



# LMR news

WINTER/SPRING 2017

SCIENCE • STEWARDSHIP • NAVY READINESS

## Welcome!

Welcome to the winter/spring 2017 issue of *LMR News*—the newsletter from the Living Marine Resources (LMR) program. Our goal is to provide you with the latest information about program operations, significant accomplishments, and future focus areas for the LMR program. We hope you will find the content useful and that it provides insights into our efforts to improve our understanding of how Navy at-sea training and testing activities could affect marine mammals—their occurrence in training areas and potential exposure, response and consequences.

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Sperm whales.



## WHO WE ARE

The LMR program is one of the Navy's applied research (6.4) programs, sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Command Engineering and Expeditionary Warfare Center (NAVFAC EXWC) in Port Hueneme, CA. The mission of the LMR program is to improve the best available science regarding the potential impacts to marine species from Navy activities, and improve the technology and methods available to the U.S. Navy Marine Species Monitoring program, while preserving core Navy readiness capabilities.

## PROGRAM OFFICE INSIGHTS

An important figure in marine mammal research, Dr. Frank Stone, has retired from federal service. He leaves the Navy with a lasting legacy of accomplishments. Frank was instrumental in starting and managing the precursor to the LMR program—the Navy's Marine Mammal Research program. The program was initiated in 1997 to obtain the scientific knowledge needed for an appropriate marine mammal monitoring and protection plan for Navy activities. Frank emphasized the need to reach beyond Navy boundaries and to partner with other government agencies, universities and private industry, both to conduct the type research required and to build valuable relationships among interested parties.

Frank's efforts have contributed significantly to expanding what we know about marine mammals and to spawning a whole new generation of marine scientists. I am one of those fortunate new generation scientists. I met Frank when I was a student at the Naval Postgraduate School in Monterey, CA. He helped me realize that there was an important Navy research need to fulfill—understanding the impacts from sound on marine mammals. I instantly felt a sense of purpose and was driven, with his guidance, to focus on expanding my knowledge on all topics pertaining to those potential impacts. I owe much of my early education and experience to Frank and I am forever grateful for his generosity and mentorship throughout my career. It is a tremendous honor to follow in his footsteps.

On behalf of the Navy and the scientific community he helped to establish, we thank him for how far he has taken us and wish him well in the future.



Anu Kumar, Program Manager

Other topics of note since our last newsletter include recent workshops and our program review.

We are pleased to share information on a productive hands-on Ishmael workshop that was held in January. Ishmael is a marine mammal sound analysis software package supported by LMR. Please see the LMR Program Participant Updates section for more information.

I recently presented our annual program status report to the LMR program sponsors and senior Navy leadership, including the Chief of Naval Operations Energy and Environmental Readiness (OPNAV N45), the Deputy Assistant Secretary of the Navy for Environment and NAVFAC Headquarters representatives. We discussed the current projects managed by LMR, which are addressing priority Navy research needs within the at-sea training and testing environmental compliance permits, and the program's fiscal performance. Feedback on the program's performance, management and effectiveness was immensely positive. The discussions noted LMR program's success in prioritizing and managing research topics that directly contribute to ensuring that the Navy has the best available science needed to assess the potential effects to marine species. A specific area that benefits from this research is improving the Navy's analyses of sonar and explosive effects to marine life, which allows the Navy to maintain readiness with minimal impact to training, while complying to environmental laws.



Humpback whale.

## LMR PROJECT SPOTLIGHT

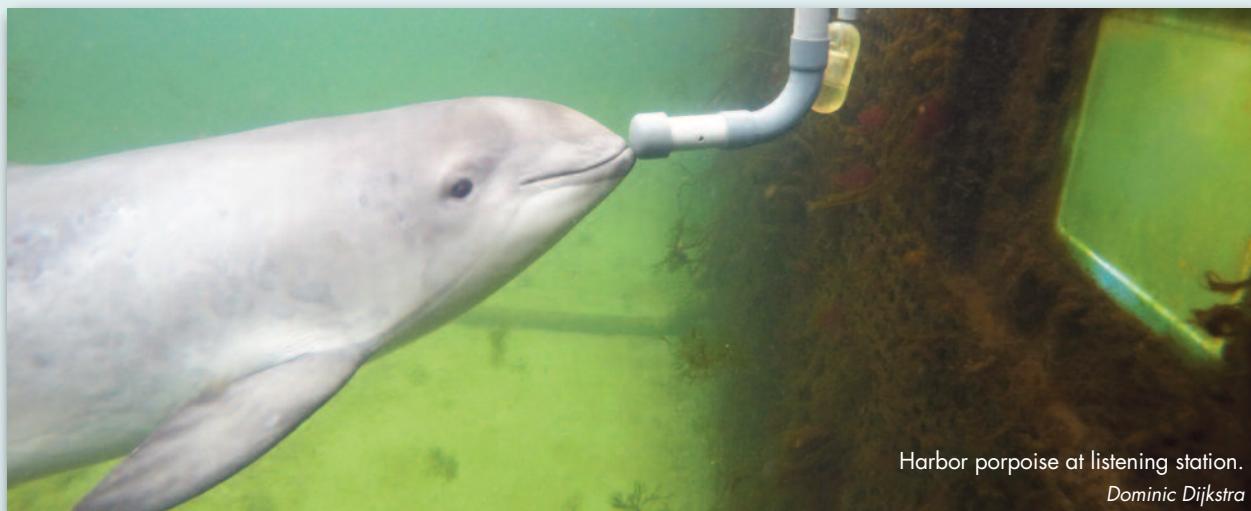
Wondering about some of the LMR-supported projects? This section provides a brief overview of one or more projects in each issue of *LMR News*.

