ISSUE 38

LMR news

NAVY READINESS • STEWARDSHIP • SCIENCE

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 support the at-sea compliance process and enable the Navy to conduct essential training and testing activities.

NAVFAC
Naval Facilities Engineering Systems Command
EXWC Engineering & Expeditionary Warfare Center

INSIDE THIS ISSUE

WHO WE ARE

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. LMR is an applied research program, sponsored by Chief of Naval Operations for Fleet Readiness and Logistics (N4) and managed by the Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) in Port Hueneme, CA. LMR funds Navy-driven research needs to support at-sea compliance and permitting.

PROGRAM OFFICE INSIGHTS

Our 2024 LMR report is now available on our website. The 122-page report summarizes 27 projects, all carefully selected to meet specific Navy-defined priority needs. These project summaries present five new projects, 11 ongoing projects and 11 projects that were completed during 2024. You can download the report PDF from the Annual Reports tab on our website (exwc.navfac.navy.mil/lmr).

See the Project Updates section for interesting news from three LMR projects.

This issue's Project Spotlight provides an overview of two completed projects from Investment Area 1: Data to Support Risk Threshold Criteria. Each project addressed an aspect of hearing measurement and response.

See the Recent Publications list for citations of eight peer-reviewed publications that have gone to press.

Program Manager Anu Kumar and Deputy Program Manager Mandy Shoemaker.

We have one new project to announce:

Investment Area	Project Number & Title	Principal Investigator(s)
Data to Support Risk Threshold Criteria	Project 78—Advancing the Navy Acoustic Effects Model (NAEMO)	Samantha Simmons Magda Chudzińska

IN-PROGRESS REVIEW

It is time for the LMR Committee members and principal investigators to mark their calendars for the 2025 In-progress Review (IPR). The IPR is scheduled for the week of November 17, 2025, and will be held in Ventura, California. A Save-the-Date was sent to participants, and additional details will be forthcoming.

PROGRAM PARTICIPANT UPDATES

The LMR program had to say goodbye to our new website developer, Ellen Cronkrite, who left in June. We are sorry to see Ellen go but wish her all the best in her next adventure. Ellen, we thank you for the support you provided to the program. We are rebuilding our website team, but in the meantime, please reach out to EXWC_LMR_Program@us.navy.mil if you are experiencing any website issues.

PROJECT STATUS UPDATES

Project 32—Confirmation of Hearing Capabilities in the Endangered Hawaiian Monk Seal (*Neomonachus schauinslandi*)

Hawaiian monk seal KP2 had a successful trip home from University of California (UC) Santa Cruz to the Waikiki Aquarium in June. After arriving at UC Santa Cruz in 2022, KP2 worked with the team at Long Marine Lab to identify species-typical auditory capabilities both in-air and in-water. The data collected from KP2 was compared with that previously collected from Hawaiian monk seal KE18. With data from both monk seals confirmed, these capabilities can be considered representative for Hawaiian monk seals. A publication in *Endangered Species Research* (Ruscher et al. 2025), released in January, details the results from this work. Two videos related to the Monk Seal work are available online. One focused on KP2 can be viewed at https://youtu.be/kC-9Vt3VxD4 and the other on KE18 is available at https://youtu.be/1NpU2_456r4.

KP2 with trainer Traci Kendall.
C. Reichmuth, NOAA/NMFS permit 24054

We want to thank both KE18 and KP2 for their participation in this project, the excellent team of researchers at UC Santa Cruz for leading this project, as well as the National Marine Fisheries Service, Sea Life Park Hawaii and Waikiki Aquarium for their help in facilitating this project.

Project 67—Measuring Behavioral Responses of Goose-beaked Whales to Continuous Active Sonar

The team conducted their first Controlled Exposure Experiment (CEE) of 2025 on 19 July with the USS *Donald Cook*, a Navy guided missile destroyer based in Mayport, Florida. The experiment involved coordinating with the USS *Donald Cook*, which emitted Continuous Active Sonar (CAS) signals along a pre-designed track. The research team deployed eight satellite tags on beaked whales in the surrounding area prior to the experiment. The data from all eight tags will be analyzed for potential behavioral responses based on the level of sound estimated to have been received at the animal, distance from the ship, and any other relevant contextual variables. A blog post describing the effort in more detail can be found at https://sites.nicholas.duke.edu/read/2025/07/22/successful-cee-trial/.

USS *Donald Cook* (DDG 75).
MC2 Mat Murch

Project 76—Evaluating Behavioral Responses of Pinnipeds to Mid-Frequency Sonar to Support Navy Compliance Permits

Dan Costa and team from UC Santa Cruz has hit the ground running in this new project, completing a pilot field effort during April and May. This effort tested the deployment and recovery procedures for the tagging portion of the study. During 22–24 April they traveled to San Nicholas Island off southern California and deployed two D-tags and two Splash tags on female California sea lions. The team then returned to San Nicholas Island during May to test a remote release device to recover the D-tags, which were both successfully recovered. Analysis of the tag data is ongoing, and the team is planning for another pilot field effort in late August.


