

LMR news

FALL 2021 • WINTER 2022

SCIENCE • STEWARDSHIP • NAVY READINESS

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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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 Installations (OPNAV N4I) 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

Our annual In-progress Review, a new video, new project publications, project field efforts, Fiscal Year 2021 (FY21) projects and FY22 project solicitation and review are some of the topics we cover in this issue.

We are happy to note that we had a successful In-progress Review (IPR) in November 2021. See the In-progress Review section on page 4 for highlights.

NAVFAC EXWC has completed a video for its science, technology, engineering and mathematics (STEM) program to give students an overview of the LMR program. The video identifies the career paths relevant to LMR, to encourage students to participate in STEM activities. Links to the video will be shared in future newsletters.

For the latest LMR publications, go to the Recent Publications section of this issue and for a spreadsheet listing all LMR-related publications, checkout the publications tab at our website, www.navfac.navy.mil/lmr.

This issue's Project Spotlight is on an Investment Area 4 (Standards and Metrics) project, Standardizing Methods and Nomenclature for Automated Detection of Navy Sonar.

Project plans and contracts for the final six FY21 projects were completed during this period and are listed in the following table. These are in addition to the two projects identified in the Summer-21 issue of



Anu Kumar
Program Manager



Mandy Shoemaker
Deputy Program Manager

LMR News and the one quick start project, Collection of *in situ* Acoustic Data for Validation of U.S. Navy Propagation Models of Ship Shock Trial Sound Sources, presented in the Spring-21 issue.

Investment Area	Project Title	Principal Investigator(s)	Need
Criteria	Loudness Perception in Killer Whales (<i>Orcinus orca</i>); Effects of Temporal and Frequency Summation	Brian Branstetter, National Marine Mammal Foundation	N-0239-21: Relationship Between Perceived Loudness of a Signal and Signal Length
Criteria	Dependence of TTS on Exposure Duration During Simulated Continuously Active Sonar: Examining the Equal-energy Hypothesis for Long-duration Exposures	Jason Mulsow, National Marine Mammal Foundation	N-0238-21: Understanding Marine Mammal Hearing and Behavioral Response to Continuously Active Sonar
Criteria	Dolphin Conditioned Hearing Attenuation	Jim Finneran, Naval Information Warfare Center	N-0225-20: Marine Mammal Conditioned Attenuation of Hearing Sensitivity
Criteria	Approaches for Examining Behavioral Responses of Whales to SURTASS LFA Sonar	John Calambokidis, Cascadia Research Collective; Brandon Southall, Southall Environmental Associates	N-0240-21: Studying Marine Mammal Behavioral Response to SURTASS LFA Sonar
Criteria	Simple and Understated: Risk Team Assessment of Low-Frequency Active Sonar (SURTASS LFA)	Stephanie Watwood, Naval Undersea Warfare Center; Greg Schorr, Marine Ecology and Telemetry Research	N-0240-21: Studying Marine Mammal Behavioral Response to SURTASS LFA Sonar
Criteria	Low Frequency Active Scientific Research Project 4 Feasibility Study	Adam Frankel, Marine Acoustics Inc.	N-0240-21: Studying Marine Mammal Behavioral Response to SURTASS LFA Sonar

Looking ahead to FY22 projects, the solicitation period for pre-proposals closed December 2, 2021. We received several responses for each of the three need areas listed below:

1. **Need Topic N-0257-22:** Demonstrate and Validate the Ability of Existing Sparse Acoustic Array Technology to Address Navy Marine Species Monitoring Goals
2. **Need Topic N-0258-22:** Demonstrate Existing Marine Mammal Tag Technologies
3. **Need Topic N-0259-22:** Improve the Ability to Identify Calling Individual from Acoustic Tags

The pre-proposal review was completed in late January and selected principal investigators (PI) were invited to submit full proposals. The full proposal submission deadline is March 14, 2022.

IN-PROGRESS REVIEW

We held our 2021 LMR In-progress Review during the week of November 15 to 18. This year's meeting took a new form as a hybrid of in-person and online participation because many program participants still were unable to travel due to COVID restrictions. The in-person meetings observed all Navy COVID requirements including attendees being vaccinated, masked and seated well apart from each other. The meeting had 42 in-person attendees and 28 attendees joining in by Zoom. Thanks to great technical support from Luners Production Services, the hybrid approach was smooth and inclusive for all attendees.