This quarter we present one of our ongoing projects that falls within the risk threshold criteria investment area, *Behavioral Dose-Response Relationship and Temporary Threshold Shift in Harbor Porpoises*. This project is lead by Ron Kastelein, Ph.D., director and owner of SEAMARCO (Sea Mammal Research Company, Inc.) in The Netherlands.

A variety of Navy sonar sources are audible to harbor porpoises (*Phocoena phocoena*), a small odontocete species that has a wide distribution area in the Northern Hemisphere, acute hearing, and functional hearing over a very wide frequency range.

It is important to understand the difference between an animal hearing a sound and that sound causing an effect. Such effects can include either a behavioral effect or a physiological effect on hearing, known as a temporary threshold shift (TTS) or permanent hearing threshold shift (PTS). Based on the limited amount of currently available information for harbor porpoises, predictions of TTS or behavioral response are derived from surrogate, mid-frequency cetacean species exposed to other sound sources (e.g., airguns). The resulting criteria might be inappropriate for harbor porpoises. More accurate data might result in reduced mitigation zones allowing for cost savings and improved training and testing opportunities.

This project consists of two study types: a behavioral dose-response study and a TTS study.



Harbor porpoise at listening station.

*Dominic Dijkstra*

The behavioral dose-response study consists of two phases:

1. Establish the dose-behavioral response relationship for playbacks of 53-C sonar sounds at two duty cycles (2.6 and 90 percent) in quiet conditions
2. Establish the dose-behavioral response relationship for playbacks of 53-C sonar sounds at 90 percent duty cycle in three Sea State noise conditions (Sea States 0, 4, 6, 8 and 10).

By the end of 2016, data have been collected for both of these phases. During the first phase no responses could be elicited in the porpoises due to exposure to 53-C sonar playback sounds at a duty cycle of 2.6 percent at the highest sound pressure level possible without causing unwanted harmonics. Data from phase 2 are currently being analyzed.

## The results of the behavioral dose-response and TTS studies will be used to update the criteria and thresholds for harbor porpoises.

The TTS study consists of three phases:

1. Establish the audiograms of the two study animals. Because the animals arrived at SEAMARCO just before the start of the studies for LMR, their basic hearing thresholds needed to be established.
2. Study TTS in harbor porpoises from exposure to 53-C sonar playback sounds at 90 percent duty cycle with exposure durations of 30 and 60 minutes. (Note that this approach is being used because TTS could not be established with exposure to 53-C sonar playback sounds at a duty cycle of 2.6 percent at the highest sound pressure level that could be produced in the pool. This is due to the low acoustic energy per time unit and the fact that the ear could also recover during the long inter-pulse intervals (one 1.6 second sonar signal every 60 seconds).)
3. Establish equal TTS curves for the entire harbor porpoise hearing range.

The first TTS study involved exposing the animals to 53-C sonar through an underwater transducer. The equal TTS over the entire hearing range study is scheduled to begin in beginning of February 2017.

The results of the behavioral dose-response and TTS studies will be used to update the criteria and thresholds for harbor porpoises that are used to estimate potential exposures from Navy training and testing activities.

## LMR PROGRAM PARTICIPANT UPDATES

Two organizations participating in LMR-funded passive acoustic monitoring projects held a passive acoustic training workshop in January 2017 in San Diego. Dave Mellinger with Oregon State University and Liz Ferguson with Bio-Waves, Inc. conducted a workshop exploring new and improved detection capabilities of Ishmael, a freely available sound analysis software package supported by LMR. The workshop brought together 23 participants from a combination of government, academia and industry over the course of two and a half days for hands-on instruction and analysis of participants' own datasets. Attendees included individuals from the Navy's Space and Warfare Systems Center Pacific, NAVFAC Atlantic, National Oceanic and Atmospheric Administration's Fisheries Science Centers, Greenridge Sciences, Inc., University of California-Santa Cruz, Scripps Institution of Oceanography, Marine Protected Species Consulting, Oceanwide Science Institute, and other institutions. Many of the participants, with backgrounds ranging from Navy personnel to Passive Acoustic Monitoring (PAM) operators to researchers at universities and laboratories, commented on how useful they found the new detection features and on their interest in using Ishmael in their analyses. Additionally, Ishmael's localization features were highlighted in the latter portion of the workshop after participants expressed interest in this capability.

