

LMR news

FALL 2017

SCIENCE • STEWARDSHIP • NAVY READINESS

Welcome!

Welcome to the fall 2017 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 mammals—their occurrence in training areas and potential exposure, response and consequences.

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Humpback whale.

Dr. Mridula Srinivasan, NOAA/NMFS/OST/AMD



WHO WE ARE

The LMR program is one of the 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 mission of the LMR program is to improve the best available science regarding the potential impacts to marine species from Navy activities, and improve the technology and methods available to the U.S. Navy Marine Species Monitoring program, while preserving core Navy readiness capabilities.

PROGRAM OFFICE INSIGHTS

Collecting pre-proposals in responses to our Broad Agency Announcement (BAA), presenting the LMR program at the 22nd Biennial Conference on the Biology of Marine Mammals and engaging with principal investigators during the LMR In-progress Review (IPR) were a few of our activities during the fall quarter.

Technical Review Committee (TRC) and LMR Advisory Committee (LMRAC) members have been reviewing the pre-proposals submitted in response to our Fiscal Year 2018 (FY18) BAA solicitation. The FY18 BAA, which closed on 17 October 2017, focused on two defined Navy needs:

1. Need N-0158-18 Evaluations and Standardization of Sonar Signal Processing Tools for Marine Mammal Research
2. Need N-0159-18 In-situ Explosive Sound Characterization and Propagation Data Collection and Analysis

The program is finalizing the review and in early 2018 will invite selected submitters to complete full proposals.

For highlights from LMR activities at the Biology of Marine Mammals conference, see the "LMR Program Participant Updates" section.

The annual LMR IPR was held in November, bringing together project principal investigators and LMRAC members to discuss program efforts. More on the meeting is provided below.

One particular item we want to note, which came up during the IPR, is the Navy's Ocean Observing System guidance. All LMR program participants (and others receiving Navy funding) are reminded to report all passive acoustic sensor deployments associated with program-funded projects. Guidance for LMR researchers can be downloaded from our website at the following link: <http://greenfleet.dodlive.mil/lmrproposals/>. Click on Appendix D—LMR Ocean Observing System Notification Procedures.



Anu Kumar, Program Manager

IN-PROGRESS REVIEW 2017

The LMR In-progress Review was held in Ventura, California during November. The annual meeting is a time for principal investigators (PIs) on LMR-funded projects to present their project overview, status and results to date to the LMRAC and other PIs. The multi-day meeting provides a great opportunity for PIs to see how their work fits into the broader LMR program and Navy needs as well as building connections with other PIs. The resulting research synergy strengthens the program and project results. For program managers and the LMRAC, it plays a crucial role in ensuring that projects are on-track to meet Navy needs.

In addition to the usual suspects (LMRAC members, program managers and sponsor, PIs), two additional presenters were invited to share information. Kenneth Hess, Director of Communication and Outreach, OPNAV N45, provided insights into “selling the science.” He discussed the varied audience for LMR project results and outlined how communicating technical ideas and products to the non-science audience differs from communicating with peers.

Another invited presenter was John Joseph from the Naval Postgraduate School (NPS). A Program Officer and research faculty member in the Oceanography Department, Mr. Joseph discussed the tool that he and Tetyana Margolina (also with NPS) developed for modeling behavioral responses, which was used in conjunction with the Southern California Behavioral Response Study (BRS) and is being adapted for the Atlantic BRS.

The PIs from the four new LMR projects also introduced their work at this year’s IPR. These projects and PIs are:

1. 3S3: Behavioral Responses of Cetaceans to Naval Sonar (PIs: Frans-Peter Lam, Petter Kvadsheim and Patrick Miller)
2. Measuring the Effect of Range on Behavioral Response of Marine Mammals through the Use of Navy Sonar (PI: Stephanie Watwood)
3. DenMod: Working Group for the Advancement of Marine Species Density Surface Modeling (PI: Len Thomas)
4. Behavioral Assessment of Auditory Sensitivity in Hawaiian Monk Seals (PI: Colleen Reichmuth and Jillian Sills)

(See the *Project Highlights* tab at LMR website, <http://greenfleet.dodlive.mil/LMR>, for fact sheets that summarize these new projects.)

Comments from LMRAC members and LMR PIs emphasized the benefits of this annual meeting. In particular, many valued how the information shared will help to improve the results of their own projects.