The 30 presentations over the week included nine new start projects and eight final briefs. For the final briefs, some work remains to be completed but projects will conclude before the 2022 IPR. These include the following:

1. **Project 21:** Extended Duration Acoustic Tagging of Right Whales
2. **Project 23:** Cuvier's Beaked Whale and Fin Whale Behavior During Military Sonar Operations: Using Medium-term Tag Technology to Develop Empirical Risk Functions
3. **Project 24:** Frequency-dependent Growth and Recovery of TTS in Bottlenose Dolphins
4. **Project 27:** High Fidelity Acoustic and Fine-Scale Movement Tags to Enable Behavioral Response Research on Deep Diving Whales
5. **Project 29:** 3S3: Behavioral Responses of Sperm Whales to Naval Sonar
6. **Project 31:** DenMod: Working Group for the Advancement of Marine Species Density Surface Modeling
7. **Project 36:** Analytical Methods to Support Development of Noise Exposure Criteria for Behavioral Response
8. **Project 39:** Use of "Chirp" Stimuli for Non-invasive, Low-frequency Measurement of Marine Mammal Auditory Evoked Potentials

The presentations all reflected the good progress researchers have made despite the challenges that COVID has continued to pose.



Southern right whale.

Three new LMRAC members joined us this year. They are Christy Cowan from U.S. Fleet Forces Command, Elizabeth Seacord from the Point Mugu Sea Range Sustainability Office and Rose Johnson from Naval Sea Systems Command.

With new members joining the LMRAC, we also must bid farewell to two members. Jene Nissen from Fleet Forces Command was a founding member of the LMRAC. His longstanding operational perspectives have been invaluable. Jene has taken a new position within Fleet Forces Command that will preclude his regular participation on the LMRAC. We wish him well in his new position and will miss not only his professional insights but his hunting stories.

Greg Sanders from the NAVAIR Point Mugu Sea Range Sustainability Office is retiring from Navy service. During his three years on the LMRAC, Greg has offered insights into the environmental compliance work being conducted at the Point Mugu Sea Range. We are sure that he will enjoy his retirement.

Our new and previous resource sponsor representatives officially handed off their baton at this IPR. As noted in our last issue of *LMR News*, Benjamin Colbert has assumed the mantle of OPNAV N4I5 representative, previously held by Danielle Kitchen.

For this year's social event, we wanted to be sure that those who couldn't join in person were with us in spirit. Gathering photos of the faces of those unable to attend, the PIs and LMRAC members carried them along for an evening of fun. Sometimes it was hard to tell who was there and who was not. These events always offer great opportunities for discussions and connections.

While nothing quite takes the place of face-to-face discussions, we believe this hybrid approach offered the next best thing. The interactions among PIs, LMRAC members and program managers continue to provide any needed course corrections and valuable input to the projects.

The LMRAC and PIs can now save the date for the 2022 IPR. It will be held the week of November 14–18, 2022. Details will follow.



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 Investment Area 4: Standards and Metrics.

Standardizing Methods and Nomenclature for Automated Detection of Navy Sonar

This project's team—Elizabeth Henderson and Tyler Helble from Naval Information Warfare Center (NIWC Pacific), Peter Dugan from Cornell University, and Susan Jarvis from Naval Undersea Warfare Center (NUWC Newport), working closely with bioacoustics experts in the research community and the Navy—has made significant progress toward standardizing how sonar signals in passive acoustic monitoring (PAM) data are detected and reported. This work will enable more comparable data analysis of sonar presence and marine mammal behavioral responses observable within passive acoustic data.

Navy and non-Navy marine mammal researchers often use automated detectors for identifying signals within PAM data sets. With multiple automated sonar detectors currently in use by different researchers, results of data analyses conducted on the same data set can often vary. In addition, the terminology (or nomenclature) used to characterize sonar signals detected in data sets also varies. Both variations can make it difficult to compare results.


This project has been working to address some of these issues by:

- evaluating existing automated detectors
- finding detection parameters that work well across sonar types, environments and recorders
- analyzing whether those parameters can be implemented in existing detectors and/or utilized to create a standardized detector
- developing a standardized and unclassified terminology, that can be used across the bioacoustics community, to describe and discuss different sonar signals.

After reviewing the literature to identify frequently used detectors and descriptions of sonar signals, the team collected a set of detectors and data sets to test. The work included learning the details of each detector, standardizing formats for inputs and outputs and coordinating with detector developers on verifying detections within the data used for testing. In addition to using unclassified data for



USS Arleigh Burke (DDG 51) and
USS Forrest Sherman (DDG 98).
MC3 Gitta Schirmacher



testing detectors, the team used real Navy training data from the Pacific Missile Range Facility (PMRF). The testing work encompassed: 1) comparing results across detectors against manually validated detections; 2) generating multiple performance metrics (e.g., precision/recall curves, ROC curves, DET curves) and 3) using Detection, Classification, Localization and Density Estimation (DCLDE) committee standards to score and assess each detector's relative performance.

