

Sonobuoys Play Valuable Role in Marine Mammal Research & Monitoring

LMR Program Now Manages Allocations to Support New & Ongoing Data Collection Efforts

SONOBUOYS, MOST OFTEN used by the Navy for submarine detection, have also proven to be a valuable asset in meeting another Navy need—understanding and monitoring marine mammals. While finding submarines continues to be the primary sonobuoy use, sonobuoys have proven remarkably valuable in marine mammal research and monitoring. From surveys of hard-to-find whale populations off Alaska to complementing marine mammal survey work off California, sonobuoys have contributed important information that supports Navy at-sea environmental stewardship.

Background on Sonobuoys

Sonobuoys are expendable underwater listening devices that the Navy typically employs for submarine detection, classification and location. Although models and capabilities vary, sonobuoys generally include a float (i.e., buoy), radio transmitter, battery and a hydrophone attached to a wire for detecting sound under water. Relatively inexpensive, simple and compact, sonobuoys are one of the most useful tools for monitoring underwater sound. They are well suited to marine mammal work—their frequency detection ranges encompass many whale sounds, and they can be deployed from both aircraft and ships.

The sonobuoy battery has a limited shelf life and the devices carry an expiration date. Once past the expiration date, they previously were categorized as surplus. Unused expired devices eventually were sent to a Navy location to be demilitarized and broken down into parts for disposal, a process that incurred shipping, labor and disposal costs.



Sonobuoys ready to be loaded for deployment.

Jeff Foster

Prior to 2009, some marine mammal researchers recognized the potential benefits of using the buoys as passive monitoring devices and often requested expired devices for their research. The success rate of expired devices, however, varied greatly from one batch to another, limiting their value relative to the effort of storing, transporting and deploying them.

Adding Sonobuoys to Current Marine Mammal Research & Monitoring Methods

In 2009, a convergence of need and opportunity helped to make unexpired sonobuoys from the Navy's research inventory available for marine mammal research and environmental monitoring uses. There was growing recognition of the need to understand more about marine mammal presence in Naval training areas, and other marine areas, accompanied by increasing appreciation of the value of sonobuoys in meeting that need. Since the Naval Research Laboratory's (NRL) needs for sonobuoys was on the decline, the Navy's Non-Combat Expenditure Allocation (NCEA) of sonobuoys to the NRL included a quantity of unexpired sonobuoys that could be made available to researchers.

One of the first projects to employ sonobuoys from the NRL allocation was a search for the endangered North Pacific right whale (*Eubalaena japonica*), one of the



Small spaces require efficient set-up—acoustic receiving and processing equipment on rear of plane seat; “belly port” through which sonobuoys will be deployed is seen below.

Brenda K. Rone

The Basics About Passive Acoustic Monitoring

PASSIVE ACOUSTIC MONITORING (PAM) refers to listening for sounds underwater; in the case of marine mammals, listening for calls, whistles, clicks and other sounds that can help researchers determine presence and activity. Marine mammals can be difficult to locate visually due to behavior, weather, light levels and other variables. PAM devices make it possible to collect data under sub-optimal visual conditions and also provide valuable insights when combined with visual data. These devices also help researchers monitor large ocean areas that would be difficult and costly to monitor visually.

In addition to sonobuoys, many types of devices can be used to collect PAM data. The Navy maintains instrumented acoustic ranges that contain fixed, seafloor-mounted hydrophones (i.e., underwater microphones). Towed arrays are hydrophone sets towed by a ship. Sonobuoys are expendable PAM devices that can be deployed from a ship or aircraft. Newer developments in PAM devices include bottom-mounted High-frequency Acoustic Recording Packages (HARP) and autonomous unmanned vehicles equipped with PAM listening devices. Acoustic monitoring devices that can be placed on animals (“acoustic data-logging tags”) can provide a wealth of

behavioral data (diving depth, movements) linked to the acoustic data they also record.

Each device offers a different benefit. Using multiple types of devices in conjunction with other data can provide the answers the Navy needs to important questions about the marine environment and the effects of Navy activities on that environment.

