SUMMER 2019

LMR news

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Welcome!

Welcome to the latest 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 species—their occurrence in training areas and potential exposure, response and consequences.

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Fin whale.

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NAVFAC Naval Facilities Engineering Command
ENGINEERING AND EXPEDITIONARY WARFARE CENTER

WHO WE ARE

The LMR program is one of the U.S. 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 LMR program's fundamental mission is to support the Navy's ability to conduct uninterrupted training and testing, which preserve core Navy readiness capabilities. Our efforts to achieve that mission include working to improve the best available science regarding the potential impacts to marine species from Navy activities, demonstrating and validating projects ready for applied research, and broadening and improving the technology and methods available to the U.S. Navy Marine Species Monitoring Program.

PROGRAM OFFICE INSIGHTS

We are pleased to announce the six LMR projects that have been selected as FY19 new starts. (Please see table on the following page.) Many thanks to all involved in the lengthy and careful reviews that resulted in these project selections.

In addition to the LMR projects listed here, the LMR Partnership Updates section announces the three projects that were selected as part of the Subcommittee on Ocean Science and Technology (SOST) partnership.

With the FY19 projects selected, the process for FY20 is now underway. This includes reviewing and selecting needs submitted by Navy personnel, followed by the Broad Agency Announcement (BAA) to solicit pre-proposals to meet those needs. The Needs submission process closed on June 14, 2019. We received 18 need submissions this year, which are currently being reviewed by the LMR Advisory Committee (LMRAC). The BAA will be issued by the end of August, 2019 and will include the selected need topics for FY20. Notice of the BAA will be provided at multiple locations including the Federal Business Opportunities website (https://www.fbo.gov) and on our website (https://www.navfac.navy.mil/lmr/proposals).

Anu Kumar, Program Manager

FY19 New Starts

No.	Project Title	Investment Area	Principal Investigator(s)	Need
1.	Use of "chirp" Stimuli for Non-invasive, Low-frequency Measurement of Marine Mammal Auditory Evoked Potentials	Criteria	Jim Finneran, Naval Information Warfare Center (NIWC) Pacific	N-0202-19: Development of Audiograms for Mysticetes
2.	Temporary Threshold Shifts in Underwater Hearing Sensitivity in Freshwater and Marine Turtles (Partnership with National Marine Fisheries Service)	Criteria	Aran Mooney, Woods Hole Oceanographic Institution Wendy Piniak, Duke University	N-0208-19: Turtle Temporary Threshold Shift Feasibility Study
3.	Improved Tag Attachment System for Remotely-deployed Medium-term Cetacean Tags	Monitoring Technology	Russ Andrews, Marine Ecology and Telemetry Research	N-0203-19: Improvement of Medium-term Tag Attachment Duration
4.	Demonstration and Validation of Passive Acoustic Density Estimation for Right Whales	Data Analysis Tools	Susan Parks, Syracuse University	N-0204-19: Demonstration and Validation of Passive Acoustic Monitoring (PAM)-based Density Estimation Methods Using Visually-verified Survey Data
5.	ACCURATE ACoustic CUe RATEs for Passive Acoustics Density Estimation	Data Analysis Tools	Tiago Marques, University of St Andrews	N-0205-19: Investigation of the Effects of Cue Rate and Cue Stability on Passive Acoustic Monitoring (PAM)-Based Density Estimation Methods
6.	Marine Species Monitoring for the Population Consequences of Disturbance	Data Analysis Tools	Cormac Booth, SMRU Consulting	N-0207-19: Identification of Monitoring Priorities for Studying the Population Consequences of Disturbance on Marine Mammals

IN-PROGRESS REVIEW 2019

LMR principal investigators and LMRAC members are reminded to mark their calendars for the 2019 IPR. It will be held the week of 4–8 November in Ventura, California. Details on the meeting will be forthcoming.

LMR PROJECT SPOTLIGHT

Wondering about some of the LMR-supported projects? This section provides a brief overview of one or more projects underway in the LMR program.

For this issue we present an overview of one our ongoing projects within Investment Area 2, Data Processing and Analysis Tools.