Hawaiian monk seal.
Audrey Quinto

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.

This quarter we present updates on two projects, 1) *High Fidelity Acoustic and Fine-scale Movement Tags* and 2) *Extended Duration Acoustic Tagging of Right Whales*.

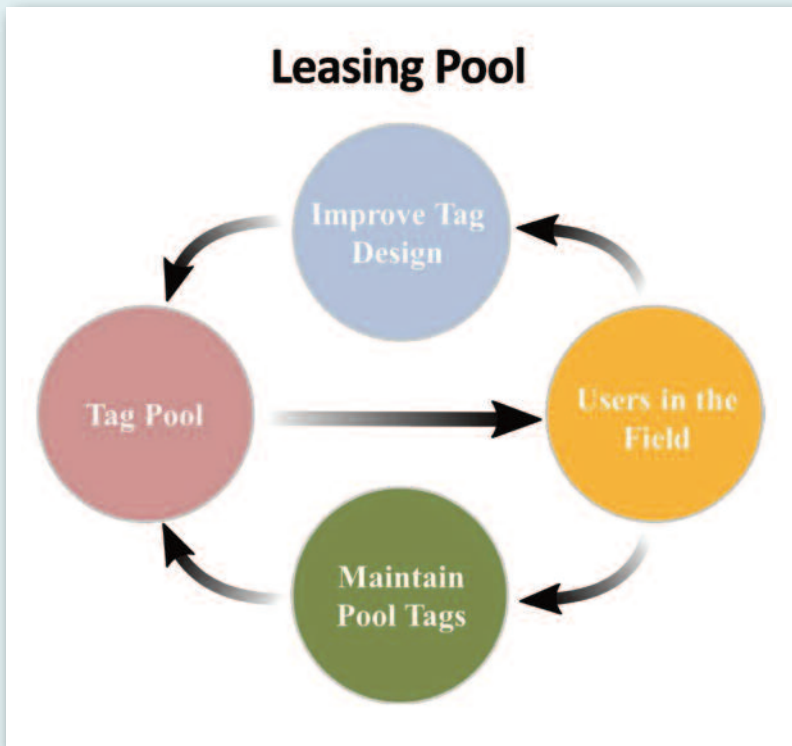
High Fidelity Acoustic and Fine-scale Movement Tags

To improve understanding of marine mammal behavior in relation to Navy activities, researchers often use monitoring devices (tags) that include sensors to measure animal movement and, with acoustic tags, the sounds made and heard by the tagged animal. This information can then be used to infer acoustic and behavioral activities. As the need for marine mammal monitoring has increased, researchers require new, readily available tags to collect fine scale acoustic and movement information during acoustic response studies that are key to meeting the needs of the Navy.

Led by Alex Shorter, an Assistant Professor in the University of Michigan's Mechanical Engineering department, this project will produce a new pool of digital acoustic recording tags (DTAGs), which will be made available for lease. DTAGs are highly integrated, compact, low-power, high fidelity acoustic bio-logging tags that are well suited for studying both deep diving beaked whales and large baleen whales.

The combination of high resolution acoustic and movement sensors make these tags key enabling technology for any behavioral response research.

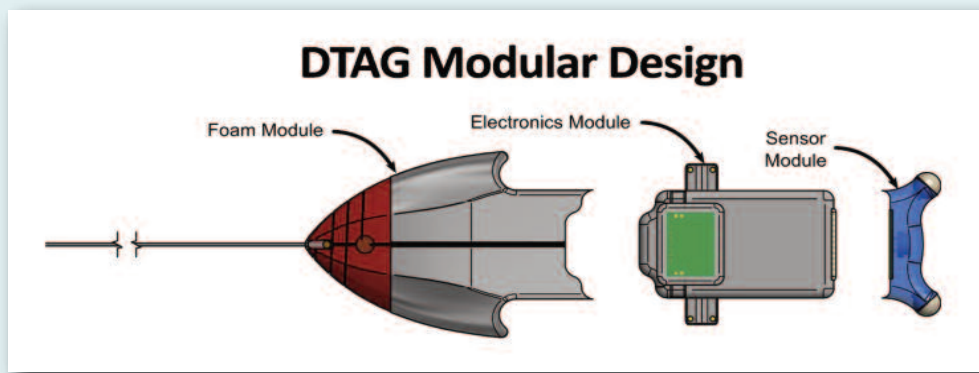
In designing the tags for the lease pool, lower cost and ease of manufacturing were among the design objectives. These objectives had to be reconciled with multiple field requirements: reduced size suitable for small odontocetes as well as larger species, longer duration tag attachments,



longer battery life and recording times, and wider bandwidth recordings. To balance these potentially conflicting requirements of lower cost, smaller size and more capability, a number of innovative features were introduced in the design of the lease pool tags.

