LMR news

FALL 2020

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.

NAVFAC Naval Facilities Engineering Command
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 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.

Anu Kumar
Program Manager

PROGRAM OFFICE INSIGHTS

Settle in for a long, and we believe quite informative, read. We have a lot of information for you this quarter.

It was another quarter during which we kept the LMR program moving forward while continuing to work from home. Our ever-improving communication technology skills enabled us to work with the LMR Advisory Committee (LMRAC) members to finalize our latest round of program needs and to issue a pre-proposal solicitation for Fiscal Year 2021. The five FY21 need topics for the solicitation are:

1. N-0226-21—Ship shock trial acoustic measurement
2. N-0237-21—Standardizing auditory evoked potential hearing thresholds with behavioral hearing thresholds
3. N-0238-21—Understanding marine mammal hearing and behavioral response to continuously active sonar
4. N-0239-21—Relationship between perceived loudness of a signal and signal length
5. N-0240-21—Studying marine mammal behavioral response to SURTASS LFA sonar.

Mandy Shoemaker
Deputy Program Manager

The deadline for pre-proposal submissions is November 12, 2020. The program staff and the LMR Advisory Committee will review all pre-proposals. The most promising submissions will be asked to submit full proposals. The request for full proposals is expected by late January 2021.

Another project topic is approaching a deadline—Phase I of the Small Business Innovation Research (SBIR) program process. As we introduced in the Fall-19 issue of *LMR News*, we submitted a research topic under the SBIR program, which was selected for the September 2019 SBIR Broad Agency Announcement (BAA) Solicitation. That topic, Unmanned Underwater Vehicle (UUV) Technology to Enable Readiness of Navy Ranges, seeks technologies that can collect a broad spectrum of ocean acoustic data to support large scale spatial and temporal research on ambient and biological sources of sound.

In the SBIR process, Phase I is a feasibility study to determine the scientific or technical merit of an idea or technology. If the Phase I work is successful, the Phase I performers can compete for Phase II funding. Phase II is the research, development and demonstration phase. It typically includes building and testing prototypes.

The two California sea lions involved in the temporary hearing threshold shift (TTS) study.
Ron Kastelein

The final Phase I report from each of the three Phase I performers (see Spring-20 *LMR News*) is due November 16, 2020, as are their Phase II proposals.

The fact sheets for our two FY20 projects are now available on our website. Project 45—Frequency-dependent Underwater TTS in California Sea Lions—can be found under the investment area *Data to Support Risk Threshold Criteria*. Project 46—Capability Enhancements for Tethys, a Passive Acoustic Metadata Workbench—can be found under the investment area *Standards and Metrics*. These fact sheets provide information about the project need, methods and schedule.

Also on our website is a new listing of publications generated from LMR and LMR-related projects. For more information, see an added section (LMR Publications Spreadsheet) following the LMR Publications section in this issue.

Lastly, we have lost a good friend and colleague, Tom Norris. We are dedicating a special section in this issue to remembering Tom.