Blue and Fin Whale Density Estimation in the Southern California Offshore Range Using PAM Data

Dr. Ana Širovic, an associate professor in the Department of Marine Biology at Texas A&M University Galveston, is using passive acoustic data to develop spatially and temporally explicit density estimates for blue and fin whales in the Southern California (SOCAL) range. Such estimates are needed to support the Navy's acoustic impact assessments for sites of high Navy interest.

Blue whale.

To estimate density from passive acoustic data, it is necessary to know the animals' average call (or cue) rates, the call detection range and the probability of call detection within that range. The project is using data from multiple sources, including long-term passive acoustic data sets from SOCAL and acoustic tag data collected over nearly 20 years of research in the area (e.g., the SOCAL Behavioral Response Study and other tagging studies). The project is leveraging results from work completed under previous Office of Naval Research funding on the analysis of the long-term passive acoustic data sets. Also, in collaboration with John Calambokidis of Cascadia Research, the team has augmented existing tag data by deploying newly available medium-term acoustic tags. The medium-term tag data, resulting from successful attachments to animals from four to 10 days, provide more information on changes in calling behavior across night and day.

This work entails analyzing blue and fin whale calls from the existing and newly acquired acoustic tag data to develop models estimating call cue rates. This includes defining uncertainty estimates at each step of the process, which are critical for understanding total uncertainty in final density estimates. To date, the project has developed the first successful model for estimating call cue rates for one type of blue whale call (D call). As the next step, this model is subsequently being applied to time series of acoustic detections.

Estimating density also requires accounting for acoustic propagation. Parameters that affect propagation most strongly include bathymetry and sediment thickness. To address this component, the project has collaborated with Tyler Helble and his team on transitioning acoustic propagation and probability of detection models for blue whale calls from a previously completed LMR project (Improving the Navy's Automated Methods for Passive Underwater Acoustic Monitoring of Marine Mammals) into this project.

Fin whale.
Brenda K. Rone, NMFS permit 15330

Another task of this project includes developing an automatic detection and classification algorithm for 40 Hz fin whale calls, which will enable the new density estimation process to be applied to fin whales in SOCAL. To develop this automatic call detection and classification process, the project team is testing convolutional neural networks as automated tools to classify fin whale calls. Convolutional neural networks (CNN) are a type of machine learning algorithm that is typically applied to visual images but here are being applied to spectrograms. The CNNs require less pre-processing, potentially offering the ability to classify signals with fewer a priori-defined characteristics. Thus far, this approach appears to be performing exceptionally well. After application of the detection and classification processes via CNNs, the same methodologies applied to the blue whale dataset will also be used for fin whale density estimation.

The methods from this work will support density estimation of other baleen whale species at locations where appropriate data exist now or in the future, particularly in the Pacific Ocean.

LMR PROGRAM PARTICIPANT UPDATES

DenMod Workshop

Members of the Density Surface Modeling (DenMod) project team will be conducting a half-day workshop prior to the World Marine Mammal Conference in December 2019. The workshop, Advancing Marine Species Density Surface Modelling with a Focus on Extrapolation, is scheduled for Saturday, December 7 at 1330–1730. To register, go to https://www.wmmconference.org/workshops.

This will be second public workshop held by the Density Modeling (DenMod) working group. The first public workshop was held prior to the Society of Marine Mammalogy 22nd Biennial Conference in Halifax, Nova Scotia. For more on that session, see the Fall 2017 issue of *LMR News*. A summary of the workshop is available at https://synergy.st-andrews.ac.uk/denmod/project-outputs.

The working group, coordinated under a project funded in part by the LMR program, is working to develop and implement innovative approaches to improve spatial modeling methods to characterize seasonal abundance and distribution of marine species, particularly in U.S. Navy training and testing areas.

Humpback whale.
Elliott Hazen, NOAA permit 14245

Pacific Marine Species Monitoring Review Meeting

LMR Program manager, Anu Kumar, attended the U.S. Navy Marine Species Monitoring Program Pacific Technical Review Meeting in Seattle, WA. Much like the annual Atlantic meeting mentioned in our Spring 2019 issue, researchers on current Pacific monitoring projects present their 2018 progress. Attendees include representatives from the Navy, National Marine Fisheries Service and Marine Mammal Commission, all of whom participate in the adaptive management process for the U.S. Navy Marine Species Monitoring Program. This meeting is a valuable opportunity to exchange information regarding projects and needs within the Navy's at-sea compliance efforts and to discuss how LMR projects can best transition to implementation.

