



LMRnews

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SPRING 2019

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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Bottlenose dolphin.



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

During this quarter we have been particularly focused on reviewing proposals and engaging in partnerships that will enhance our work. In addition, we attended two valuable meetings with our colleagues in the other two Navy marine species programs—Navy Marine Species Monitoring Program and Office of Naval Research Marine Mammal Biology (ONR MMB) program.

We in the LMR program office have been working with the LMR Advisory Committee (LMRAC) and Technical Review Committee experts to review proposals resulting from our Fiscal Year 2019 (FY19) Broad Agency Announcement (BAA). As noted in our Winter 2019 issue of *LMR News*, the six needs listed in the BAA generated significant interest and a breadth of responses. From the numerous preproposals received, a subset were invited to submit full proposals, which currently are in review. Following program review and recommendation to N45, our program sponsor, selections will be finalized.

In addition to LMR proposal reviews, we have participated in reviewing proposals to the Subcommittee on Ocean Science and Technology (SOST). You can read more about SOST and that review process in our Partnership Updates section later in this issue.

LMR Deputy Program manager, Mandy Shoemaker, attended the U.S. Navy Marine Species Monitoring Program Atlantic Technical Review Meeting in Virginia Beach, Virginia. During this annual meeting, researchers on current Atlantic monitoring projects presented their 2018 progress.



Anu Kumar, Program Manager

Attendees include representatives from the Navy, National Marine Fisheries Service and Marine Mammal Commission, all of whom participate in the adaptive management process of 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.

Both the LMR Program manager, Anu Kumar, and Mandy Shoemaker attended the ONR MMB program's recent program review, held in late April. Much like the LMR In-progress Review, principal investigators on ONR MMB projects present updates on their work to date. This information helps to identify which of the early research efforts might be appropriate for the LMR's validation/demonstration process before becoming available for implementation by the Marine Species Monitoring Program.

This type of ongoing coordination among the Navy's marine species programs is critical to promoting efficient use of limited resources to meet Navy needs.

And speaking of Navy needs, it is time for Navy personnel to submit proposed research needs. Anyone within the Navy may submit needs for consideration by the LMR program. For details on submitting needs, see the program website at navysustainability.dodlive.mil/lmr. The Needs submission deadline is June 14, 2019.

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 November 4th in Ventura, California. Email with specific details will be forthcoming.



Pilot whales.
Rune Roland Hansen, permit 2015/223222

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 acoustic effects projects, which contribute critical data to Navy risk assessment criteria.

Frequency-dependent Growth and Recovery of Temporary Threshold Shift in Bottlenose Dolphins

The Navy continues to work to improve its acoustic impact assessments for marine species. The acoustic impact assessments apply auditory weighting functions, similar to those used in assessing risk to human hearing, to predict the occurrence of temporary threshold shift (TTS) and permanent threshold shift (PTS) as functions of frequency. Threshold shift is one of the few direct measures of adverse effects of intense sound on hearing. The associated weighting functions are mathematical functions that emphasize, or “weight,” noise at different frequencies according to the listener’s susceptibility to noise at that frequency. Direct measurements of TTS in representative marine mammal species—across a broad spectrum of sound frequencies—are needed to support the TTS/PTS thresholds and weighting function derivations.

Dr. James Finneran, a research scientist at the Naval Information Warfare Center (NIWC)

Pacific, is conducting this project to quantify the TTS thresholds and derive weighting functions for bottlenose dolphins. The specific objectives of this effort are to

1. Determine exposure levels corresponding to the onset of TTS across a broad range of frequencies in bottlenose dolphins (*Tursiops truncatus*)
2. Develop TTS recovery models for use in acoustic impact assessments and
3. Examine the relationship between TTS measured using behavioral methods and auditory evoked potential (AEP) methods.

