LMR news

ISSUE 36

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.

INSIDE THIS ISSUE

NAVFAC Naval Facilities Engineering Systems Command
EXWC 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 Installations (OPNAV N4I) and managed by the Naval Facilities 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 preserves 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

It has been a busy summer for project field efforts, proposal reviews, Navy need selection and publications. We provide brief updates on three field efforts in the Project Status Updates section. Program staff worked with the LMR advisory committee (LMRAC) to review submissions in response the fiscal year 2025 (FY25) proposal solicitation and we are close to finalizing project selections. We also are finalizing which Navy needs will guide the next proposal solicitation, which we expect to issue during October.

Program Manager Anu Kumar and Deputy Program Manager Mandy Shoemaker.

Our annual report, LMR 2023: U.S. Navy's Living Marine Resources Program Annual Report, is available on our website: exwc.navfac.navy.mil/LMR/Annual-Reports.

This issue's Project Spotlight provides an overview of Project 46: Tethys Capabilities Enhancements. This work is making the Tethys metadata workbench more user-friendly and functional.

We also want to point readers to a topic that has been raised in the marine mammal community regarding common names for species. A letter in a recent issue of *Marine Mammal Science* proposed renaming the Cuvier's beaked whale (*Ziphius cavirostris*) the goose-beaked whale. This species is one frequently studied and reported on in LMR reports. The letter is available at: onlinelibrary.wiley.com/doi/10.1111/mms.13150.

PROJECT STATUS UPDATES

Project 37: Collection of Auditory Evoked Potential Hearing Thresholds in Minke Whales

This project, one of three projects funded under the Subcommittee on Ocean Science and Technology (SOST) partnership, is collecting auditory evoked potential (AEP) hearing thresholds for one mysticete species, the minke whale (*Balaenoptera acutorostrata*). (For background information, see the SOST Partnership tab on the LMR website, exwc.navfac.navy.mil/LMR.)

Minke whale.
Anne Smrcina, NOAA

In June 2024, the project team completed its fourth and final field effort in Norway, during which they successfully tested hearing of two minke whales. Adhering to careful and protective procedures, veterinarians observed both whales for two hours prior to approving steps to test hearing. During testing, the team verified an auditory brainstem response (ABR) to a "chirp" stimulus, and then moved to validating prior measurements and attempting to narrow down the upper frequency limit of hearing. Following testing with each whale, the team attached a dorsal fin-mounted satellite tag, as well as a suction cup-mounted CAT tag, just prior to release. The tags help the team to monitor post-testing behavior.

A project manuscript detailing the catch and release procedures used was published in *Aquatic Mammals*. The publication citation is: Kleivane, L., Kvadsheim, P.H., Vinje, A.V.P., Mulsow, J., Ølberg, R.A., Teilmann, J., Harms, C. and Houser, D. 2024. Capture and release of minke whales offers new research opportunities, including measurements of mysticete hearing. *Aquatic Mammals*, 50(4):352-368. DOI 10.1578/AM.50.4.2024.352.

Project 63: Cetacean Caller-ID [CETACID]: Validating Approaches for Identifying Focal Communication Signals Using Acoustic Recording Tags

Principal investigator Frants Jensen completed two field efforts, one in Sarasota, Florida (for bottlenose dolphins) in May and the other in Stellwagen Bank National Marine Sanctuary off Massachusetts (for baleen whales) in July. The two-week effort in Florida, in collaboration with the Sarasota Dolphin Research Project, achieved successful tagging of seven different, closely bonded pairs of animals. During the Stellwagen effort, Jensen and team were able to tag a pair of humpback whales simultaneously and complete a focal follow to confirm the pair's behavior over four hours. These tag deployments will contribute high-quality validation data for their analyses.

Bottlenose dolphins.
Gary Barone, NOAA

Project 67: Measuring Behavioral Responses of Goose-beaked Whales to Continuous Active Sonar in the Atlantic

In collaboration with the Atlantic Behavioral Response Study (BRS), the Project 67 team conducted a successful controlled exposure experiment (CEE) in July. The researchers coordinated with a guided missile destroyer, the USS *Thomas Hudner*, to perform the CEE with continuous active sonar (CAS) signals. One of three tagged goose-beaked whales was a focal animal for the team to evaluate before/during/after behavior. For additional details, see an update on the Navy's Marine Species Monitoring program website at: www.navymarinespeciesmonitoring.us/blog/successful-cee-trial-uss-thomas-hudner.

Goose-beaked whale.
Erin L. Keene, Marine Ecology & Telemetry Research permit 14097

IN-PROGRESS REVIEW

A reminder to all principal investigators (PI) and LMR Advisory Committee (LMRAC) members that the 2024 In-progress Review (IPR) is scheduled for the week of December 9, 2024. All PIs and LMRAC members will receive email from Anu Kumar and Mandy Shoemaker with additional details.