The tests revealed that the existing detectors had been optimized to perform best on their original data sets and were unreliable for use on other data sets. The team then redirected its efforts from adapting an existing detector to developing a new detector. Working in RAVEN-X, team members employed a subset of data from Scripps Institute of Oceanography, Cornell University and PMRF to train, test and evaluate a new detector. The data included 770 sonar and 19,300 non-sonar examples.

To test the new detector, the team collaborated with the Sanctuary Soundscape Monitoring Project (SanctSound). SanctSound is a four-year project managed by NOAA and the U.S. Navy to better understand underwater sound within national marine sanctuaries. Passive acoustic monitoring devices were placed at thirty recording locations in seven sanctuaries and one marine national monument within the Sanctuary system. The project team used 17 data sets from eight of the SanctSound recording locations, including five in the Hawaiian Islands Humpback Whale National Marine Sanctuary and three in the Papahānaumokuākea Marine National Monument. Many of these data sets contained sonar and humpback whale calls. SanctSound data analysts provided manual detection logs for one deployment from each of the eight locations to validate the sonar detector output in the presence of humpback singing. The Navy team focused validation efforts on the two sites with the most sonar detected, and initial runs indicated that the sonar detector works well, with fewer than three false detections per hour. For comparison, 20 false detections per hour is the cutoff for determining if a detector is useful. During 2022, the team will be analyzing the remaining Hawaiian Island SanctSound data sets for the presence of sonar and finalizing work on the sonar detector. This will include some general bandwidth-based classification and testing on additional Navy range data.

In addition to the detector evaluation and development efforts, a second key component of the project has been to organize standardized and unclassified nomenclature for describing sonar signal detections in passive acoustic data sets. The team began by identifying sonar descriptors used in the Navy's acoustics effect model (NAEMO). They shared the initial set with U.S. Fleet Forces sonar operators both to ensure accuracy and to avoid classified information. Drawing on feedback, the team has developed a technical report of recommended nomenclature that will be available later this year.

The results will be presented at an upcoming DCLDE meeting, and the team will be training Navy-funded researchers on the detector and nomenclature applications.

PROJECT STATUS UPDATES

Two projects had successful field efforts during this reporting period.

The FISHEX project (Effects of Underwater Explosions on Fishes, project 26) completed its final field effort in October 2021. The target species in this round was Pacific chub mackerel (*Scomber japonicus*). Originally planned for September 2020, this final effort was delayed due to COVID restrictions. The goal of the project is to provide data that for developing thresholds for impacts to fishes from underwater explosions. Results are being analyzed and reports from the project are expected in June 2022.

The MarEcoTel team has been back in the field tagging marine mammals for multiple Navy projects, including LMR project 23, Cuvier's Beaked Whale and Fin Whale Behavior During Military Sonar Operations. During their November foray they logged over

110 hours on the water surveying for marine mammals. They had 15 sightings of Fin whales (31 individuals) and deployed two SMRT (Sound and Motion Recording and Telemetry) tags (Attachment durations of just over 3 and 5 days). They also sighted eight groups of Cuvier's beaked whales (an estimated 19 individuals) and deployed five SMRT

tags with durations ranging from brief to over 11 days. In their most recent expedition in January 2022, their final survey for LMR project 23, they had only a single sighting of Cuvier's beaked whales. With that one sighting, they were able to deploy their last SMRT tag, which stayed attached for almost seven days. All SMRT tags were ultimately recovered, and the team is processing tag the data.



The moment before a tag is deployed on a Cuvier's beaked whale.
Brenda Rone, NMFS/MarEcoTel permit 21163

PROGRAM PARTICIPANT UPDATES

In an update to news in our Summer-21 issue, with the return of KE18—a male Hawaiian monk seal who was the subject of LMR project—a new monk seal exhibit was opened at Sea Life Park in Hawaii. A Hawaiian cultural practitioner blessed and welcomed KE18 back to the park. Educational panels, supported in part by LMR, were installed (see photo) and are helping to educate visitors about this endangered species and the role KE18 played in expanding knowledge of monk seal hearing and sound production.



PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY22 Full proposals due	March 14, 2022
b.	FY22 Full proposal review	March–June 2022
2.	Quarterly Status Reports (QSR)	
a.	Submit spring QSR	April 29, 2022 (effort from January–March)
b.	Submit summer QSR	July 30, 2022 (effort from April–June)
c.	Submit fall QSR	October 28, 2022 (effort from July–September)
d.	Submit winter QSR	January 31, 2023 (effort from October–December)
3.	In-progress Review	November 14–18, 2022

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.

And as a reminder, the full and updated Fall-21/Winter-22 publication spreadsheet, which includes these entries, is available on our website.