One feature is a modular design that supports flexible design at reduced costs. The three primary modules in this flexible design are the foam, electronics and sensor modules.

Having separate electronics and sensor modules allows for greater customization in the combination of recording components. For example, although the basic package, which supports stereo recording of up to 240 kHz with a bandwidth of 200 Hz to 60 kHz, is optimized for beaked whales and other higher frequency odontocetes, tags can also be optimized during fabrication for lower frequency animals (sperm whales and baleen whales).



The combination of high resolution acoustic and movement sensors make these tags key enabling technology for any behavioral response research.

Another project innovation is the tag leasing program, which will help to make tags available and sustain tag improvements. A collection of the tags (i.e., the pool) is maintained at the University of Michigan. Users lease tags for their field work then return the tags to pool, where they are repaired (if needed), updated or modified based on user feedback, and then are again available to users. The project expects to have 30 DTAGs available to the pool by 2019.

This project—initiated under Office of Naval Research (ONR) funding, now being validated with LMR funding and then moving into implementation by the Navy's Marine Species Monitoring Program—reflects the way in which the Navy's marine species programs are coordinated to meet Navy needs.

Extended Duration Acoustic Tagging of Right Whales

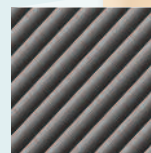
As acoustic monitoring tag capabilities improve and longer recording times are possible, a complementary need is longer attachment time on the tagged animal. The non-invasive suction cup attachment mechanisms that are often used with DTAGs generally do not stay attached for long periods. This issue typically has limited data collection to less than one day.

Susan Parks, an Associate Professor in the Department of Biology at Syracuse University, is leading this project to assess the viability of using new micro-texture and biocompatible glue attachment methods with the new tags (described in the preceding project summary). Based on the promising results in previous ONR-supported studies, it is expected that the texture/glue combination on tag suction cup could extend the tag attachment from hours to multiple days.

Researchers are trying to test the attachment of the DTAG-3s using these promising methods during monitoring studies of North Atlantic right whales off the Southeastern United States. The monitoring studies, supported by U.S. Fleet Forces, are focused on right whales due to their endangered status and proximity to the undersea warfare training range (USWTR) off of Jacksonville, Florida. This training range is one of the identified priority regions for the LMR program and the Navy.

The 2017 right whale study season presented obstacles to field-testing the new tag attachments. The obstacles included a short survey time-frame due to weather and limited right whales sightings—only three, a mother/calf pair and one other adult. During a subsequent 2017 effort with humpback whales, at the National Oceanic and Atmospheric Administration Stellwagen Bank National Marine Sanctuary, micro-texture suction cups made of two material (offering low and standard stiffness) were tested with seven tag deployments. Results are being analyzed.

The project team's plan for 2019 is to test the micro-texture in combination with the biocompatible glues on free-ranging whales.



Representation of micro-texture on a tag's suction cup edges.



LMR PROGRAM PARTICIPANT UPDATES

Several PIs from LMR projects participated in the 22nd Biennial Conference on the Biology of Marine Mammals, held in Halifax, Nova Scotia. The LMR program also had a poster session entry that provided an overview of the program, its mission and types of research conducted. The conference was attended by over 1,500 scientists, managers, policy makers and students from around the world. It offered both an effective forum for publicizing Navy marine species research and monitoring efforts and identifying new research results that could contribute to Navy projects.

Prior to the Halifax marine mammals conference, the Density Modeling (DenMod) working group held its first meetings. The working group, coordinated under a project funded in part by the LMR program, is working to develop and implement innovative approaches to improve spatial modeling methods to characterize seasonal abundance and distribution of marine species, particularly in U.S. Navy training and testing areas.

The group held two meetings. The first was a meeting of scientists participating in the working group. They focused on the range of potential topics to be addressed in the first year and agreed on the following four priority topics:

1. Extrapolation

How far from sampling transects can density be estimated and what influences extrapolation.