PROGRAM PARTICIPANT UPDATES

Kumar and Shoemaker Awarded

During a recent visit to NAVFAC EXWC, Rear Admiral Lore Aguayo awarded LMR program managers, Anu Kumar and Mandy Shoemaker, with Command coins to recognize their ten years of years of dedicated service and accomplishments under the LMR program. Accomplishments noted include their collaborations with allied foreign Navies, other governmental agencies and other U.S. Navy programs and their strong financial management. These efforts have helped the Navy to work towards unified solutions and invest in research topics that would be too expensive or risky to take on alone. The LMR program continues to be recognized by OPNAV and EXWC as an example of how to run a successful research program.

RDML Aguayo is currently serving as commander, Naval Facilities Engineering Systems Command, Atlantic as well as Fleet Civil Engineer and director, Fleet Installations and Environment, U.S. Fleet Forces Command.

Congratulations from all of us who work with them!

LMR at the DCLDE Conference

Multiple LMR-funded projects and PIs were part of the June 2024 Detection Classification Localization and Density Estimation (DCLDE) conference. While the conference title is a mouthful, it captures each part of critical research on using data from an important tool for monitoring marine mammals—passive acoustic monitoring. This biannual event shares the many advancements in using acoustic monitoring to study "where, what and how many" marine mammals are in a monitored area. These tools are frequently used by the Navy and the broader marine mammal research community. In addition to project presentations, multiple LMR-funded PIs chaired sessions on new approaches to density estimation. LMR is proud to support such an important topic.

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 a project from Investment Area 4: Standards and Metrics.

Tethys Capability Enhancements (LMR Project 46)

This project, led by Dr. Marie Roch of San Diego State University, has focused on enhancing Tethys, a set of standards and accompanying software created to organize, explore and archive data derived from acoustic monitoring devices. These data contribute to improved understanding of marine mammal populations and assist the Navy's at-sea environmental compliance process.

Tethys offers researchers a method to store acoustic metadata in a manner that can be preserved over long time periods, which enables combining multiple studies to increase temporal and spatial coverage. Data can be accessed from a variety of platforms such as web browsers, MATLAB®, Java, Python and R. Tethys also provides easy access to environmental data, which represent a set of critical variables to be considered when attempting to understand animal behavior.

Pacific white-sided dolphins.
Adam U, Marine Ecology & Telemetry Research permit 14097

The prior version of Tethys was developed under a previous LMR project (Project 18, completed in 2020), co-funded by the Bureau of Ocean Energy Management (BOEM). That project built upon early work funded by the ONR Marine Mammal Biology program. As the Tethys user group expanded and became increasingly diverse, the need for additional enhancements to make the workbench more accessible became apparent.

During this phase of the Tethys project, significant technology updates have improved the system's security and updated system components to ensure continued viability. This included migrating the server code to the most recent version of Python and upgrading the database engine to the most

recent version of Oracle's Berkeley extended markup language database (Berkeley DBXML). High-performance indices have enhanced scalability and query construction was reengineered to take advantage of these new indices. Query times have been reduced in many cases by up to two orders of magnitude. In addition, the project team implemented a caching scheme that reduces the time for commonly used complex queries to milliseconds. As part of the query system overhaul, the team also reengineered the system for generating queries from user selection criteria.

Risso's dolphins.
Wayne Hoggard, NOAA

To simplify data import, the team developed a web-based interface that lets users establish relationships between data from their database, spreadsheet or text file and Tethys fields. A web-based interface shows the user a sample of their data and Tethys fields. Users can associate their data with Tethys fields by clicking on their data and dragging it to Tethys fields. Additional options allow users to specify unit conversion, combine multiple pieces of data, etc. This only needs to be done once. Users can then use their set of associations to import new data that are stored in the same format. Import is accomplished through existing mechanisms or a new web-based data import facility. Combined, these new interfaces provide a streamlined way to import data into Tethys.

A data exploration interface provides multiple views of data, and users can now easily see maps of instrument deployments (including the tracks of mobile instruments such as gliders and towed arrays), as well as when and where analysis efforts have been made for specific species. New filters and data displays show results in local or universal time and include lunar illumination, diel and twilight data, which are relevant to many species behavioral patterns.

Many improvements were introduced during a beta-user workshop in 2022 that allowed participants to enter a portion of their data into the database and directly experience some of the already completed improvements. The workshop also encouraged participants to offer their insights on additional development needed to further improve the utility of Tethys to a larger audience. Feedback from the workshop has been incorporated into the current software release.