LMR PROJECT SPOTLIGHT

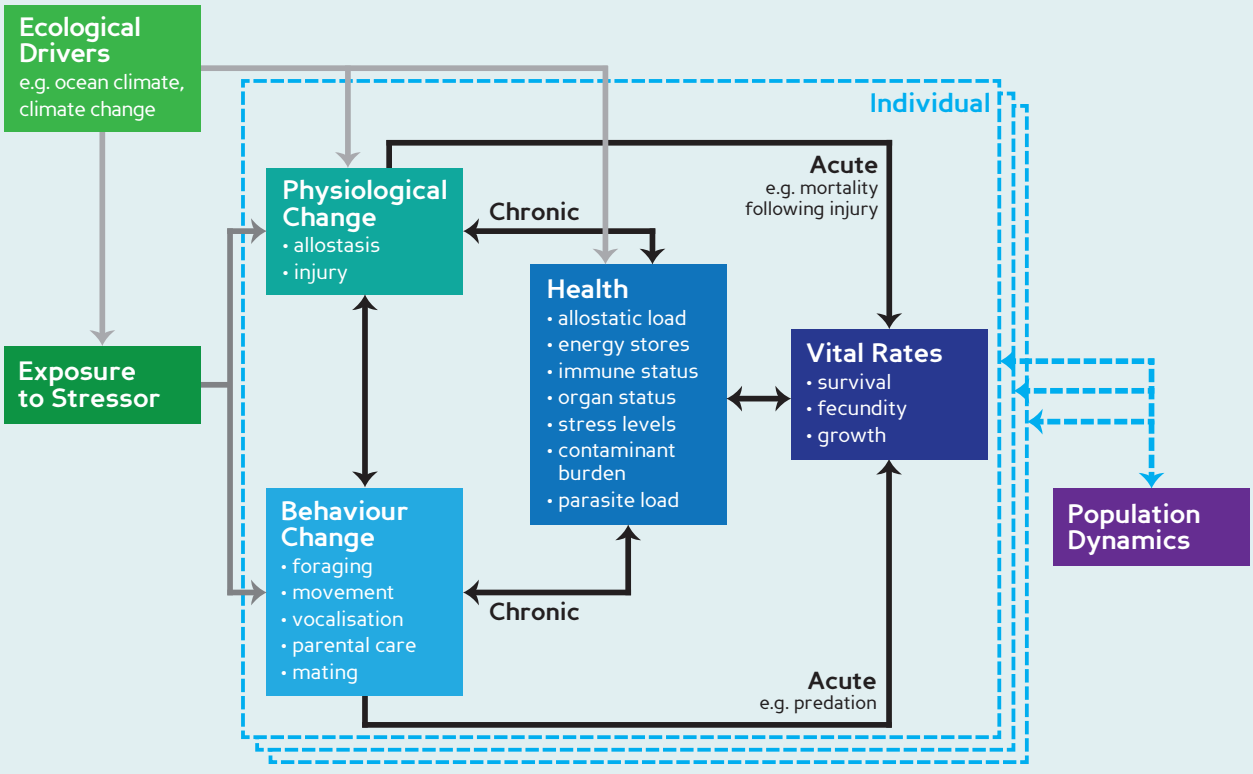
Wondering about some of the LMR-supported projects? This section provides a brief overview of one or more projects underway in the LMR program.

For this issue we present an overview of a project under investment area 2: Improved Collection and Processing of Protected Species Data in Areas of Navy Interest.

MSM4PCoD: Marine Species Monitoring for the Population Consequences of Disturbance

Current marine mammal monitoring efforts, by the U.S. Navy and others, use well established methods that generally focus on animal presence and abundance. Because of the large areas involved and difficulties in sighting species that spend most of their time below the sea surface, these surveys tend to provide imprecise estimates and typically only have the power to detect large population changes after a long time of monitoring. In order to forecast a more complete range of outcomes for the possible effects of disturbance (e.g. from Navy training/testing activities) on marine mammals, the Navy has supported efforts to build a conceptual framework called population consequences of disturbance (PCoD). Securing adequate data for PCoD analyses may require additional methods for monitoring populations subject to disturbance.

PCoD Framework



The overall objective of this project, MSM4PCoD, is to review the U.S. Navy Marine Species Monitoring (MSM) program to date and identify how current monitoring efforts could be adapted to supply appropriate data for future analyses of the consequences on marine mammals from possible disturbance by Navy activities. This project will assess how well current Navy MSM program efforts can support PCoD analyses and recommend what could be improved.

The project team, led by Cormac Booth at SMRU Consulting, began by holding a series of meetings with Navy stakeholders to go over monitoring objectives and efforts to date. During review meetings and a scoping workshop, participants worked to focus the scope of the project and agree on next steps to ensure the project would support Navy needs. Parameters discussed included geographic regions for Navy monitoring and species within regions that were priorities.

For this project, participants agreed to focus the effort on (current) priority areas of the Atlantic Fleet Training and Testing region (excluding the Gulf of Maine and Gulf of Mexico) and the Pacific Training and Testing ranges of Hawaii and Southern California.

