



LIVING MARINE RESOURCES PROJECT 30

Measuring the Effect of Range on the Behavioral Response of Marine Mammals Through the Use of Navy Sonar

NEED

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), that apply to marine mammals and other marine protected species. As part of the regulatory compliance process associated with these acts, the Navy assesses potential impacts from Fleet and Systems Command military readiness activities involving active sonar and the use of explosives and explosive munitions.

Data from several Navy-funded projects have documented cetacean responses, particularly by Cuvier's and Blainville's beaked whales, to mid-frequency active sonar (MFAS) from ships. Data from some field efforts, however, have indicated that a given animal can react differently to similar exposures (i.e., within the same range of received sound levels) depending on the sonar source itself and the distance the animal is from the source. In order to improve the Navy's quantitative impact assessments, data on responses (i.e., effects) to different sources at different distances (i.e., range) are needed.

SOLUTION

This project proposes to conduct controlled exposure experiments (CEE) using sonar from two different platforms, each of which will be deployed at multiple, pre-defined distances from tagged animals.

The effort will be coordinated with another Living Marine Resources (LMR)-funded project that is using high-resolution, medium-duration monitoring tags to record behavioral responses of Cuvier's beaked whales and fin whales during Navy training and testing activities. That project (LMR project 23) is employing an opportunistic exposure experiment

(OEE) approach, in which animals are tagged prior to Navy training activities in order to document the behavior of these two species before, during and after the actual Navy exercises. The data from the CEEs will augment the OEE data.



Blainville's beaked whale.
Mark Deakos, NMFS permit 14451

METHODOLOGY

The CEE project will include both exposure and control scenarios for each of two types of sonar platforms—helicopter-dipping sonar and directional command activated sonobuoy system (DICASS) sonobuoys. These were selected based on how frequently they are used during training on the Southern California Antisubmarine Warfare Range (SOAR). Each sonar type will be tested as outlined in the following table. Standard mitigation actions will be conducted prior to all experiments, as outlined in the research permits.

Helicopter-dipping Sonar

Transmission (exposure)	Helicopter conducts dipping sonar at typical depth and source level at defined distances from tagged animal (beginning distant then progressively closer).
No transmission (control)	Helicopter conducts dipping sonar maneuvers at typical depth but does not transmit. Conducted at the same defined distances as exposure.

DICASS Sonobuoys from Tagging Boat

Tagging boat (rigid hulled inflatable boat or RHIB) arrives at the farthest defined distance, team deploys sonobuoy over the side to standard depth, and sonar is transmitted at a defined time. This is repeated at different and progressively closer distances.
RHIB team deploys sonobuoy over the side to standard depth, no sonar transmitted. Repeated at each of the defined distances as exposure.

Animal response data will be collected from the same tags on the same animals that are tagged for the OEEs. However, the data regarding sonar sources is collected in much finer detail for the CEEs, with information regarding time, distance and the sources themselves.

The monitoring tags being used by the teams are high-resolution, behavior recording tags deployed on Cuvier's beaked whales (*Ziphius cavirostris*) and ESA-listed fin whales (*Balaenoptera physalus*) on the Southern California Offshore Range (SCORE). The primary tag is a new version of the Wildlife Computers/Andrews Whale Lander tag, referred to as Lander2 tag. This tag includes Fastloc GPS and 3-axis accelerometers and magnetometers (sensors that can detect an animal's fine movements and directions) along with standard depth and temperature sensors. All the sensors are within a more hydrodynamic package that is expected to remain attached for longer periods.

If it becomes available during the study timeframe, the team will use the SMRT (Sound and Motion Recording and Transmitting) tag. This tag, which will include integrated acoustic recording capabilities, is still in the early stages of commercial development.

As with the OEE project, data from this project will be analyzed within a unified framework that combines whale movements and diving behavior from tags, tracks from platforms participating in the experiments

and archived acoustic data from the range hydrophones and/or acoustic recording tags. Combining these pieces will help to predict the likelihood of a behavioral change as a function of sonar use, including variables such as sonar type, received level (recorded on animal or estimated), distance and orientation of the transmitting platform, and the sonar exposure characteristics.