SOST Partnership

The National Science and Technology Council's Committee on the Environment, Natural Resources, and Sustainability (CENRS) established the Subcommittee on Ocean Science and Technology (SOST) in 2013. The SOST's purpose is to advise CENRS on national issues of ocean science and technology and to serve as the lead interagency entity for federal coordination on those matters. In 2014, the SOST authorized the establishment of an Interagency Task Force on Ocean Noise and Marine Life (ITF-ONML) to increase coordination and communication across federal agencies in addressing issues related to the potential impacts of anthropogenic noise on marine life.

In 2017, the member agencies of the SOST ITF-ONML proposed to use the ITF as a mechanism to help identify immediate, cross-agency research needs and to support improved collaboration on interagency research investments. Under the auspices of the SOST ITF-ONML, the Chief of Naval Operations Energy and Environment Readiness Division, Office of Naval Research, the Bureau of Ocean Energy Management, the National Oceanic and Atmospheric Administration, and the Marine Mammal Commission partnered to jointly fund research on the auditory capabilities of mysticete whales.

The SOST ITF-ONML issued a call for pre-proposals via the LMR program in July 2018 pertaining to the development of audiograms for mysticetes. Following careful review and discussion by members of the review committee, three projects that covered a variety of methods were funded to increase the chance of success in obtaining data to address the need topic. The three projects selected for funding are listed in the following table.

No.	Project Title	Principal Investigator(s)
1.	Collection of Auditory Evoked Potential Hearing Thresholds in Minke Whales	Dorian Houser, National Marine Mammal Foundation
2.	Towards a Mysticete Audiogram Using Humpback Whales' Behavioral Response Thresholds	Rebecca Dunlop and Michael Noad, The University of Queensland
3.	Investigating Bone-conduction as a Pathway for Mysticete Hearing	Ted Cranford, San Diego State University Petr Krysl, University of California San Diego

For additional information regarding the need topic or the three selected projects, visit https://www.navfac.navy.mil/lmr/sost.

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.


Harbor porpoise.

Jones, R., Finneran, J.J., Mulsow, J., and Burkard, R.F. (2019). Effects of Stimulus Cosine Onset Properties on Bottlenose Dolphin (*Tursiops truncatus*) Auditory Brainstem Responses, *Journal of the Acoustical Society of America,* 145, 2994–3002.

Kastelein, R.A., Ainslie, M.A., and van Kester, R. (2019). Behavioral Responses of Harbor Porpoises (*Phocoena phocoena*) to U.S. Navy 53C Sonar Signals in Noise. *Aquatic Mammals*, 45(4), 359–366.

Joyce, T.W., Durban, J.W., Claridge, D.E., Dunn, C.A., Hickmott, L.S., Fearnbach, H., Dolan, K., and Moretti, D. (2019). Behavioral Responses of Satellite Tracked Blainville's Beaked Whales (*Mesoplodon densirostris*) to Mid–frequency Active Sonar. *Marine Mammal Science*, 2019; 1–18.

For lists of other publications, please see our annual program reports and recent issues of *LMR News*.

PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY20 Needs Approved	August 2019
b.	FY20 BAA Announcement	August 2019
2.	Project & Contracts Management	
a.	FY19 New Start Contracts	September 30, 2019
3.	Quarterly Status Reports (QSR)	
a.	Submit fall QSR	October 31, 2019
b.	Submit winter QSR	January 31, 2020
c.	Submit spring QSR	April 30, 2020
d.	Submit summer QSR	July 31, 2020

LMR INVESTMENT AREAS

The LMR program focuses its research funding in five investment areas:

1. Data to support risk threshold criteria

Collect data to improve the Navy's acoustic and explosive impact assessments and validate mitigation requirements, information critical to the Navy's environmental compliance and permitting process. This includes data on how well animals can hear, how and when animals may be exposed to acoustic and explosive sources, and how animals respond or are affected when exposed. Projects in this area can include hearing studies, sound exposure and behavioral response studies.