The workshop presenters are tentatively planning to conduct additional workshops in the future. For more information, contact Liz Ferguson at [eferguson@bio-waves.net](mailto:eferguson@bio-waves.net).



## IN-PROGRESS REVIEW 2017

Our 2017 IPR will be held the week of 13 November 2017, in the Port Hueneme area. While details still are being worked out, Principal Investigators on LMR projects can mark their calendars now.

## RECENT PUBLICATIONS

This section includes recent publications and reports resulting from projects that are partially or fully funded by the LMR program. The information provided in the publications is of significant value to the Navy's at-sea environmental compliance process and directly feeds into the National Environmental Policy Act, Marine Mammal Protection Act and Endangered Species Act compliance documentation.

Branstetter, B. K., St. Leger, J. Acton, D., Stewart, J., Houser, D., Finneran, J. J., and Jenkins, K. (2017), Killer whale (*Orcinus orca*) behavioral audiograms. *The Journal of the Acoustical Society of America*, 141(4), 2387–2398

Premus, V., Abbot, P., Gedney, C., Christman, R., Helfrick, M., Campbell, R., and Douglas, K. (2016). IRAP: An integrated, real-time, autonomous passive acoustic monitoring system for beaked whale detection, localization, and tracking. *Journal of the Acoustical Society of America*, 140(4): 3181.

Rice, A.C., Baumann-Pickering, S., Širović, A., Hildebrand, J.A., Debich, A.J., Meyer-Löbbeke, A., Thayre, B.J., Trickey, J.S., and Wiggins, S.M. (2017) "Passive Acoustic Monitoring for Marine Mammals in the SOCAL Range Complex June 2015—April 2016," Marine Physical Laboratory, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, MPL Technical Memorandum #610 under Cooperative Ecosystems Study Unit Cooperative Agreement N62473-16-2-0012 for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI. <http://cetus.ucsd.edu/Publications/Reports/RiceMPLTM610-2017.pdf>

Wiggins, S.M., Debich, A.J., Trickey, J.S., Rice, A.C., Thayre, B.J., Baumann-Pickering, S., Širović, A. and Hildebrand, J.A. (2017). "Summary of Ambient and Anthropogenic Sound in the Gulf of Alaska and Northwest Coast," in Marine Physical Laboratory Technical Memorandum 611 (Scripps Institution of Oceanography, University of California San Diego, La Jolla, California). <http://cetus.ucsd.edu/Publications/Reports/WigginsMPLTM611-2017.pdf>

Several additional publications are currently in preparation or in review. For lists of other publications, please see our FY15 and FY14 program reports and recent issues of *LMR News*.



Tagged Risso's dolphin.  
A. Friedlaender, permit 14534

## OUR WEBSITE—CHANGES

For many years DLA-Defense Automated Printing Service (DAPS) has hosted the LMR website. Over these years we obtained great service from DAPS at a low cost. However, in mid-May the DAPS data center that has hosted our website was taken offline. This change means transitioning to another host and new website addresses. The public information portion of the LMR website is currently available on the Navy's GreenFleet site. You can now find links to all of our informational materials at <http://greenfleet.dodlive.mil/LMR>.

The screenshot shows the homepage of the U.S. Navy Energy, Environment and Climate Change website. The header features the U.S. Navy seal and the title "U.S. NAVY ENERGY, ENVIRONMENT AND CLIMATE CHANGE". The navigation menu includes links for HOME, CURRENTS MAGAZINE, ENERGY, ENVIRONMENT, CLIMATE CHANGE, COMPATIBILITY, KIDS' CORNER, LIBRARY, and CONTACT US. Below the menu, a breadcrumb trail shows "Home > Environment > Living Marine Resources (LMR) Program". The main content area is titled "Living Marine Resources (LMR) Program" and includes tabs for Main, LMR News, Project Highlights, Annual Reports, and Proposals. The "Main" tab is selected. The "Our Mission" section describes the program's goal to improve understanding of marine species near Navy training and testing activities. It lists four key mission points: improving science, technology, and monitoring capabilities, and preserving core Navy readiness. The "Site Relocation Notice" section informs users about the change in hosting facility and the required CAC or PKI certificate for access. The "Opportunities To Participate" section mentions pre-proposals for August. The "Learn More" section links to the Fall 2016 newsletter. The "Project Highlights" section provides a link to the program's research projects.

You can now find links to all of our informational materials at <http://greenfleet.dodlive.mil/LMR>.