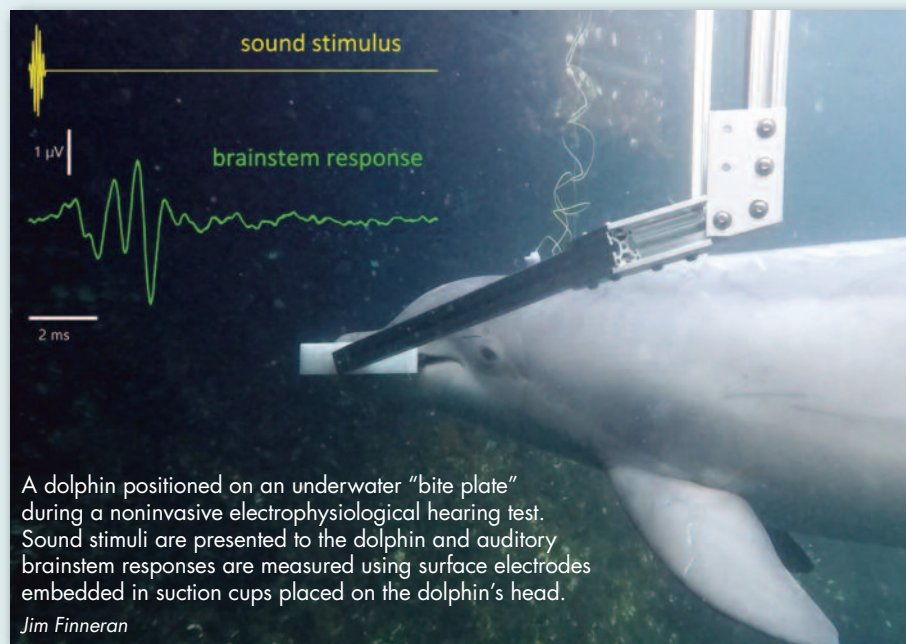


Bottlenose dolphins.
Mark H. Deakos, permit 14451

The project methodology includes measuring hearing thresholds in bottlenose dolphins using both behavioral methods (tracking a trained animal's response to a sound) and noninvasive electrophysiological methods (measuring auditory evoked potentials, i.e., changes in brainwaves in response to a sound). Researchers establish baseline hearing thresholds, then measure hearing thresholds immediately before and after exposure to a fatiguing noise to determine any threshold shift occurrences. The study follows a protocol approved by the Institutional Animal Care and Use Committee (IACUC) at NIWC Pacific, and subject health, welfare and behavior are continuously monitored and managed by attending veterinarians and animal care staff.

Initial efforts entailed animal training (to respond to sound cues), baseline hearing measurements and refining the TTS exposure protocols for the study. The project team then began collecting high-frequency TTS data. The team completed TTS testing with 80-kHz fatiguing noise with a single dolphin and 40-kHz fatiguing noise with two dolphins. Maximum one-hour exposure levels were approximately 160-165 dB sound pressure levels (SPL), equivalent to approximately 196 to 201 dB sound exposure levels (SEL). Low- and mid-frequency data collection is planned to begin later in the project.

The data resulting from this effort will be used to update the weighting function and TTS/PTS threshold values for the mid-frequency cetacean group, validate the extrapolation procedures used to derive weighting functions and TTS/PTS thresholds for other species groups, develop practical models for recovery from TTS and enable broad comparisons between behavioral- and AEP-based measures of TTS. This information is directly applicable to all Navy environmental compliance documents analyzing potential impacts from acoustic sound sources.



LMR PROGRAM PARTICIPANT UPDATES

Both Anu Kumar and Mandy Shoemaker attended the Naval Innovative Science and Engineering Technical Exchange Meeting (NISE TEM) in Port Hueneme, CA. The NISE TEM brings together scientists and engineers from the Naval Research and Development community (the Navy's labs and warfare centers) to share their work, learn about others' work and create new networks for future work. This offered the LMR program a great opportunity to learn about the work going on at other Navy labs and warfare centers, and potentially foster new collaboration. The great presentations covered topics that included unmanned aerial and underwater vehicle technology, image processing, machine learning, and artificial intelligence.

LMR PARTNERSHIP UPDATES

LMR has embarked on an important new partnership effort with the Subcommittee on Ocean Science and Technology (SOST). The federal partners include the Office of Naval Research, Chief of Naval Operations N45, the Bureau of Ocean Energy Management (BOEM), the National Oceanic and Atmospheric Administration (NOAA), and the Marine Mammal Commission (MMC). The group issued a Broad Agency Announcement on mysticete hearing in July 2018. Projects funded under this SOST partnership will be announced in the next newsletter.



Orcas.
Allen Shimada, NOAA/NMFS

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.