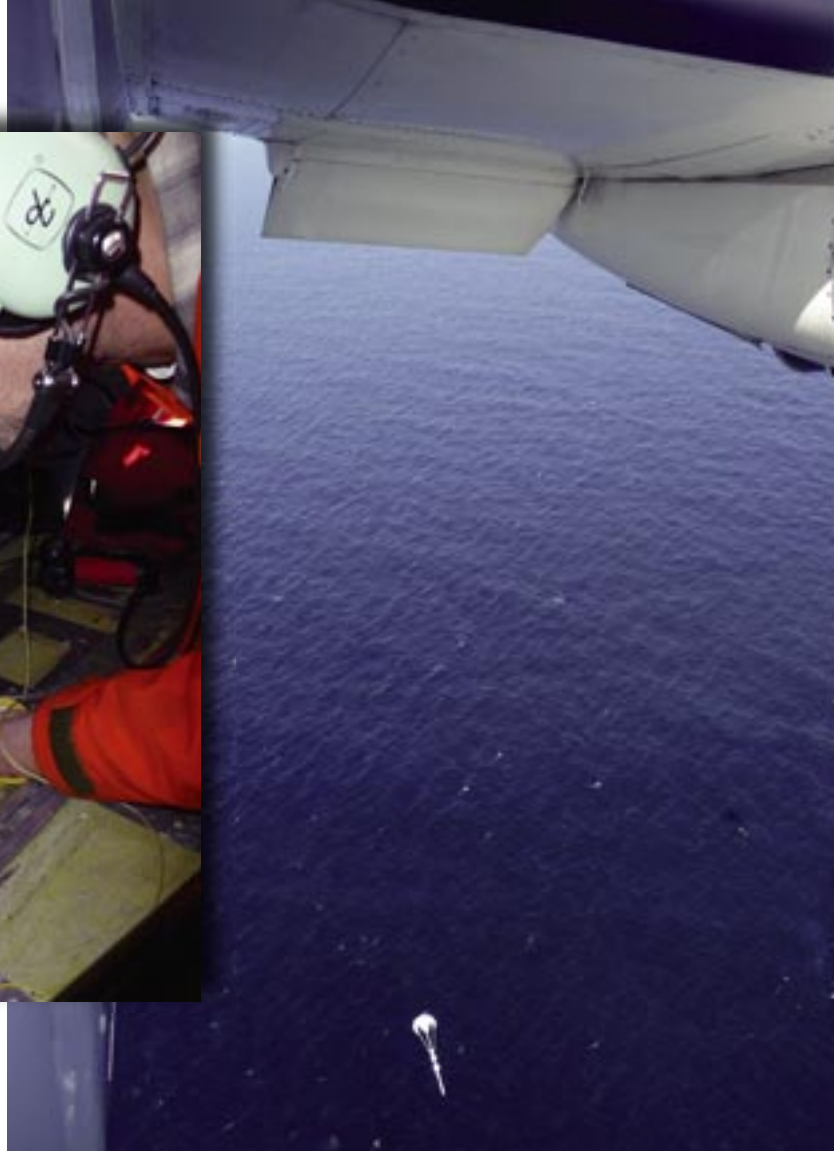
PAM technology continues to develop and is opening new capabilities for learning about specific species and sub-populations, as well as informing researchers about behavior, abundance and densities, location and communication.



ABOVE: Sonobuoy about to be deployed from the belly port.

RIGHT: Sonobuoy with open parachute following deployment.

Jeff Foster



rarest large whale species. The National Marine Mammal Laboratory (NMML), part of the National Oceanic and Atmospheric Administration's (NOAA) Alaska Fisheries Science Center, realized that a small population of these right whales, perhaps as few as 40, still existed in the eastern North Pacific. Finding such a small number of whales in such a large ocean expanse presented a daunting task. In 2007 and 2008 the NMML team obtained surplus sonobuoys, which improved their ability to locate whales in poor sighting conditions. For 2009 they wanted to include non-surplus sonobuoys with aerial surveys.

At that time Dr. Robin Fitch (formerly Captain Fitch) was staff to the Assistant Secretary of the Navy's Marine

Mammal Task Force. With her support, the NMML team submitted a request for sonobuoys to the Naval Air Systems Command PMA-264 (the Air Anti-Submarine Warfare Systems Program Office). Jeff Leonhard and his team at the Sonobuoy Logistics group were able to secure Program Office approval for the use. Leonhard and Theresa Yost, who also supports PMA-264 logistics, obtained sonobuoys for NOAA NMML from the NRL allocation and provided logistical support in getting the sonobuoys to the researchers. Yost characterized the projects as exciting for the logistics team, "We had only thought of sonobuoys relative to detecting submarines; we had no idea of the impact they could have for marine species."