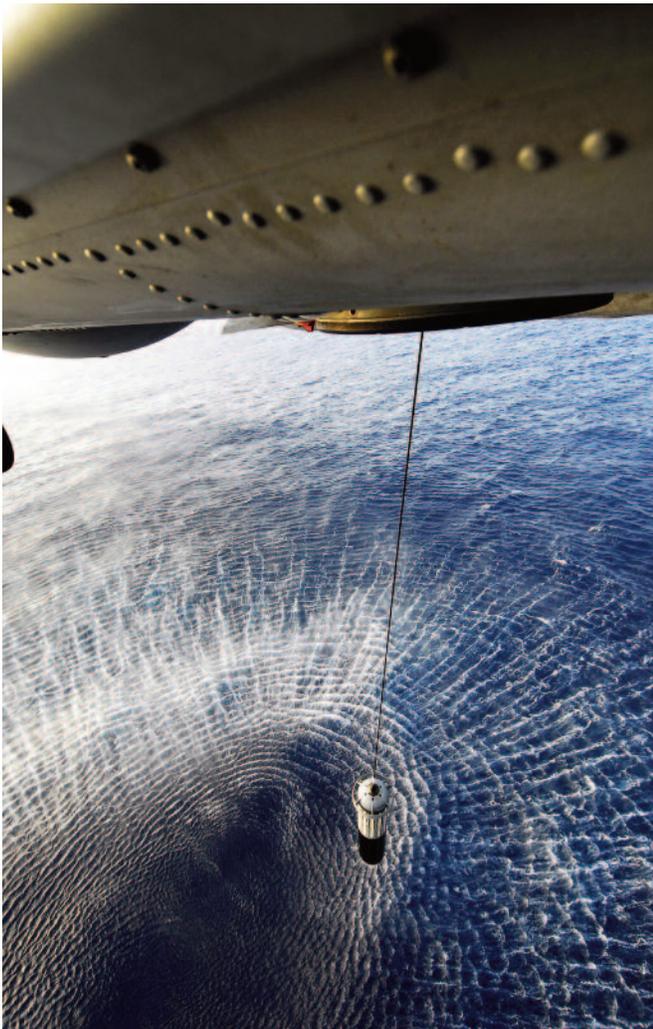
Cuvier's beaked whale.
Erin A. Falcone, NMFS permit 16111

SCHEDULE

The CEEs are scheduled to be carried out in late 2018, 2019 and 2020. Following each field effort, data will be processed and provided to the ongoing OEE analyses. Completion of the final combined CEE/OEE report is scheduled for 2020.

NAVY BENEFITS

Adding this CEE effort to the ongoing OEE project will generate larger samples of high-resolution behavioral data, including both transmission and non-transmission control experiments in predictable



An MH-60R Sea Hawk helicopter hovers while deploying its sonar dipping buoy during an undersea warfare exercise.

MC3 Walter M. Wayman

patterns at multiple, predetermined distances. This approach enhances assessment of range to effect on behavioral response and continues development of the CEE methodology through the use of the two source types, helicopters and sonobuoys.

The results will allow the Navy to improve impact assessments and better estimate the potential effects of sonar use on Cuvier's beaked whales and fin whales within the Southern California ranges.

TRANSITION

Project results will be provided through annual reports, methodology and results publications, and data sets to support empirical risk function development for the Navy's at-sea environmental compliance efforts.

ABOUT THE PRINCIPAL INVESTIGATORS

Stephanie Watwood is a biologist at the Naval Undersea Warfare Center (NUWC). She has extensive experience in collecting and analyzing cetacean acoustic data, particularly related to cetacean behavior. Dr. Watwood holds a Ph.D. in biological oceanography from the Woods Hole Oceanographic Institution/Massachusetts Institute of Technology joint program.



Key collaborators include Dave Moretti from NUWC; Greg Schorr, Erin Falcone and Brenda Rone from the Foundation for Marine Ecology & Telemetry Research (MarCoTel); Alex Zerbini from MarCoTel and NOAA; and Stacy DeRuiter from Calvin College.

About the LMR Program

The Living Marine Resources (LMR) program seeks to develop, demonstrate, and assess data and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. For more information, contact the LMR program manager at exwc_lmr_program@navy.mil or visit <http://greenfleet.dodlive.mil/lmr>.