Kastelein, R.A., Helder-Hoek, L. and Gransier, R. (2019). Frequency of greatest temporary threshold shift in harbor seals (*Phoca vitulina*) depends on the fatiguing sound level. *The Journal of the Acoustical Society of America* 145, 1353-1362.

Kastelein, R.A., Helder-Hoek, L., van Kester, R., Huisman, R. and Gransier, R. (2019). Temporary Hearing Threshold Shift in Harbor Porpoises (*Phocoena phocoena*) Due to One-Sixth Octave Noise Band at 16 kHz. *Aquatic Mammals* 45(3), 280-292.

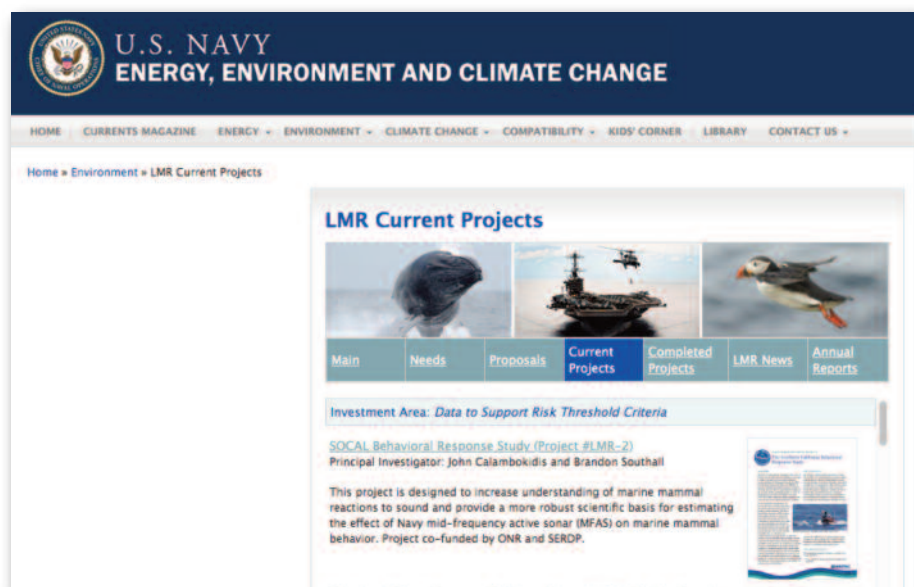
Mooney, A.T., Smith, A., Larsen, O.N., Hansen, K.A., Wahlberg, M., Rasmussen, M.H. (2019). Field-based hearing measurements of two seabird species. *Journal of Experimental Biology* 222: jeb190710.

Southall, B. L., DeRuiter, S. L., Friedlaender, A., Stimpert, A. K., Goldbogen, J. A., Hazen, E., Casey, C., Fregosi, S., Cade, D. E., Allen, A. N. et al. (2019). Behavioral responses of individual blue whales (*Balaenoptera musculus*) to mid-frequency military sonar. *Journal of Experimental Biology* 222: jeb190637.

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

OUR WEBSITE

Keep an eye on our website for the soon-to-be-released 2018 LMR Program Report on the status of the LMR program. This annual document reviews the program's mission and history and provides updates on LMR projects. If you are on the *LMR News* email list, you will be notified when the report is available. The website address is navysustainability.dodlive.mil/LMR.



navysustainability.dodlive.mil/LMR

PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY19 Full Proposals Review	May, 2019
b.	FY20 Needs Submission Deadline	June 14, 2019
c.	FY20 Needs Approved	August, 2019
2.	Project & Contracts Management	
a.	FY19 New Start Contracts	September 30, 2019
3.	Quarterly Status Reports (QSR)	
a.	Submit summer QSR	July 31, 2019
b.	Submit fall QSR	October 31, 2019
c.	Submit winter QSR	January 31, 2020
d.	Submit spring QSR	April 30, 2020

LMR ANNUAL REPORT

We are excited to announce that our 2018 Living Marine Resources program report is now available online. Our annual report provides an overview of the LMR program's mission, history and structure, in addition to summarizing the status of projects that were completed, ongoing or newly started during 2018. The report also lists LMR-related publications that became available in 2018.

A PDF of the report can be found under the "Annual Reports" tab on our website, or by following the link: navysustainability.dodlive.mil/lmryir/.



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If you want to subscribe to, or unsubscribe from, *LMR News*, please 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 proposal review process and information on the FY20 needs and pre-proposal requests.



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.