The sonobuoys made it possible for the NMML team to "...find a needle in a haystack." (See "Finding the Needle in the Haystack: Using Sonobuoys to Locate a Critically Endangered Species" at www.afsc.noaa.gov/Quarterly/jas2011/divrptsNMML2.htm.) Aerial observers detected right whales on more than 55 percent of the aircraft-deployed sonobuoys, a significant improvement in detections by visual sightings alone. Dr. Fitch characterizes the sonobuoys as a "game changer" for understanding the whale population that was once thought to be near extinction.

Sonobuoys also have played a key role in Navy-funded behavioral response studies (BRS). The first application of non-expired buoys to a BRS



North Pacific right whale.

Brenda K. Rone, NMML Permit #782-1719

It has been great to support these types of projects—they are good for the Navy, good for research and good for our marine stewardship.

—Jeff Leonhard

What is CalCOFI?

CALCOFI ORIGINATED IN 1949 in response to the sardine population collapse off California. A partnership of the California Department of Fish & Wildlife, NOAA Fisheries Service and Scripps Institution of Oceanography, CalCOFI research has expanded well beyond its original purpose and now collects data on a wide range of variables important to the marine environment and living resources off of southern and central California.

CalCOFI carries out quarterly research cruises to collect data on more than 30 physical, chemical and biological oceanographic variables both at established stations and while underway. Marine mammal visual and acoustic surveys, employing both sonobuoys and other passive acoustic devices, have been added to cruise data collection efforts.

For more details on CalCOFI and its work, see <http://calcofi.org>.

effort was the multi-organization project in the Mediterranean Sea in 2009 (MED 09 trials). This effort focused on beaked whales, which are notoriously difficult to locate, track and observe. The acoustic signals captured by both sonobuoys and ship-towed hydrophones helped the researchers properly position vessels. (For more information the MED 09 trials, see the article “Latest Behavioral Response Study Builds Upon Years of Marine Mammal Research” in the summer 2010 issue of *Currents*.) A more recent project is the ongoing BRS effort in the Southern California (SOCAL) range complex. Placing data-logging devices on animals can provide more complete behavioral data but is difficult to achieve. The sonobuoys significantly improve project success because researchers can find more animals on which to deploy the data-loggers, creating more chances for a successful tag deployment and subsequent experimental sound exposure.

Other ongoing projects that have helped the Navy build its marine mammal knowledge are those carried out by



An example of manually deploying a sonobuoy from a ship. Julie Rivers, Natural and Marine Resources Program manager at Commander, U.S. Pacific Fleet deploying a sonobuoy to listen for marine mammals in Hawaii.

Sean Hanser

California Cooperative Oceanic Fisheries Investigations (CalCOFI) partnership. As of the 2013 field season, they have deployed sonobuoys on 36 cruises. During quarterly cruises

CalCOFI collects data on more than 30 oceanographic variables. For acoustic monitoring, use a towed hydrophone array and deploy sonobuoys at their stations. This acoustic monitoring

combination supports subsequent modeling of marine animal distribution and helps to identify the likely percentage of animals that might be missed during visual counts. In one example, results have increased understanding of humpback whale presence during the winter when visual detection is limited.

Sonobuoys also are proving to be a valuable tool for monitoring during Navy Mine Warfare Exercise (MINEX) training. Anu Kumar, formally the Marine Resources Branch Head at the Naval Facilities Engineering Command (NAVFAC) Atlantic and now the Deputy Manager of the Living Marine Resources (LMR) program, and Dr. Cara Hotchkin, a Marine Resource Specialist at NAVFAC Atlantic, along with Dave Moretti from Naval Undersea Warfare Center (NUWC) Newport and Commander Carl Hager from the U.S. Naval Academy have teamed up to experiment with

The Basics About the LMR Program

THE LMR PROGRAM seeks to develop, demonstrate, and assess data and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. This mission is accomplished through the following five primary focus areas:

1. Providing science-based information to support Navy environmental effects assessments for at-sea training and testing.
2. Improving knowledge of the ecology and population dynamics of marine species of concern.
3. Developing the scientific basis for the criteria and thresholds to measure the biological effects of Navy-generated sound.
4. Improving understanding of underwater sound and sound field characterization unique to assessing the biological consequences of underwater sound (as opposed to tactical applica-

