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.

INSIDE THIS ISSUE

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

This last quarter found us keeping the LMR program moving forward while continuing to work from home. We appreciate the hard work and flexibility of our program participants, especially the LMR Advisory Committee (LMRAC) members and principal investigators (PI), during the pandemic disruptions.

We are glad to announce that our annual report on the LMR program is now available. If you did not receive an email with a digital copy of the report, you can find it at the annual reports tab on our website (www.navfac.navy.mil/lmr/annual_reports). This annual document reviews the program's mission and history, provides updates on LMR projects and lists publications that became available during 2019. Among the projects presented in the report are seven completed projects, eight new start projects and 18 ongoing projects. The report also presents information on the important partnership efforts that provide enormous value. These projects are critical to ensuring the Navy can meet its environmental compliance needs and maintain training.

We also are pleased to announce the two LMR projects that have been selected as Fiscal Year 2020 (FY20) new starts. Many thanks to all involved in the lengthy and careful reviews that resulted in these project selections. In addition to these two projects, a number of other projects were put on hold. We hope to be able to start some of these in FY21 as funding allows.

Anu Kumar
Program Manager

Mandy Shoemaker
Deputy Program Manager

Investment Area	Project Title	Principal Investigator	Need
Criteria	Frequency-dependent, Underwater, Temporary Threshold Shift in California Sea Lions	Ron Kastelein Sea Mammal Research Company (SEAMARCO)	N-0224-20 Frequency-dependent, Underwater, Temporary Threshold Shift in California Sea Lions
Standards and Metrics	Capability Enhancements for Tethys, a Passive Acoustic Metadata Workbench	Marie Roch San Diego State University	N-0228-20 Marine Mammal Acoustic Software Application Enhancements

We also are moving forward with our FY21 needs process. We have been working with the LMR Advisory Committee (LMRAC) to review Navy-identified needs that will serve to define future project areas. As in past years, a pre-proposal solicitation will be issued to address the needs. As of this writing, we expect to issue the solicitation in late August or early September 2020.

PROJECT STATUS UPDATES

As we noted in the Spring-20 issue of LMR News, the COVID-19 pandemic is affecting work on some LMR-funded projects. In this section we will provide updates on projects when timelines change due to the pandemic.

One project, The Effects of Underwater Explosions on Fish (FISHEX), has canceled the 2020 field effort. This will delay this project by at least one year.

IN-PROGRESS REVIEW

We are disappointed to announce that we cannot safely hold an in-person In-progress Review (IPR) this year. We are exploring options for limited online review during the week of December 1, 2020. We will be in touch with PIs and LMRAC members to discuss ideas.

California sea lion.
Cordelia Shea

In addition, looking ahead to 2021, we are polling PIs and LMRAC members on possible dates and will provide updates as we have new information.

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 a project under the Data Processing and Analysis Tools investment area.

ACCURATE: ACoustic CUe RATEs for Passive Acoustics Density Estimation

A team led by Tiago Marques, a senior research fellow at the Centre for Research into Ecological and Environmental Modelling (CREEM), University of St Andrews, is working to evaluate and expand the current state of knowledge marine mammal cue rates for marine mammal density estimates. The project includes several sub-teams addressing different components. Each of these teams is led by experienced co-principal investigators, including Ana Širović (Texas A&M University Galveston), Susan Parks (Syracuse University), Simone Bauman-Pickering (University of California San Diego), Karlina Merkens/Erin Oleson (National Oceanic and Atmospheric Administration) and Len Thomas/Doug Gillespie (University of St Andrews). Kalliopi Gkikopoulou (University of St Andrews) is the key postdoctoral researcher working on the project and Cormac Booth (SMRU Consulting) is in charge of project management.

Marine mammal density estimates are a critical input for the Navy's acoustic effects modeling. While these estimates are typically generated from visual aerial or shipboard surveys, such methods are expensive to conduct, are limited in the areas and time-frames they cover and are not effective at documenting species that spend little time at the water's surface, thus being hard to see. One alternative for estimating density is using fixed-passive acoustic monitoring (PAM), which can provide data in remote areas and during long continuous periods rather than for (sets of) discrete daylight times. A key factor in generating PAM-based density estimation (PAM-DE) is the marine mammal sound production rate,

Pilot whales being tagged with a DTAG to collect sound and movement data.
Rune Roland Hansen, Norwegian Animal Research Authority permit 2015/223222

called a "cue rate." Marine mammal cue rates can vary due to many factors—species, time of day, year, group size, age, sex, behavioral state, season, bottom depth and location, among others. Further, cue rates often are determined from limited data sets and assumed to be representative for the species. All of these aspects affect how to estimate density from PAM data. To improve its use of PAM-DE in acoustic effects modeling, the Navy needs information on most appropriate species for which to collect cue rate data and the appropriate cue rates to use in density estimates.