The priority regions and species defined for the project were:

- **Atlantic Fleet Testing and Training (AFTT)**
  - Cuvier's beaked whale
  - Short-finned pilot whale
  - Sperm whale
  - Humpback whales
  - Fin whale
  - North Atlantic right whale
- **Pacific (Hawaii & SOCAL-HSTT)**
  - Cuvier's beaked whales
  - Blainville's beaked whales
  - Short-finned pilot whale
  - False killer whale
  - Humpback whales
  - Minke whale (lower priority)
  - Bryde's whale (lower priority)

With the necessary specifics agreed upon, the project now is moving ahead on three core tasks:

1. **Review applicable current and past MSM projects and methodologies for the priority areas and species and compile information into a reference database.**

   This includes assessing the monitoring that has been conducted over the past 10-15 years of the MSM program effort. For each monitoring study the team is documenting the methods employed, the species sampled and the sample sizes obtained for different species/method combinations. The elements of monitoring determined to be relevant for PCoD will be compiled into a database.

2. **Select suitable metrics for monitoring populations of deep diving odontocetes (e.g., beaked whales, pilot whales) and large baleen whales (e.g., North Atlantic right whale, humpback whale) using PCoD models that already exist or are currently in development.**

   The results of the first step will be used to identify appropriate metrics, or population characteristics, that may be suitable for monitoring and that could support PCoD analyses. The modeling outputs developed (and conclusions drawn) from previous PCoD-related projects will help to define the most appropriate metrics for the power analyses planned in the third step.


Pilot whales.

3. **Conduct power analyses to assess the power of these metrics to inform PCoD analyses when collected within existing MSM projects and determine the effort required to increase this power.**

   Power analyses ensure sample sizes are sufficiently large to allow detection of an effect, such as changes in population size and demographics. Conducting power analyses on information from the monitoring program will indicate whether MSM efforts to date can support PCoD analyses and will help to identify what efforts would be required for different species/method/metric combinations. A series of power analyses for a minimum of two priority case study species (likely one deep diving odontocete and one large whale species), as determined by the most suitable species from the MSM review, are expected.

   Power depends on effect size (in this case magnitude of the long-term decline or sudden decrease) and so an important early task is to develop a range of scenarios for what determines a biologically meaningful change. After the initial power analyses, a set of simulation scenarios will be developed to determine the amount and type of sampling effort that would be required for different approaches to inform PCoD in the future.

Final recommendations, including a set of practical recommendations of how PCoD elements could be incorporated into existing MSM efforts, are expected by late 2023.

Helping the Navy to improve monitoring of consequences to target those species and populations most suitable for identifying PCoD will enhance the information collected and the analyses produced by marine species monitoring, which will increase monitoring benefits.

PROJECT STATUS UPDATES

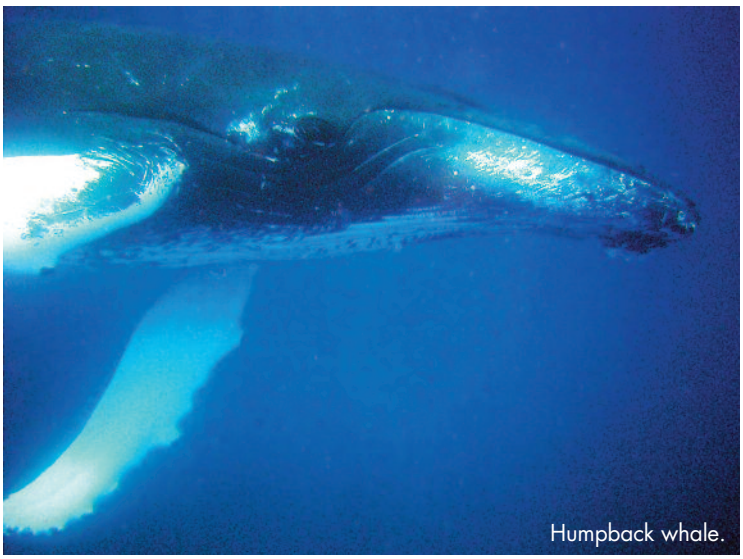
As we have noted in previous issues, a few of our projects had delayed field work due to COVID restrictions. Fortunately two of those projects were able to get out on the water and conduct some field effort.