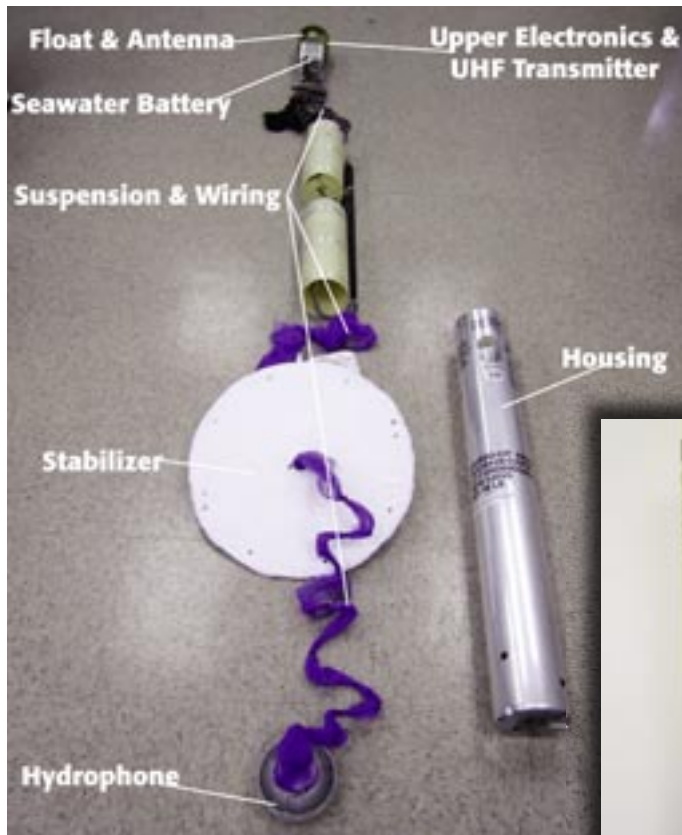
tions of underwater sound or propagation loss modeling for military communications or tactical applications).

5. Developing technologies and methods to mitigate and monitor environmental consequences to living marine resources resulting from naval activities on at-sea training and testing ranges.

The program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by NAVFAC out of the Naval Facilities Engineering and Expeditionary Warfare Center in Port Hueneme, California.

For more information, visit the LMR program web site at www.lmr.navy.mil or contact Bob Gisiner, the LMR Program Manager at 805-982-4853, DSN: 551-4853 or bob.gisiner@navy.mil





ABOVE: Parts of a USSI-Q53F sonobuoy after being removed from its housing.

RIGHT: Sparton Q53F sonobuoy housings.
Applied Logistics Services, Inc.



We had only thought of sonobuoys relative to detecting submarines; we had no idea of the impact they could have for marine species.

—Theresa Yost

including a shore-based receiver are scheduled for testing during the spring of 2014. Results from this test would help to simplify the equipment setup, reduce costs, and provide greater flexibility for researchers to get out in the training area to monitor for marine mammals and collect data relatively quickly and efficiently while extending the research monitoring coverage area.

sonobuoys to detect and locate marine mammals in Navy training areas. This has been a collaborative effort funded by United States Fleet Forces Command.

Most recently the team successfully acoustically detected, located, and followed bottlenose dolphins in near real-time at the MINEX range off the coast of Virginia Beach, Virginia. They temporarily moored a sonobuoy at each of the four corners of the area and a fifth sonobuoy centrally located within the range. Working at a remote location on a boat anchored outside the range and away from the training activity, the scientific crew was able to detect and locate bottlenose dolphin whistles and clicks

adjacent to and within the range in near real-time. They used a prototype portable version of the Marine Mammal Monitoring on Navy Ranges (M3R) software to process the acoustic signals from the sonobuoys. The M3R software was originally developed by NUWC for the Navy's ranges with fixed bottom-mounted hydrophones. This type of technology is still in the beginning stages of development and a few years away from being available for routine use. In the meantime, sonobuoys are proving to be an important and inexpensive platform for some types of portable monitoring capabilities.

Refinements to the M3R software and new equipment configurations

Getting the Support

The Sonobuoy Liaison Working Group (SLWG) has played an important role in supporting sonobuoy allocations to marine mammal research and monitoring. The SLWG includes representatives from the Navy branches involved in receiving and testing the sonobuoys as they come from the manufacturers; representatives from the Navy commands responsible for shipping, storing and distributing the sonobuoys; and the users in the fleets. They help to determine how many of the devices are ordered by the Navy and how many are made available to the NCEA. The SLWG is supported by the Sonobuoy Logistics group of PMA-264.