Sperm whale with a DTAG, which collects the type of data used in this project.
Rune Roland Hansen, Norwegian Animal Research Authority permit 2015/223222

The ACCURATE project team is undertaking a comprehensive, quantitative synthesis of the current state of knowledge on acoustic cue rates and cue rate stability for marine mammal density estimation from passive acoustics. The ultimate project goal is to determine the most appropriate cue rates to use in different contextual settings. The project will produce a comprehensive set of recommendations of the most appropriate means by which to advance PAM-DE to meet Navy needs.

The project is organized around several tasks that draw upon existing data and will develop new methods. The project team is working to

- Identify, review, compile and provide open access to all data available on cue rates (and their variability) across deep–diving and baleen whale species

- Develop methods to estimate cue rates from different data types (e.g., time-depth data) and for different taxa

- Apply these methods to species of interest for the Navy

- Explore the factors that determine cue rate variability over time and space

- Evaluate impacts of cue rate variability on density estimates from cue–based methods.

Two primary tasks for 2020 are identifying and compiling existing information on cue rates, as well as extracting and analyzing existing tag data to estimate cue rates for selected deep-diving species.

The project has initiated an extensive bibliographic search for peer-reviewed papers and grey literature reports as well as contacting researchers involved in PAM work to understand existing, but unpublished, data sources. Project participants established online options for other researchers to provide references and recommendations for PAM data sources. These include a dedicated email (papers4accuratereview@gmail.com) and an information and contact page at Research Gate (www.researchgate.net/project/ACCURATE-ACoustic-CUe-RATEs-for-passive-acoustics-density-estimation). The ACCURATE team hopes to be able to work with any other teams that might have relevant data and information on the topic, with a natural focus on, but not exclusive to, other LMR-funded projects. The ACCURATE team encourages researchers that might be interested in the topic, in particular if they have data or past work that might be applicable, to contact the team. There are multiple opportunities for synergistic and symbiotic connections among teams.

Working with researchers who deploy animal tags on marine mammals, the team is securing digital acoustic tag (DTAG) data and extracting whale vocalizations (e.g., click data). Thus far this ongoing task has secured data
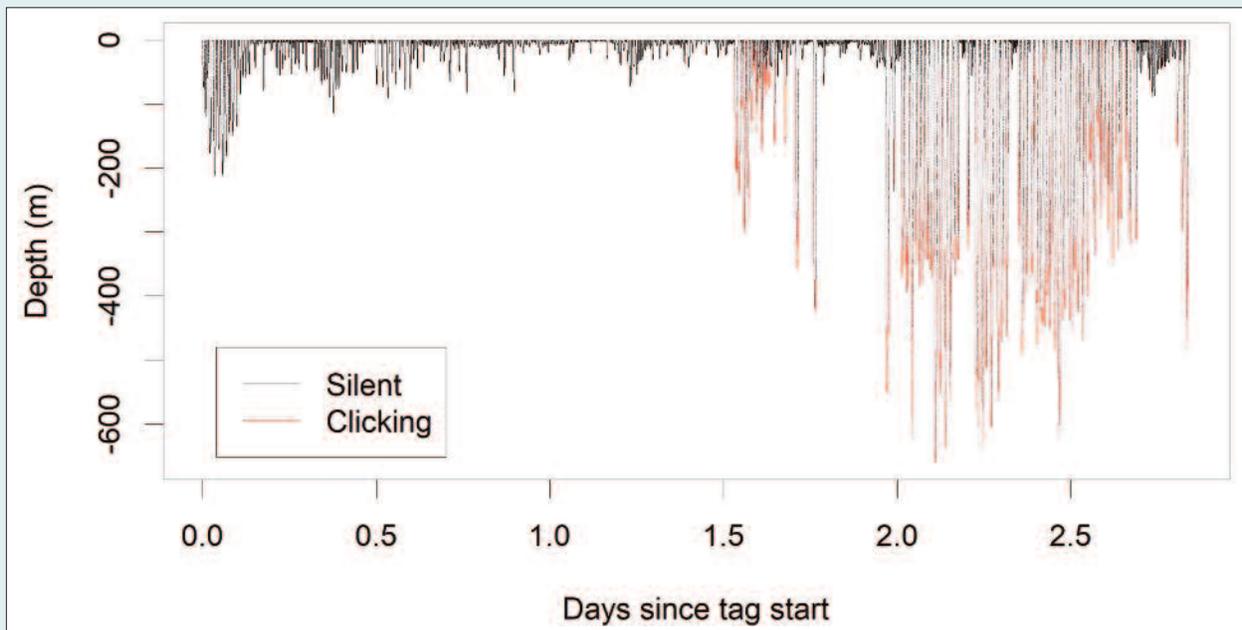
The depth profile of a Narwhal, with seconds where clicking occurs highlighted in red. Clearly there is a relationship between the depth at which the animal is and the probability that it might produce a sound. Another interesting aspect is the fact that for the first 1.5 days of the tag deployment the animal produced no sound, which hints towards tag effects that must be accounted when making inferences form tag data.