California sea lion.
Cordelia Shea

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 compliance process and directly feeds into the National Environmental Policy Act, Marine Mammal Protection Act and Endangered Species Act compliance documentation.

Dombroski, J.R.G., Calambokidis, J., Gillespie, D., Širović, A. and Parks, S.E. (2025). The role of accelerometer hardware limitations in focal caller identification from acoustic recording tags attached to mysticetes. *The Journal of the Acoustical Society of America*, 158(1):548-556. DOI 10.1121/10.0037198.

Dunlop, R., Gumley, E., McGrath, E.H. and Noad, M. (2025). Southern Ocean humpback whales are shifting to an earlier return migration. *Scientific Reports*, 15:22859. DOI 10.1038/s41598-025-07010-9.

Dunlop, R.A., Noad, M.J. and Houser, D.S. (2025). Humpback whale masked hearing thresholds in noise measured with modified behavioral observation audiometry. *Communications Biology*, 8:932. DOI 10.1038/s42003-025-08349-5.

Erbe, C., Houser, D., Bowles, A. and Porter, M.B. (Eds.). *Marine Mammal Acoustics in a Noisy Ocean*. Springer Nature Link, 2025. DOI 10.1007/978-3-031-77022-7.

Gkikopoulou, K.C., Gillespie, D.M., Johnson, M., Aguilar de Soto, N., Tyack, P. L. and Marques, T. A. (2025). Sensitivity of density estimates to off-axis beam pattern assumptions in deep-diving odontocetes. *The Journal of the Acoustical Society of America*, 157(6):4002-4016. DOI 10.1121/10.0036810.

Houser, D.S., Donohoe, K., Mulsow, J. and Finneran, J.J. (2025). Quantifying differences in dolphin hearing thresholds obtained with behavioral and auditory evoked potential methods. *The Journal of the Acoustical Society of America,* 157(3):1955-1968. DOI 10.1121/10.0036153.

Mulsow, J., Pardini, M.R., Schlundt, C.E., Accomando, A.W. and Finneran, J.J. (2025). Temporary threshold shift to simulated naval continuous active sonar in bottlenose dolphins (*Tursiops truncatus*). *The Journal of the Acoustical Society of America*, 57(6): 4667-4684. DOI 10.1121/10.0036946.

Stephens, J., Accomando, A.W., Nease, K., Branstetter, B.K. and Robeck, T.R. (2025). Latencies of conditioned vocal responses to hearing test tones in killer whales (*Orcinus orca*). *Frontiers in Behavioral Neuroscience*, 19. DOI 10.3389/fnbeh.2024.1495579.

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

LMR PROJECT SPOTLIGHT

Wondering about some of the LMR-supported projects? This section provides a brief overview of selected projects funded by the LMR program.

For this issue we present two recently completed projects from Investment Area 1: Data to Support Risk Threshold Criteria.

These projects are an example of how the LMR program directly supports Navy warfighters by reducing risk and enabling military readiness. The Navy is required to assess the impacts of military readiness activities on protected marine species. A lack of data results in increased risk to the Navy and requires regulators to take a precautionary approach in dictating mitigation or other permit conditions, which can reduce the realism and effectiveness of training and testing.

Project 47—Standardizing Auditory Evoked Potential Hearing Thresholds with Behavioral Hearing Thresholds

This project was led by Dorian Houser of the National Marine Mammal Foundation, working with investigators Jason Mulsow and Jim Finneran of the U.S. Navy Marine Mammal Program, Naval Information Warfare Center Pacific (NIWC). The team worked to empirically determine relationships between behavioral and AEP hearing thresholds in small odontocetes to make behaviorally "equivalent" AEP audiograms. They specifically looked at comparisons to the auditory steady state response (ASSR), an AEP method that establishes a quasi-steady state evoked response to a repetitive sound stimulus. Although frequency-specific differences between behavioral and AEP audiograms have been previously explored in the bottlenose dolphin, a systematic evaluation of the differences between approaches has not been completed. By measuring behavioral and AEP hearing thresholds in the same individuals across the range of hearing, the

Collecting AEP threshold data.
Dorian Houser

team collected data on the frequency-dependent relationship between behavioral and AEP thresholds and how the relationships changed as a function of the particular AEP test method employed.