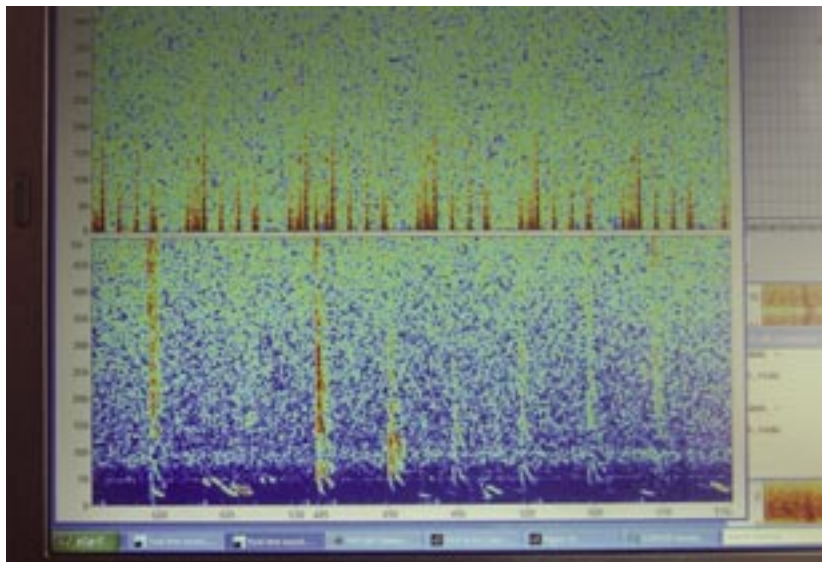
Deployed sonobuoy to acoustically detect dolphins after a MINEX operation in the Atlantic. Dolphins are visible just beyond the buoy and a visual survey vessel is seen in the distance.

Dr. Cara Hotchkin

As Jeff Leonhard noted regarding the marine mammal projects that made use of sonobuoys, “It has been great to support these types of projects—they are good for the Navy, good for research and good for our marine stewardship.” Leonhard also values the feedback received from

researchers like the NMML group regarding how the buoys worked and the type of data obtained, as well as helping his team track sonobuoy disposition. Theresa Yost added that the work the researchers do with the sonobuoys, and how they use them, is impressive.

Dr. Fitch is enthusiastic about the role of sonobuoys and the role of acoustics in marine mammal work. “We are on a great frontier with the acoustics aspect of marine mammal research. Every month researchers are learning new whale calls and are able to connect recorded sound to a specific species. Acoustic tools have helped us gain tremendous understanding of population densities, well beyond just presence and absence,” she said.



Monitoring sound signals from two channels. The lower screen displays what is called the “gunshot” sound, the call-type selected for in-flight detection of North Pacific right whales.

Brenda K. Rone

Transition to the Living Marine Resources Program

In FY 2013, the evaluation process for marine mammal-related sonobuoy requests was assigned to the LMR program. The mission of the LMR program is to develop, demonstrate, and assess information and technology solutions to protect living marine resources while preserving core Navy readiness capabilities. The Living Marine Resources Advisory Committee



North Pacific right whale.
Amy S. Kennedy, NMML Permit #782-1719

(LMRAC) includes representatives of all the major Navy Fleet and Systems Command activities affected by at-sea environmental issues.

A number of factors made the LMR program an appropriate venue for evaluating sonobuoy requests. The LMRAC's broad representation, coupled with the LMR's needs and proposal evaluation process, ensures that the main Navy stakeholders on marine mammal issues are involved in solicitations and reviews. In addition, LMR has established processes for transitioning data and technology to Navy users. These include data standards and archiving processes as well as Technology Transition Plan processes used for research and development projects.

The same review mechanism used to evaluate other marine mammal research proposals is applied to marine mammal sonobuoy requests. Following LMRAC review, the LMR program works with the SLWG on available allocations. In FY13, LMR was able to allocate 409 sonobuoys to various marine mammal research and population survey projects. The FY14 requests total 480.

As the LMR Program Manager, Dr. Robert Gisiner, points out, "The growing body of acoustics data, thanks in part to these sonobuoys, is critical to the Navy's permit application process and stewardship efforts. It helps the Navy to maintain necessary levels of realistic readiness training while minimizing the effects to marine mammals."

Summary

The sonobuoy allocation program has provided valuable support to Navy efforts in multiple areas:

- Advancing survey methodologies to meet the Navy's need for improved data on marine mammal distribution and abundance.
- Expanding species identification with improved automated signal DCL (detection, classification and localization) while reducing monitoring costs.
- Assessing the effect of Navy sound sources on mammals with improved metrics of environmental risk from Navy at-sea activities. ⚓

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