from approximately 260 DTAG deployments. Tagged species include Blainville's beaked whales (*Mesoplodon cavirostris*), Cuvier's beaked whales (*Ziphius cavirostris*), pilot whales (*Globicephala melas*) and sperm whales (*Physeter macrocephalus*). All cues and cue types from each tag are being counted to obtain a cue rate per tag. The estimated cue rate per tag then will be combined into a simple cue rate per species, where possible trying to differentiate factors affecting cue rate.

Additional tasks getting underway include evaluating methods for cue rate estimation in baleen whales, estimating cue rate from proxy data and investigating inter–click interval (ICI) patterns for deep divers (e.g., Cuvier's and Blainville's beaked whales).

As these and other tasks progress, the team will explicitly assess how the cue rates change over time and space, in particular to understand the main drivers of cue rate variability for considered species and cues. One objective is to define easy–to–measure covariates (e.g., species, population, sub–population, behavioral state, season, sex, etc.) that can be used to predict cue rate. The project team will then build models predicting cue rate as a function of possible factors of interest, providing a framework to estimate cue rate for other times and places based on available covariates.

As a final step, the project team will conduct a simulation exercise to evaluate the potential consequences of using biased cue rates. The project will also identify the potential effects of using different cues (with different characteristics) in cue–based density estimation exercises. This will provide guidance on interpreting the density estimates derived using cue rates from times and places other than the original PAM survey.

Results will be provided through regular project reports as well as manuscripts that will be submitted to peer-reviewed journals. Presentations, and potentially a workshop, at marine mammal conferences (when possible) will also disseminate information. Cue rates compiled and estimated throughout the project will be organized and available in a publicly available database. Final reporting currently is expected by the end of 2023.

Marine mammal density estimates are a critical element of the Navy's acoustic effects modeling, which supports environmental compliance. Passive acoustic monitoring potentially offers a cost-effective method to generate density estimates for a wide range of species across Navy priority areas. By addressing a fundamental aspect of PAM-DE—understanding cue rates and cue rate stability—this project will advance the practical application of PAM–DE for Navy purposes. The resulting repository of synthesized data will support future density estimation from passive acoustic monitoring.

LMR PROGRAM PARTICIPANT UPDATES

The Effects of Sound in the Ocean on Marine Mammals (ESOMM) conference brings together scientists that study the effects of sonar, to share their research results with operational users and regulators and show how to improve management and regulation of sonar systems based on science. Many participants in ESOMM meetings are now or have previously worked on LMR projects. The ESOMM 2020 co-chairs—Brandon Southall, Doug Nowacek and Andy Read—have announced that the meeting is postponed until November 2–5, 2021. The meeting is invitation-only and invitees will continue to receive updates via email.

The Detection, Classification, Localization, and Density Estimation (DCLDE) Workshop provides a structured opportunity to share information on acoustic methods applied to marine mammals. As the workshop title suggests, the focus is on methods to detect, classify, locate, track, count and monitor marine mammals in their environment. Such methods are central to much of the work funded by the LMR program. The DCLDE 2020 committee have announced that the meeting has been rescheduled for November 7–13, 2021.