2. Uncertainty estimation

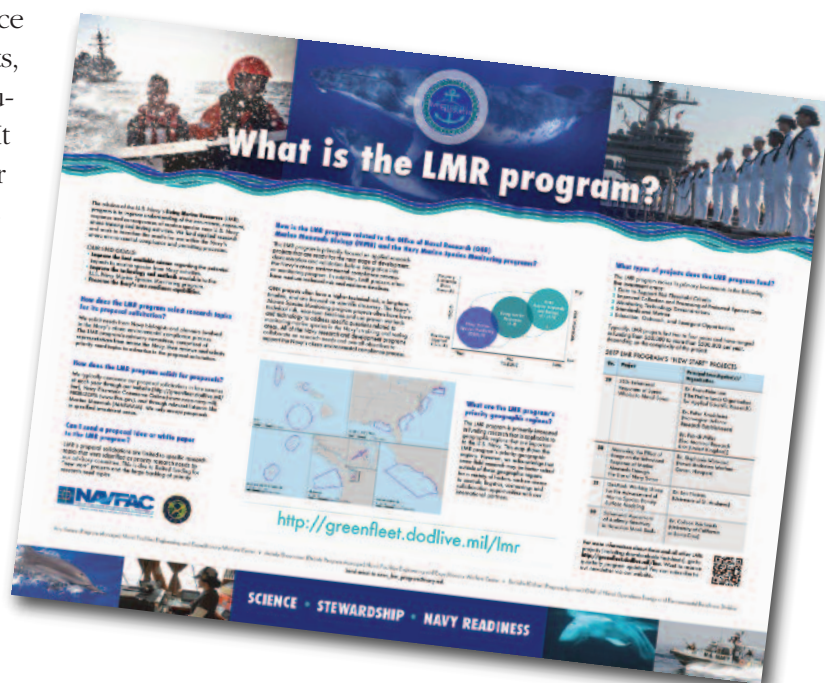
How is the model formulated, how detectable is a given species, how to address perception and availability bias, etc.

3. Model unification

With many alternative approaches to statistical analyses (e.g., generalized additive model [GAM], generalized linear model [GLM], hierarchical Bayesian, etc.) how to select approaches and use strengths from various ones.

4. Workflow

How to track the steps followed in modeling to make it reproducible.



The second meeting was a public workshop attended by representatives from a non-governmental organization, the academic research community, industry consulting groups, government agencies and regulators. Project leaders discussed the goals of the project and the workshop and provided an overview of the project plan, including their priority topics. Workshop participants discussed how they use models in their work and discussed the project's priorities. Members of the DenMod team welcomed the input and saw the meetings as a good first step in the project.

RECENT PUBLICATIONS

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

Cranford, T.W., Krysl, P. (2017) Sound Paths, Cetaceans. In *Encyclopedia of Marine Mammals (Third Edition)*.

Friedlaender, A.S., Herbert-Read, J.E., Hazen, E.L., Cade, D.E., Calambokidis, J., Southall, B.L., Stimpert, A.K., and Goldbogen, J.A. (2017). Context-dependent lateralized feeding strategies in blue whales. *Current Biology*, 27(22):R1206-R1208.

Kastelein, R.A., Helder-Hoek, L. and Van de Voorde, S. (2017). Effects of exposure to 53-C sonar playback sounds (3.5-4.1 kHz) on harbor porpoise (*Phocoena phocoena*) hearing. *Journal of the Acoustical Society of America*, 142:1965-1975.

An additional article we want to note provides an example of how LMR's independent investments in the HARPs, a tracking algorithm and the GPL detector provided important tools that enabled the lead author to conduct the study and demonstrate the capability of combining these technologies.

Guazzo, R.A., Helble, T.A., D'Spain, G.L., Weller, D.W., Wiggins, S.M., Hildebrand, J.A. (2017) Migratory behavior of eastern North Pacific gray whales tracked using a hydrophone array. *PLoS ONE* 12(10): e0185585.

For lists of other publications, please see our FY16, FY15 and FY14 program reports and recent issues of *LMR News*.



Blue whale.

PROGRAM INVESTMENT AREAS

The LMR program's five key investment areas are:

1. Data to Support Risk Threshold Criteria

Research regarding potential impacts to marine species from Navy training and testing activities, primarily focused on potential impacts from sound (e.g., hearing studies, sound exposure and behavioral response studies).