Project 23—Cuvier's Beaked Whale and Fin Whale Behavior During Military Sonar Operations: Using Medium-term Tag Technology to Develop Empirical Risk Functions

The MarEcoTel and Naval Undersea Warfare Center teams were able to coordinate a field effort in early October. They were able to get approximately eight days on the water, focusing on obtaining baseline monitoring data (photo identification, acoustic monitoring via M3R [Marine Mammal Monitoring on Ranges], etc.). Sightings included fin and Bryde's whales, but no sightings of beaked whales (although they were heard sporadically on the M3R system). No tagging efforts were conducted.

Project 38—Towards a Mysticete Audiogram using Humpback Whales' Behavioral Response Thresholds

The University of Queensland team completed a small-scale pilot test in mid-October. They successfully tested their new equipment, which will smooth the path to a full effort when conditions allow.


Humpback whale.

IN-PROGRESS REVIEW

We want to remind our principal investigators (PI) and LMRAC members that the 2020 in-progress review (IPR) will be held online during the first week of December. The LMRAC-only session will be November 30 and PI sessions will be scheduled over December 1–3. This virtual IPR, spanning nine time zones, will focus on those projects that were able to make progress under COVID pandemic restrictions. As we have noted in previous *LMR News* issues, many of our PIs were prevented from accessing workplaces or conducting field work needed to collect data. Some, however, were able to pivot their work from planned field work to analysis. PIs should have received a draft agenda. If not, be sure to contact Mandy Shoemaker.

We hope to see you all in-person in 2021.

LMR PROGRAM PARTICIPANT UPDATES

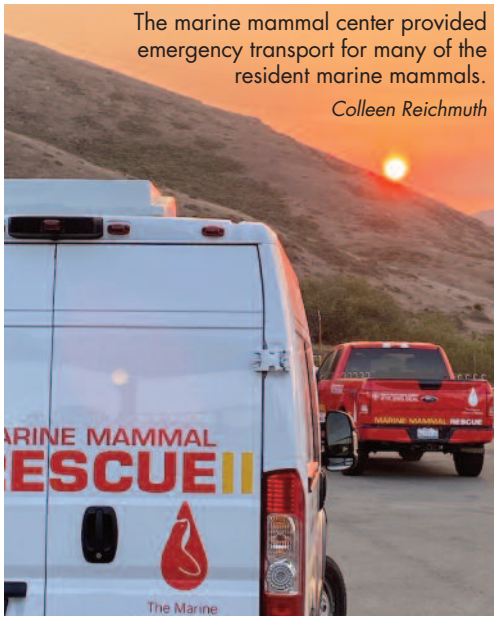
Podcast on Puffin Work

A podcast from the Woods Hole Oceanographic Institution highlights work by Dr. Aran Mooney on an LMR funded project, Hearing and Estimated Noise Impacts in Three Species of Auk: Implications for the Marbled Murrelet. Mooney discusses his work studying auditory responses of Atlantic puffins in Iceland. To listen to the podcast, go to https://www.youtube.com/watch?v=MUWCNkqZ6DY. For more this LMR project, see the Project 22 fact sheet at the Current Projects tab on our website www.navfac.navy.mil/lmr.