In a companion project sponsored by BOEM, the Tethys team is now working to integrate Tethys with PAMGuard. The team is coordinating with Dr. Douglas Gillespie at the University of St Andrews to develop the ability for PAMGuard, a widely used detection, classification and localization (DCL) tool, to automatically publish data to Tethys. This work to integrate PAMGuard and Tethys will be beneficial to the Navy and the general user audience. A beta distribution of this work was distributed to attendees of the PAMGuard/Tethys workshop, a one-day event that was part of the 2024 Detection, Classification, Localization and Density Estimation workshop. The recent Tethys 3.1 and PAMGuard 2.02.12 releases now make much of the new functionality available to the public.


Blainville's beaked whale.
Marie C. Hill, NOAA

Another key component of the Tethys effort is working to develop standards for the data produced by passive acoustic monitoring. Dr. Roch leads the Acoustical Society of America/American National Standards (ASA/ANSI) Institute working group that is addressing this topic. This committee brings together bioacousticians from industry, government and academia to focus on defining which data must be archived to provide scientifically useful long-term retention of these data. The starting point for the standard was the community standards developed for the Tethys project, which the National Center for Environmental Information adopted for the data to be retained in its passive acoustic monitoring data archive. The committee has completed the first draft of the standard along with a how-to guide (recommended by ASA/ANSI) that sets out why and how the standard is used. The ANSI standards committee met in May, where all aspects of the proposed standard were vetted by the committee. While a final edit of the standards and a how-to scenarios document are currently underway, the 2023 release of Tethys 3 (tethys.sdsu.edu/tethys3) provides a reference implementation of the standards.

This project helps the Navy retain the long-term information about marine mammal species needed for Navy monitoring and mitigation plans and is currently used in producing some of the monitoring reports provided to the Navy's Pacific Fleet. Tethys's data preservation and the ability to reuse data have expanded the scope of science and policy-based questions that can be asked. Retaining data from large-scale spatial and temporal studies provides clear benefits for advancing science, enhancing the Navy's capabilities for monitoring cetaceans and preparing environmental impact assessments.

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.

Bowman, V., Jenkins, A.K., Dahl, P.H., Kotecki, S.E., Casper, B.M., Boerger, C., Smith, M.E. and Popper, A.N. (2024). Injuries to Pacific mackerel (*Scomber japonicus*) from underwater explosions. *ICES Journal of Marine Science*, 2024: fsae116. DOI 10.1093/icesjms/fsae116.

Guazzo, R.A., Stevenson, D.L., Edell, M.K., Gagnon, G.J. and Helble, T.A., 2024. A decade of change and stability for fin whale song in the North Atlantic. *Frontiers in Marine Science*, 11. DOI 10.3389/fmars.2024.1278068.

Kleivane, L., Kvadsheim, P.H., Vinje, A.V.P., Mulsow, J., Ølberg, R.A., Teilmann, J., Harms, C. and Houser, D. 2024. Capture and release of minke whales offers new research opportunities, including measurements of mysticete hearing. *Aquatic Mammals*, 50(4):352-368. DOI 10.1578/AM.50.4.2024.352.

Salas, A.K., Capuano, A.M., Harms, C.A., Piniak, W.E.D. and Mooney, T.A. (2024). Frequency-dependent temporary threshold shifts in the Eastern painted turtle (*Chrysemys picta picta*). *The Journal of the Acoustical Society of America*, 155(5):3254-3266. DOI 10.1121/10.0026021.

Eastern painted turtle.
Andria Salas

Salas, A.K., Sims, M.A., Harms, C.A., Piniak, W.E.D. and Mooney, T.A. (2024). Narrowband noise induces frequency-specific underwater temporary threshold shifts in freshwater turtles. *JASA Express Letters*, 4(8). DOI 10.1121/10.0028321.

The following citations included data and/or analyses from LMR-funded investigators:

Posdaljian, N., Solsona-Berga, A., Hildebrand, J.A., Soderstjerna, C., Wiggins, S.M., Lenssen, K. and Baumann-Pickering, S. (2024). Sperm Whale Demographics in the Gulf of Alaska and Bering Sea/Aleutian Islands: An Overlooked Female Habitat. *PLoS One* 19: e0285068. DOI 10.1371/journal.pone.0285068.