The team's initial focus was on determining AEP threshold "equivalence" corrections for behavioral threshold prediction. Five bottlenose dolphins of the United States Navy Marine Mammal Program were tested to determine the frequency-specific offsets between behavioral and AEP hearing thresholds. Each day, after a hearing threshold was determined behaviorally with the dolphin submerged, AEP thresholds were obtained using four different methods: dolphins partially submerged and using either tone pips or sinusoidal amplitude modulated (SAM) tones for testing, and with dolphins out of the water using either tone pips or SAM tones. In all the AEP tests, a contact transducer, or "jawphone," was attached to the jaw and used to deliver sounds to the dolphins.

The AEP test scenarios replicated approaches commonly used with stranded and rehabilitating odontocetes. The methods allowed the variability in each AEP method to be determined. Subsequently, the AEP thresholds obtained under each test condition were compared to the behavioral threshold collected on the same day to determine frequency-specific differences between the AEP and behavioral results. The differences between the behavioral and AEP thresholds were used to adjust the AEP thresholds such that they become effectively behaviorally equivalent.

Independent of the test medium, SAM tone stimuli yielded thresholds that consistently overestimated (i.e., were higher than) behavioral thresholds. Tone pip trains consistently underestimated thresholds when presented in air, and while they underestimated thresholds at lower test frequencies, they overestimated thresholds at higher test frequencies when presented under water.

The goal of this work was to understand the differences in the threshold outcomes of the various AEP data collection methods and how they relate to the behavioral method. Knowing the relationship between AEP and behavioral thresholds enables better approximations of behavioral thresholds in dolphins for which only AEP thresholds exist.

A publication on the work and its results is available in *The Journal of the Acoustical Society of America*: Houser, D.S., Donohoe, K., Mulsow, J. and Finneran, J.J. (2025). Quantifying differences in dolphin hearing thresholds obtained with behavioral and auditory evoked potential methods. *The Journal of the Acoustical Society of America*, 157(3):1955-1968. DOI 10.1121/10.0036153.

Project 51—Dependence of TTS on Exposure Duration During Simulated Continuous Active Sonar: Examining the Equal-energy Hypothesis for Long-duration Exposures

This project, led by Jason Mulsow of the U.S. Navy Marine Mammal Program at NIWC, measured temporary threshold shift (TTS) in the bottlenose dolphin using both auditory evoked potential (AEP) and behavioral threshold measurements for longer duration signal exposure with signal qualities simulating continuous active sonar (CAS). The intent was to determine if equal energy exposures result in equal TTS, independent of exposure duration. In current Navy noise effects analyses, estimates of TTS onset are based on the equal-energy hypothesis, which states that exposures of equal sound exposure levels (SEL) result in equal TTS. In other words, the short, high sound pressure levels (SPLs) of pulsed sonar are considered equivalent—in terms of TTS—to lower SPL continuous exposures that have the same cumulative SEL. However, while source and received SPLs of CAS may be lower than those of pulsed sonars, it is important to consider if accumulated SEL may be high due to the high duty cycles of CAS, which has fewer quiet periods.

A bottlenose dolphin at the U.S. Navy Marine Mammal Program positions on the noise exposure station. Inset: Noise levels are continuously measured during experimental sessions using suction-cup hydrophones placed on both sides of the dolphin's head.

The project team collected hearing data from four bottlenose dolphins, with testing at both a frequency representative of Navy CAS (2.8 kHz) and a frequency closer to the region of best hearing sensitivity (28 kHz) for this species. The fatiguing stimuli used to induce TTS were both pure tones and frequency-modulated (FM) tones with bandwidths characteristic of CAS. The researchers used rapid behavioral and AEP procedures for determining hearing thresholds so that thresholds could be measured on a short

time scale relative to hearing recovery after 28-kHz noise exposure. The 28-kHz stimulus was a one-octave hyperbolic FM sweep based on simulated CAS used by another LMR-funded project, and the 2.8-kHz stimulus was a one-third octave linear FM sweep.

Intermittent hearing tests were conducted following the noise exposures, both to track the hearing recovery rate with time post-exposure and to ensure complete recovery of hearing threshold before subsequent exposures, minimizing the chance of inducing a permanent threshold shift. The health and welfare of the dolphins was monitored by the attending veterinarians and animal care staff at the Naval Information Warfare Center, Pacific over the course of the study.