Atlantic puffin.
Aran Mooney

Marine Mammals at Long Marine Laboratory

In August, raging wildfires generating thick smoke and ash approached the University of California Santa Cruz and the Long Marine Laboratory. As air quality deteriorated and ash began falling into the marine mammal pools, the two marine mammal research groups at the lab began a complicated animal evacuation. Working with reduced staff due to pandemic restrictions, the researchers' emergency contingency plans were put to the test. Two host facilities—The Marine Mammal Center (Sausalito, CA) and Sea World (San Diego, CA)—stepped forward to offer refuge and evacuation help for the animals and their trainers. The effort entailed moving dolphins, seals and sea lions, including those from the Pinniped Lab managed by Dr. Colleen Reichmuth, a principal investigator on LMR project 32 (Behavioral Assessment of Auditory Sensitivity in Hawaiian Monk Seals). Their primary caretakers traveled with the animals and remained with them off-site throughout the time they were away, to provide continuity of care and to ensure the fewest possible changes for the animals routines, given the stress of the move.



The marine mammal center provided emergency transport for many of the resident marine mammals.
Colleen Reichmuth

Reichmuth is happy to report that, as of late October, all of the Long Marine Lab's marine mammals are now back on site. The animals are safe, healthy, eating well and reacclimatizing to their environment. As she noted in her update, "We greatly appreciate the support offered by our partners, funders, colleagues and friends. Spending such intense time away from home with our animals has certainly increased our gratitude for the opportunity to work with marine mammals at Long Marine Lab, despite the closure of most of the campus at the University of California Santa Cruz."

For more on the initial evacuation, see an article from UCSC News at https://news.ucsc.edu/2020/08/marine-mammal-evacuation.html.

On a sadder note from the Long Marine Lab, Sprouts, the beloved Pacific harbor seal, died on September 9, 2020 at The Marine Mammal Center hospital after developing an untreatable esophageal carcinoma. If there was a silver lining to the wildfire evacuation, it was that Sprouts was at The Marine Mammal Center with a wonderful medical team that did everything possible to make him comfortable and provide him the best quality care.

During his 31 years, Sprouts contributed to important scientific studies, supported unforgettable educational opportunities for students of all ages, and trained generations of future scientists, veterinarians, animal care specialists and teachers. He worked closely with many graduate students, some of whom have worked on LMR projects, and contributed to more than 34 scientific publications. Results of Sprouts' participation in hearing and TTS research also helped in establishing the Navy's and NOAA's acoustic criteria and thresholds for phocids (true seals). Those criteria are used to estimate potential impacts from acoustic sources.

In a letter from the Pinniped Lab, Reichmuth noted, "He embodied the spirit that we strive to create and sustain at the marine lab—as a place where marine mammals and scientists and students at every level work cooperatively together in harmony."

Field Work Video

The team from the project 3S3: Behavioral Responses of Cetaceans to Naval Sonar compiled photos and video clips from their 2019 field work in the waters off Norway. It includes footage of getting monitoring tags onto a sperm whale. To view the video, go to https://vimeo.com/431769941.


Sperm whale.

PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY21 pre-proposals due	November 12, 2020
b.	Pre-proposal review	November 2020 through January 2021
2.	Quarterly Status Reports (QSR)	
a.	Submit winter QSR	January 29, 2021
b.	Submit spring QSR	April 30, 2021
c.	Submit summer QSR	July 30, 2021
d.	Submit fall QSR	October 29, 2021
3.	Virtual In-progress Review	November 30 to December 03, 2020

Remembering
Tom Norris
1965–2020

California surfer with a knack for bioacoustics channels Jacques Cousteau. That's one way I think of Tom Norris. For him, marine science was about the animals, the ocean and the adventure. I think this combination of interests and experience helped Tom bring unusual creativity to everything he did.

I met Tom when I was a student at Moss Landing Marine Laboratories, where he became both a mentor and an inspiration. He invited me to participate in his research projects, which included exciting at-sea adventure, often with a mix of triumph and failure. Working with him, I learned that even when things did not always go as expected, don't give up and keep being creative. Oh and have fun and enjoy the ride.

Tom's work in bioacoustics helped to let all of us in on hearing what was going on below the sea surface. He was an accomplished marine scientist, a leader in his field of bioacoustics, who worked on several U.S. Navy projects. In 2006 he started Bio-Waves, and assembled a collection of skilled scientists with unique talents in bioacoustics that have helped the Navy detect marine mammals using acoustic monitoring. Tom's work led to analysis tools, as well as occurrence and density data, that are used to support the Navy's environmental compliance assessments across a broad range of locations in both the Atlantic and Pacific.

