize interaction with certain marine species.



Blue whale
Roxanne Parker, permit no. 14856
issued to Bruce Mate

Melon-headed whales
Robin Baird, Cascadia Research,
permit no. 20605-03

Humpback whale
Sally Mizroch,
NOAA Fisheries Service

- The Navy establishes mitigation zones to reduce potential impacts on marine species from certain training and testing activities. Navy personnel visually observe each zone. If signs are detected indicating marine mammal, sea turtle, or seabird activity, applicable activities cease until the animal exits the zone or other activity recommencement criteria are met.
- There are areas in Hawaii where marine mammals conduct important reproductive or feeding behaviors. To mitigate potential effects of specific training activities on marine mammals, the Navy implements additional protective measures during certain times of the year and in specific geographic areas.
- To aid scientists in better understanding how marine species react to human activities, the Navy provides reports on its training and testing activities, including findings from passive acoustic monitoring, to NMFS. These reports are also available to the public.

Cuvier's beaked whale
Jenny Trickey, SEMARNAT
permit no. SGPA/DVGS/00451/18

For More Information:

- U.S. Navy Marine Species Monitoring Program
  www.navymarinespeciesmonitoring.us
- Commander, U.S. Pacific Fleet
  www.cpf.navy.mil
- U.S. Navy Living Marine Resources Program
  exwc.navfac.navy.mil/lmr
- Office of Naval Research Marine Mammals and Biology Program
  www.nre.navy.mil/organization/departments/code-32/division-322/marine-mammals-and-biology
- Commander, U.S. Pacific Fleet Facebook Page
  www.facebook.com/USPacificFleet
- U.S. Navy Stewards of the Sea
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NOAA Fisheries Service (melon-headed whales)

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