2. Data analysis and processing tools

Make required monitoring program data processing and analysis more efficient and cost-effective. This includes developing tools to automate the processing of large amounts of data to reduce costs, increase efficiency and provide consistency. These tools support the Navy's environmental compliance process and permitting process. Projects in this area can include new detection and classification algorithms, improvements to software programs, or development of novel analytical methods.

3. Monitoring technology demonstrations

Continue to develop and demonstrate technologies that can improve field data collection methods. The technologies enable efficient and cost-effective implementation of the Navy's Marine Species Monitoring program. Examples include new monitoring technologies and platforms, including sensors, tags, moored devices, buoys, gliders and REMUS 600s.

4. Standards and metrics

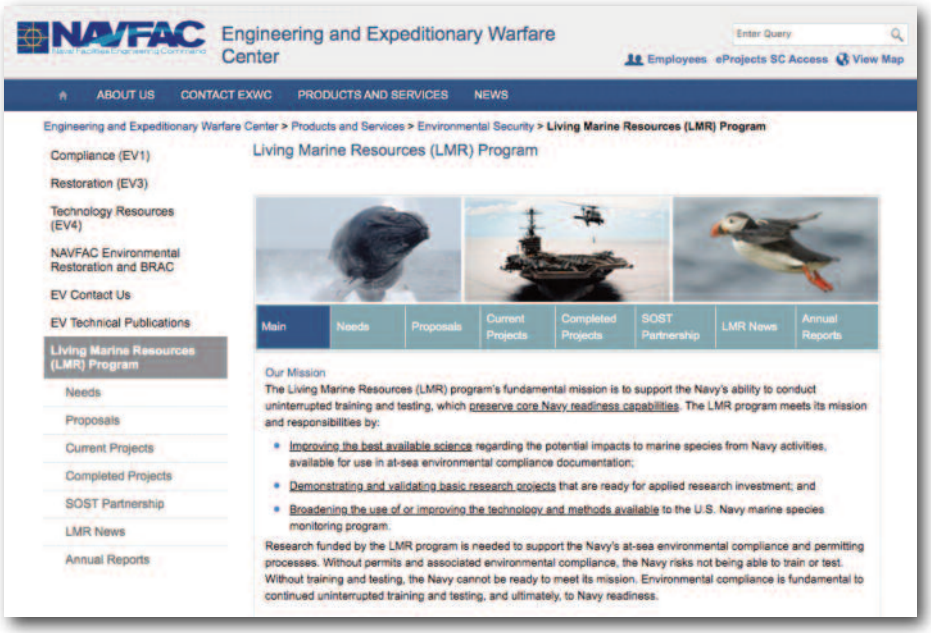
Work to establish interagency and scientific community standards and metrics for data collection, management and analysis. This promotes data comparability and enables data aggregation from different data sets. It ensures consistent, agreed-upon standards and metrics in order to provide cost-effective improvements to data and results that can be incorporated into the environmental compliance process. Projects in this area can include standards for data collection methods, standardized data management tools, and new metrics for reporting performance of data analysis methods.

5. Emergent topics

This investment area is reserved for other priority topics needed by the Navy that may come up and do not fall within the preceding topics.

OUR WEBSITE HAS MOVED

The public face of the LMR program is now housed on the Naval Facilities Engineering Command (NAVFAC) website. You can find links to all of our informational materials, including our 2018 annual report and past issues of *LMR News*, at the new and improved LMR website at http://www.navfac.navy.mil/lmr.



www.navfac.navy.mil/lmr

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If you want to subscribe to *LMR News*, send your email address to Lorraine Wass at ljwass@outlook.com.

CONTACT THE LMR PROGRAM

For more information about the LMR program and its operations, contact Anu Kumar, Program Manager, at exwc_lmr_program@navy.mil and 805-982-4853.

IN THE NEXT ISSUE OF *LMR NEWS*

Our next issue will provide updates on the 2019 IPR and project updates as available.