OUR WEBSITE

You can find links to all of our informational materials, including our most recent annual report, at our website—www.navfac.navy.mil/lmr.
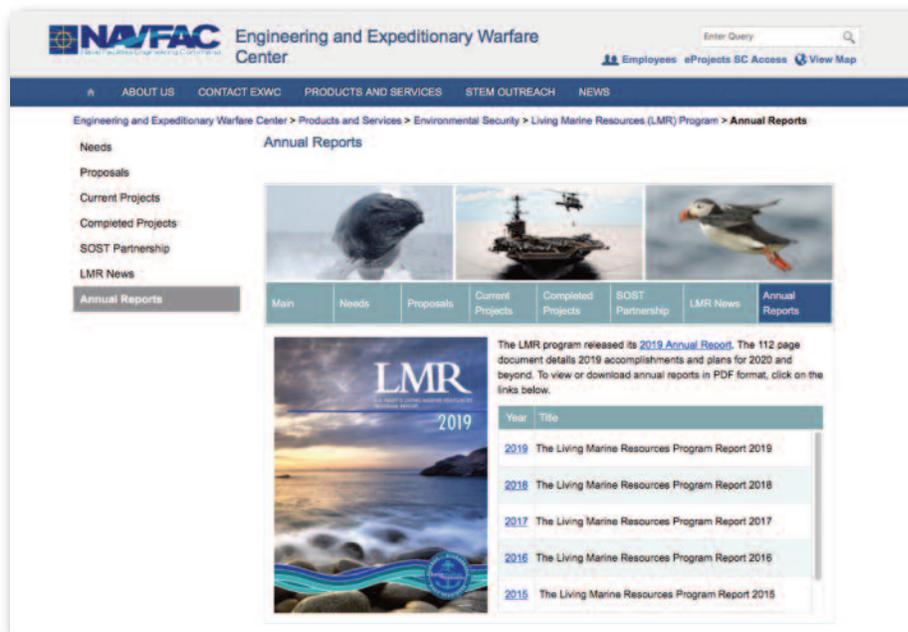
www.navfac.navy.mil/lmr

RECENT PUBLICATIONS

This section includes recent publications and reports resulting from projects that are or have been 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.

Barlow, J., Schorr, G.S., Falcone, E.A. and Moretti, D. (2020). Variation in dive behavior of Cuvier's beaked whales with seafloor depth, time-of-day, and lunar illumination. *Marine Ecology Progress Series*, 644:199-214. (DOI: 10.3354/meps13350)

Varghese, H.K., Miksis-Olds, J., DiMarzio, N., Lowell, K., Linder, E., Mayer, L. and Moretti, D. (2020). The effect of two 12 kHz multibeam mapping surveys on the foraging behavior of Cuvier's beaked whales off of southern California. *The Journal of the Acoustical Society of America*, 147(6):3849–3858. (DOI: 10.1121/10.0001385). *(Note: This project, though not funded by the LMR program, used data from the Marine Mammal Monitoring on Ranges [M3R] system developed under projects funded by the LMR and Office of Naval Research Marine Mammal Biology programs.)*

Cuvier's beaked whale.
Erin L. Keene, Marine Ecology & Telemetry Research permit 14097

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.	FY21 Needs Approved	August, 2020
b.	FY21 BAA Announcement	August, 2020
2.	Quarterly Status Reports (QSR)	
a.	Submit fall QSR	October 30, 2020
b	Submit winter QSR	January 29, 2021
c.	Submit spring QSR	April 30, 2021
d.	Submit summer QSR	July 30, 2021

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.

LMR-RELATED PHOTOS—KEEP THEM COMING

We encourage all LMR participants to share photos of marine mammals, survey efforts, personnel who were involved and the equipment used. We'd like to include some of those images in a future issue of *LMR News* and give you credit—right there with your photo.

Surely among all of those photos from field work you have a few that you're particularly proud of. Please send them along, accompanied by a caption, photo credit and permit number (as applicable) and be sure that the photos are in high resolution format. Who knows, you may see one of those photos in a future issue of the LMR newsletter. Submit your photos via email to: exwc_lmr_program@navy.mil.

Atlantic puffins, Husavik, Iceland.
Aran Mooney

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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 information on pre-proposal solictations, new publications, updates on the pandemic's effects and other information as available.