Bouchet, P., Harris, C. and Thomas, L. (2021). Assessing the role of sampling uncertainty for predicting behavioural responses of tagged cetaceans exposed to naval sonar. *Frontiers in Marine Science*. DOI 10.3389/fmars.2021.674554.

Miller, D.L., Fifield, D., Wakefield, E. and Sigourney, D.B. (2021). Extending density surface models to include multiple and double-observer survey data. *PeerJ*, 9:12113. DOI 10.7717/peerj.12113.

Wakefield, E.D., Miller, D.L., Bond, S., Carvalho, P., Catry, P., Dilley, B., Fifield, D., Gjerdrum, C., González-Solís, J., Hogan, H., Laptikhovskiy, V., Miller, J., Miller, P., Pinder, S., Pipa, T., Thompson, L., Thompson, P. and Matthiopoulos, J. (2021). The summer distribution, habitat associations and abundance of seabirds in the sub-polar frontal zone of the North-west Atlantic. *Progress in Oceanography*. DOI 10.1016/j.pocean.2021.102657.

Hildebrand, J.A., Frasier, K.E., Helble, T.A., and Roch, M.A. (2022). Performance metrics for marine mammal signal detection and classification. *The Journal of the Acoustical Society of America*, 151(1), January 2022. DOI 10.1121/10.0009270

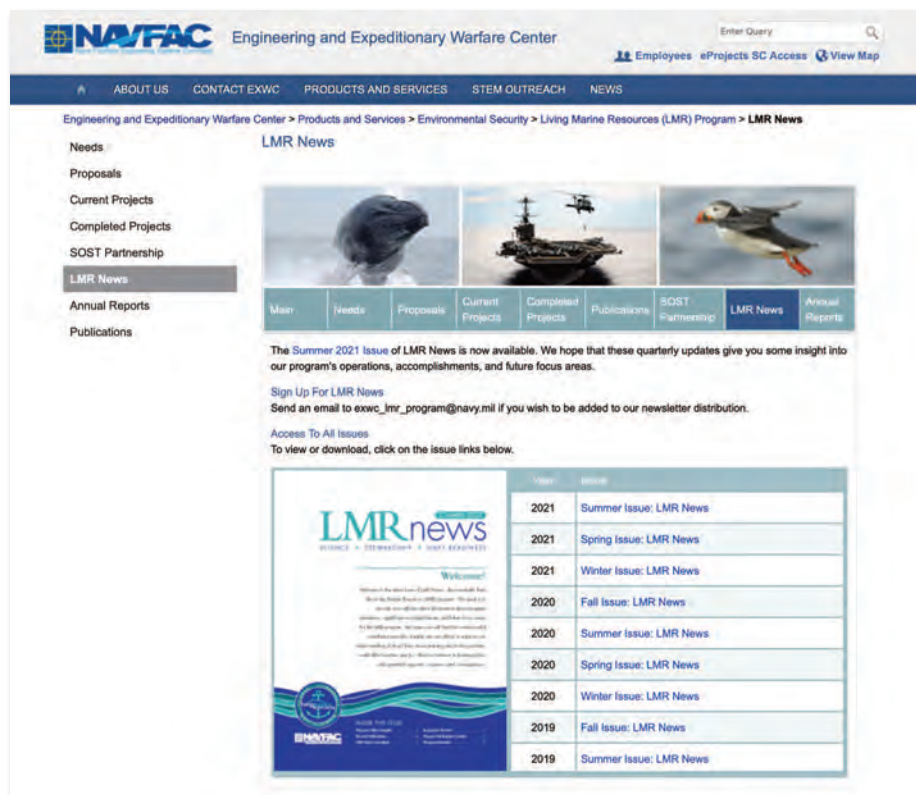
Kastelein, R.A., Helder-Hoek, L., Defillett, L.N., Kuiphof, F., Huijser, L.A.E. and Terhune, J.M. (2022). Temporary hearing threshold shift in California sea lions (*Zalophus californianus*) due to one-sixth-octave noise bands centered at 8 and 16 kHz: Effect of duty cycle and testing the equal-energy hypothesis. *Aquatic Mammals*, 48(1), 36-58. DOI 10.1578/AM.48.1.2022.36.



California sea lion.
Josh Kaye-Carr, NOAA

OUR WEBSITE

You can find links to all of our informational materials, including fact sheets, an updated publication spreadsheet and our most recent annual report, at our website—www.navfac.navy.mil/lmr.



The Summer 2021 Issue of LMR News is now available. We hope that these quarterly updates give you some insight into our program's operations, accomplishments, and future focus areas.

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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 available information on proposal reviews, ongoing project updates and other program news.

www.navfac.navy.mil/lmr

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.