With his many influences on Navy marine species research and monitoring, members of the LMR Advisory Committee and staff wanted to share in remembering Tom. Below are words that reflect some of their thoughts about Tom.

Pancreatic cancer took Tom much too soon. He will be missed by us all, will continue to be in our hearts and will be a legend in our community.

—Anu and the LMR Team

For more details on Tom's work, see www.the-scientist.com/news-opinion/tom-norris-marine-mammal-acoustician-dies-at-55-67945

Hang loose, Tom.
—The LMR Team

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.

Burkard, R., Finneran, J.J., Mulsow, J., and Jones, R. (2020) Offset auditory brainstem response (ABR) amplitude in bottlenose dolphins. *The Journal of the Acoustical Society of America*, 148(3):1445-1455. DOI: 10.1121/10.0001900.

Curtis, K.A., Falcone, E.A., Schorr, G.S., Moore, J.E., Moretti, D.J., Barlow, J., and Keene, E. (2020). Abundance, survival, and annual rate of change of Cuvier's beaked whales (*Ziphius cavirostris*) on a Navy sonar range. *Marine Mammal Science* (online early view). DOI: 10.1111/mms.12747.

Hansen, K.A., Hernandez, A., Mooney, T.A., Rasmussen, M.H., Sørensen, K., and Wahlberg, M. (2020) The common murre (*Uria aalge*), an auk seabird, react to underwater sound. *The Journal of the Acoustical Society of America*, 147(6):4069. DOI: 10.1121/10.0001400.

Kastelein, R.A., Helder-Hoek, L., Cornelisse, S.A., Huijser, L.A.E., and Gransier, R. (2020) Temporary hearing threshold shift at ecologically relevant frequencies in a harbor porpoise (*Phocoena phocoena*) due to exposure to a noise band centered at 88.4 kHz. *Aquatic Mammals* 46(5), 444-453. DOI: 10.1578/AM.46.5.2020.444.

Cuvier's beaked whales.
Gregory S. Schorr, permit 16111

We also want to share the following publication that, although not funded by LMR, is complementary to the work the principal investigator has done for LMR. This effort was funded by the Netherlands Ministry of Infrastructure and the Environment.

Kastelein, R.A., Helder-Hoek, L., Cornelisse, S.A., Defillet, L.N., and Huijser, L.A.E. (2020) Temporary threshold shift in a second harbor porpoise (*Phocoena phocoena*) after exposure to a noise band at 1.5 kHz and a 6.5 kHz continuous wave. *Aquatic Mammals* 2020, 46(5), 431-443. DOI 10.1578/AM.46.5.2020.431.