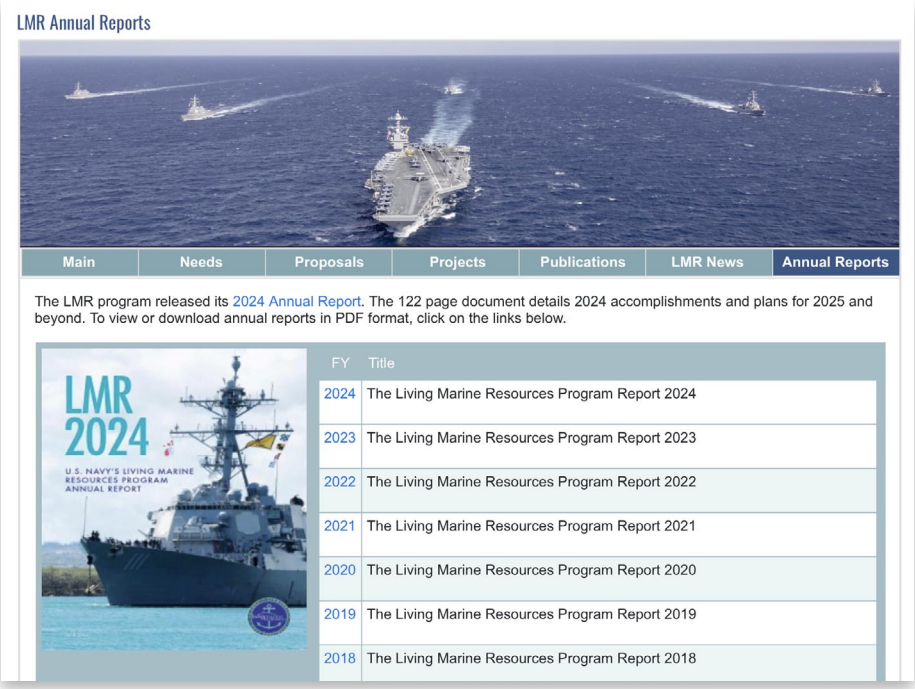
For both the 2.8- and 28-kHz exposures, behavioral TTS increased exponentially with increasing SEL, independent of the specific exposure duration and level parameters. The lowest TTS onset SEL at 28 kHz was approximately 20 dB below that at 2.8 kHz, reflecting frequency-specific vulnerability in this species. Behavioral TTS onset SELs were similar to or higher than those for existing Navy TTS criteria in delphinids and supported the use of the equal-energy hypothesis in estimating TTS resulting from exposures that vary in duration and level. An unexpected finding was the lack of an obvious effect of the noise exposures on the AEP measurements at 28 kHz.

The data and conclusions will be used to support updating the Navy's acoustic criteria and thresholds for estimating TTS exposures for high-frequency toothed whales from at-sea training and testing activities that involve CAS signals. The data will also be used to refine the Navy's acoustic criteria and thresholds for estimating TTS exposures for other marine mammal species for which TTS data are not available (e.g., baleen whales). This work is directly applicable to the Navy's at-sea compliance process and aids in obtaining permits to conduct uninterrupted training and testing activities for different signal types, such as CAS.

A publication on the work and its results is available in *The Journal of the Acoustical Society of America*: Mulsow, J., Pardini, M.R., Schlundt, C.E., Accomando, A.W. and Finneran, J.J. (2025). Temporary threshold shift to simulated naval continuous active sonar in bottlenose dolphins (*Tursiops truncatus*). *The Journal of the Acoustical Society of America*, *57*(6): 4667-4684. DOI 10.1121/10.0036946.

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

A note on our program schedule: The LMR program normally issues a proposal solicitation in the Fall of each year. However, due to budget cuts proposed for Fiscal Years 2026 and 2027, we will not be soliciting proposals for specific need topics this year. We will continue to collect, evaluate and prioritize need topics to keep a record of ongoing needs.

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY26 Needs Evaluation	August 2025
2.	Quarterly Status Reports (QSR)	
a.	Submit fall QSR	October 31, 2025 (effort from July–September)
b.	Submit winter QSR	January 31, 2026 (effort from October–December)
c.	Submit spring QSR	April 30, 2026 (effort from January–March)
d.	Submit summer QSR	July 31, 2026 (effort from April–June)
3.	In-progress Review	Week of November 17, 2025

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 future issues of *LMR News* and give you credit—right there with your photo. Please email your high-resolution photos, accompanied by captions, photo credits and permit numbers (as applicable), to EXWC_LMR_program@us.navy.mil.

Goose-beaked whale, *Gregory S. Schorr, permit 16111*

HELP WITH OUR MAILING LIST

If you want to subscribe to, or unsubscribe from, *LMR News*, please send your email address to Michelle Alcorn at michelle.c.alcorn.civ@us.navy.mil. Please note that this is a new email for mailing list updates.

CONTACT THE LMR PROGRAM

For more information about the LMR program and its operations, please 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 required data to support the Navy's acoustic and explosive impact assessments and validate mitigation requirements, information critical to Navy at-sea compliance and permitting.

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 Navy at-sea compliance and permitting.

3. MONITORING TECHNOLOGY DEMONSTRATIONS

Continue to develop and demonstrate technologies that provide critical field data collection capabilities and methods. The technologies enable efficient and cost-effective implementation of the Navy's Marine Species Monitoring program.

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. This increases the utility of limited data and provides a cost-effective means of incorporating results into Navy at-sea compliance and permitting.

5. EMERGENT TOPICS

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