We recently added summaries of eight new start projects, which can be found under the Project Highlights tab.

<b>Project No.</b>	<b>Project Title</b>	<b>Project Summary</b>	<b>Investment Area</b>
16-21	Extended Duration Acoustic Tagging of Right Whales	This project is testing a new longer-lasting attachment method for digital tags.	Monitoring and Mitigation
16-22	Hearing and Estimated Acoustic Impacts in Three Species of Auk: Implications for the Marbled Murrelet	This project is measuring the hearing of up to three Auk species to provide key hearing data needed to define acoustic criteria for the marbled murrelet.	Data to Support Risk Threshold Criteria
16-23	Cuvier's Beaked Whale and Fin Whale Behavior During Military Sonar Operations: Using Medium-term Tag Technology to Develop Empirical Risk Functions	This effort will generate significantly larger samples of high-resolution behavioral data, particularly for beaked whales, to support development of risk functions.	Data to Support Risk Threshold Criteria
16-24	Frequency-dependent Growth and Recovery of TTS in Bottlenose Dolphin	The data that results from this effort will help to define weighting functions and temporary threshold shift/permanent threshold shift values for mid-frequency cetaceans.	Data to Support Risk Threshold Criteria
16-25	A Blainville's Beaked Whale Behavioral Risk Function for Hawaiian Populations	This effort will result in the publication of the first behavioral risk function for the Blainville's beaked whale at the Pacific Missile Range Facility.	Data to Support Risk Threshold Criteria
16-26	The Effects of Underwater Explosions on Fish	The results from this project will help to predict potential effects to fish that may occur during Navy explosives training activities.	Data to Support Risk Threshold Criteria
16-27	High Fidelity Acoustic and Fine-scale Movement Tags	This project will build new generation digital tags (DTAG-3s) to be field-tested during upcoming behavioral response studies.	Monitoring and Mitigation
16-28	Proposed ASA Standards on Towed Passive Acoustic Monitoring and Mitigation Systems	This project would help to support development of an American National Standard on towed cabled PAM systems and operations for monitoring and mitigation.	Standards and Metrics

## PROGRAM INVESTMENT AREAS

The LMR program's five key investment areas are:

### 1. Data to Support Risk Threshold Criteria

Research regarding potential impacts to marine species from Navy training and testing activities, primarily focused on potential impacts from sound (e.g., hearing studies, sound exposure and behavioral response studies).

### 2. Improved Collection and Processing of Protected Species Data in Areas of Navy Interest

Develop methods to improve the ability to process large amounts of marine species data and provide cost-effective solutions to enhance marine species monitoring capabilities (e.g., new detection and classification algorithms, automated processing tools for passive acoustic monitoring data).

### 3. Monitoring and Mitigation Technology Demonstrations

Demonstrate technologies that offer to enhance marine species monitoring capabilities (e.g., new passive acoustic monitoring technologies and platforms such as gliders).

### 4. Standards and Metrics

Establish interagency and scientific community standards and metrics to evaluate marine species data to provide comparable results (e.g., standards for hearing studies, detector and classifier performance analysis standards).

### 5. Education and Outreach, Emergent Opportunities

Support education and outreach on LMR-funded research investments and new scientific methods available to the broader scientific community. Emergent research topics of priority interest to the Navy (e.g., LMR website and program outreach on investments, Introduction to Density Estimation from Acoustics (IDEA) training, other study topics needed by the Navy).



Cuvier's beaked whales.  
Gregory S. Schorr, permit 16111

## PROGRAM SCHEDULE

No.	What	When
1.	<b>Proposal Solicitation &amp; Review</b>	
a.	Proposal review	Spring/Summer, 2017
b.	Notify Submitters of Evaluation Results	Summer, 2017
c.	FY18 BAA Solicitation Period	Late Summer into Fall, 2017
2.	<b>Project &amp; Contracts Management</b>	
a.	FY17 New Start Contracts	September 30, 2017
3.	<b>Quarterly Status Reports (QSR)</b>	
a.	Submit summer QSR	July 3, 2017
b.	Submit fall QSR	October 2, 2017
c.	Submit winter QSR	January 2, 2018
d.	Submit spring QSR	April 2, 2018

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## CONTACT THE LMR PROGRAM

For more information about the LMR program and its operations, contact Anu Kumar, Program Manager, [exwc\\_lmr\\_program@navy.mil](mailto:exwc_lmr_program@navy.mil), 805-982-4853.

## IN THE NEXT ISSUE OF *LMR NEWS*

Our next issue will provide updates and notes on proposal reviews, project field tests and more as available.

Watch for a new article about the LMR program's FY16 new start projects in the summer-17 issue of *Currents* magazine at <http://greenfleet.dodlive.mil/currents-magazine>.



A dipole towed array deployed.  
D.M. Rossi, University of Pavia