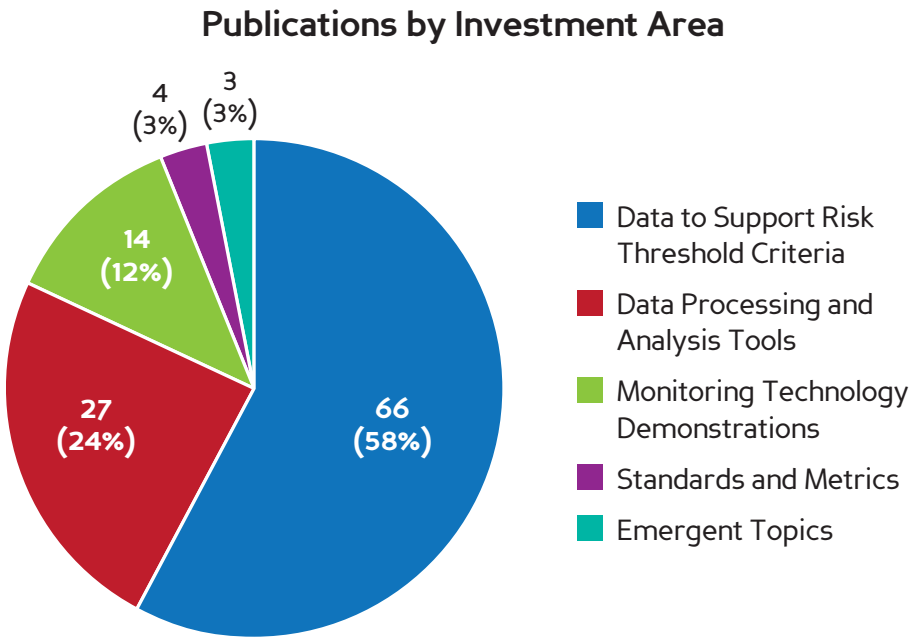
LMR PUBLICATIONS SPREADSHEET

Building on our quarterly publication listings, and recognizing the value of the publications generated over the life of the LMR program, we are excited to announce that we recently added a spreadsheet with the full list to-date of publications on our website. To see the spreadsheet, go to https://www.navfac.navy.mil/lmr and click on the Publications tab.

The spreadsheet list currently includes 113 publications, beginning in 2013 from the earlier Marine Mammal Research program, which preceded the LMR program's establishment in 2014. While the list focuses on publications resulting from Navy LMR funding, it also includes publications not specifically funded by the LMR program but that acknowledged use of data, methodology or technology developed with funding from the LMR program.

The spreadsheet provides full citations (authors, year, title, journal, issue, etc.) and, as appropriate, the LMR project number and investment area under which it was funded. In addition to journal publications, the spreadsheet includes entries for final and technical reports.

The pie chart below provides one view of publications to date, showing percentages by investment area.



Along with the publication list included with each newsletter, we will post an updated version of the spreadsheet each quarter.

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 Processing and Analysis 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

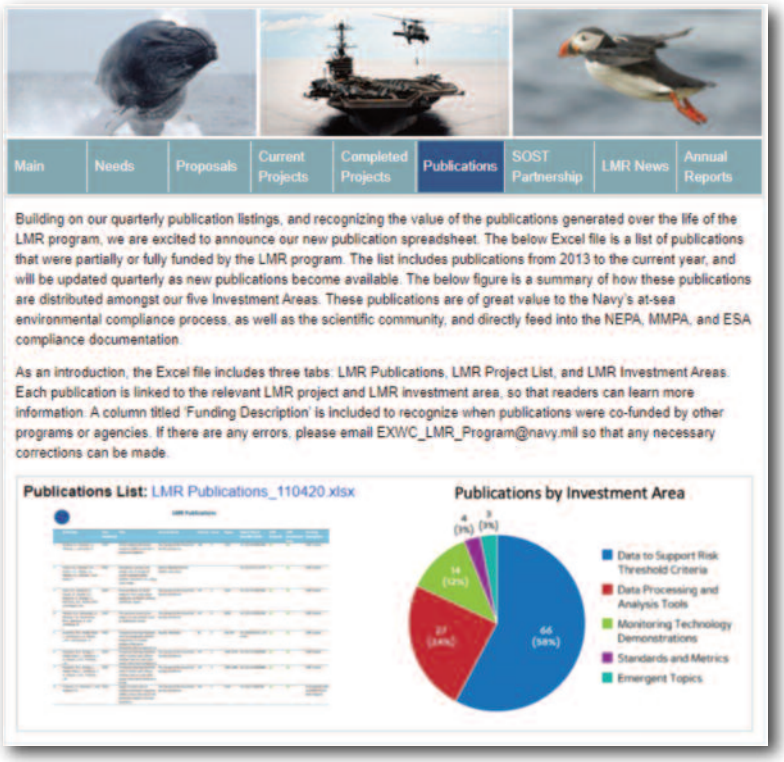
Work to establish interagency and scientific community standards and metrics for data collection, management and analysis. This promotes data comparability and enables data aggregation from different data sets. It ensures consistent, agreed-upon standards and metrics in order to provide cost-effective 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.

OUR WEBSITE

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



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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 information on the virtual IPR, project updates and other program news.

www.navfac.navy.mil/lmr