2. Improved Collection and Processing of Protected Species Data in Areas of Navy Interest

Develop methods to improve the ability to process large amounts of marine species data and provide cost-effective solutions to enhance marine species monitoring capabilities (e.g., new detection and classification algorithms, automated processing tools for passive acoustic monitoring data).

3. Monitoring and Mitigation Technology Demonstrations

Demonstrate technologies that offer to enhance marine species monitoring capabilities (e.g., new passive acoustic monitoring technologies and platforms such as gliders).

4. Standards and Metrics

Establish interagency and scientific community standards and metrics to evaluate marine species data to provide comparable results (e.g., standards for hearing studies, detector and classifier performance analysis standards).

5. Education and Outreach, Emergent Opportunities

Support education and outreach on LMR-funded research investments and new scientific methods available to the broader scientific community. Emergent research topics of priority interest to the Navy (e.g., LMR website and program outreach on investments, Introduction to Density Estimation from Acoustics (IDEA) training, other study topics needed by the Navy).

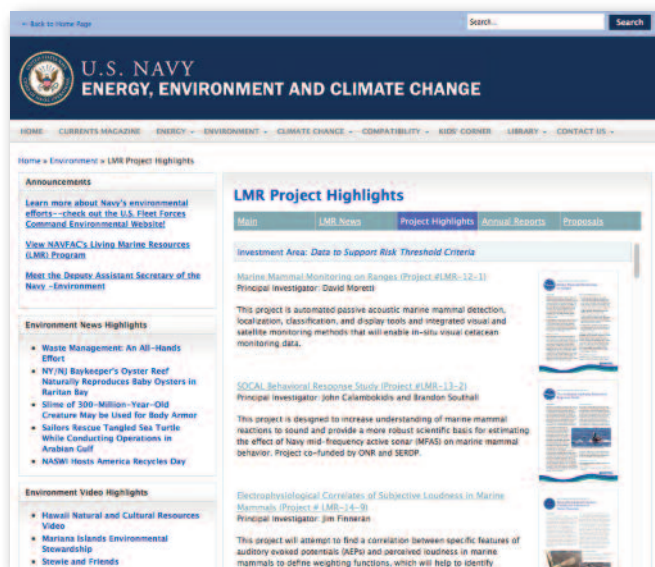


<http://greenfleet.dodlive.mil/LMR>

OUR WEBSITE

Please visit the *Project Highlights* tab at our website, <http://greenfleet.dodlive.mil/LMR>, to find fact sheets for our four new start projects:

1. **Project 29**
3S3: Behavioral Responses of Cetacean to Naval Sonar.
2. **Project 30**
Measuring the Effect of Range on Behavioral Response of Marine Mammals through the Use of Navy Sonar.
3. **Project 31**
DenMod: Working Group for the Advancement of Marine Species Density Surface Modeling.
4. **Project 32**
Behavioral Assessment of Auditory Sensitivity in Hawaiian Monk Seals.



PROGRAM SCHEDULE

No.	What	When
1.	Proposal Solicitation & Review	
a.	FY18 BAA Notify Submitters of pre-proposal evaluation results	January, 2018
2.	Project & Contracts Management	
a.	FY18 New Start Contracts	September 30, 2018
3.	Quarterly Status Reports (QSR)	
a.	Submit winter QSR	January 2, 2018
b.	Submit spring QSR	April 2, 2018
c.	Submit summer QSR	July 2, 2018
d.	Submit fall QSR	October 1, 2018

LMR-RELATED PHOTOS—KEEP THEM COMING

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

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

A LIMPET satellite tag being deployed on the dorsal fin of a fin whale.

Gregory S. Schorr, NMFS Permit 16111



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If you want to subscribe to, or unsubscribe from, *LMR News*, please send your email address to Lorraine Wass at ljwass@outlook.com.

CONTACT THE LMR PROGRAM

For more information about the LMR program and its operations, contact Anu Kumar, Program Manager, at exwc_lmr_program@navy.mil and 805-982-4853.

IN THE NEXT ISSUE OF *LMR NEWS*

Our next issue will provide updates and notes on project field tests and more as available.

Read more about Navy contributions to and use of monitoring tags to research and track marine mammals in the fall-17 issue of *Currents* magazine at <http://greenfleet.dodlive.mil/currents-magazine>.