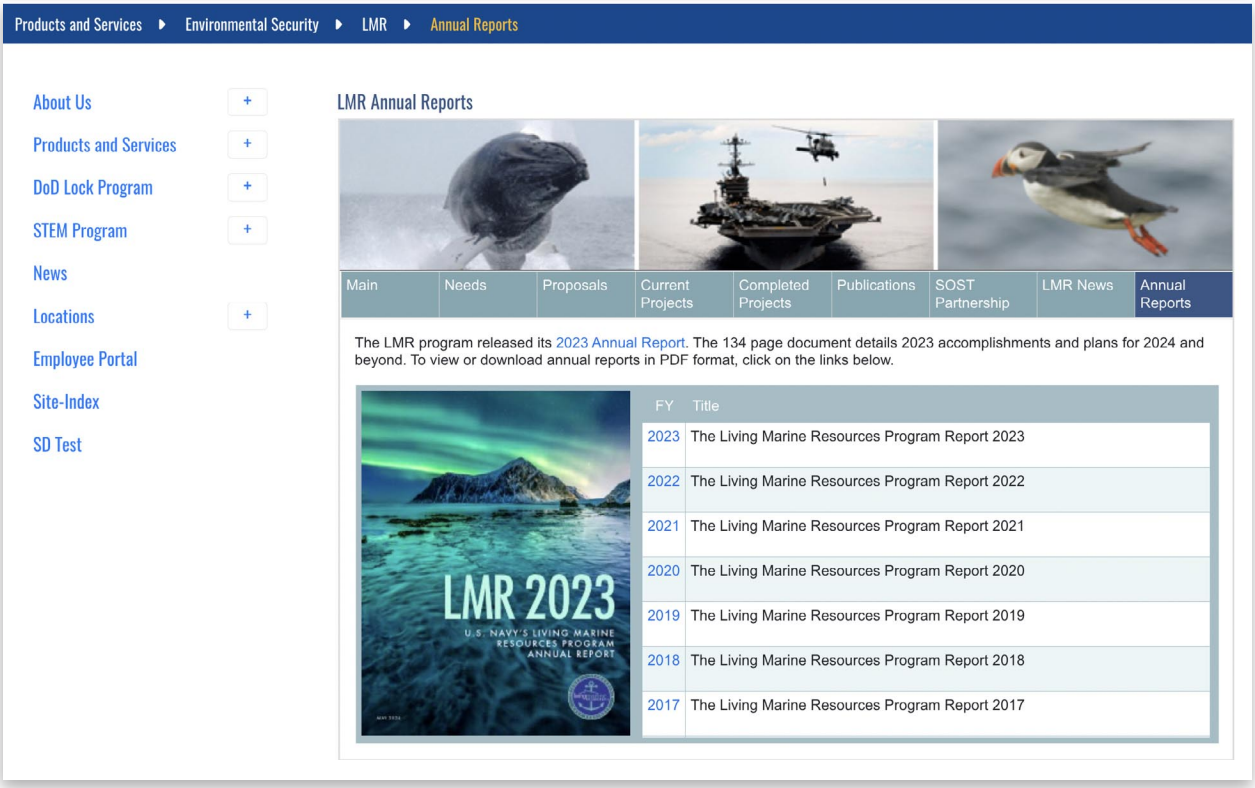
van Helsdingen, A. B. M., Marques, T A. and Jones-Todd, C. M. (2024). An Inhomogeneous Weibull-Hawkes Process to Model Underdispersed Acoustic Cues. *Journal of Agricultural, Biological, and Environmental Statistics*. DOI: 10.1007/s13253-024-00626-w.

Zeh, J. M., Adcock, D. L., Perez-Marrufo, V., Cusano, D. A., Robbins, J., Tackaberry, J. E., Jensen, F. H., Weinrich, M., Friedlaender, A. S., Wiley, D. N. and Parks, S E. (2024). Acoustic Behavior of Humpback Whale Calves on the Feeding Ground: Comparisons Across Age and Implications for Vocal Development. *PLoS One* 9: e0303741. DOI 10.1371/journal.pone.0303741.

As a reminder, the full and updated publication spreadsheet, which includes these entries, is available on our website.

OUR WEBSITE

At our website—exwc.navfac.navy.mil/lmr—you can find links to all our informational materials, including fact sheets, an updated publication spreadsheet and our annual reports.



PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY26 Needs Evaluation	August 2024
b.	FY26 Proposal Solicitation	October 2024
2.	Quarterly Status Reports (QSR)	
a.	Submit fall QSR	October 31, 2024 (effort from July–September)
b.	Submit winter QSR	January 31, 2025 (effort from October–December)
c.	Submit spring QSR	April 30, 2025 (effort from January–March)
d.	Submit summer QSR	July 31, 2025 (effort from April–June)
3.	In-progress Review	Week of December 9, 2024

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CONTACT THE LMR PROGRAM

Note that we have had a slight change in our program email address. It now includes 'us.' before navy.mil. For more information about the LMR program and its operations, please use this new format to contact Anu Kumar, Program Manager, at EXWC_LMR_program@us.navy.mil and 805-982-4853.

IN THE NEXT ISSUE OF *LMR NEWS*

Our next issue will provide available information on new projects, project updates and publications.

exwc.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.