



LIVING MARINE RESOURCES PROJECT 23

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

NEED

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

Building data sets that can provide insights into behavioral responses depends upon appropriate field methods, monitoring technology and skilled analyses of the data collected. Behavioral and acoustic monitoring methods can include field observations, Controlled Exposure Experiments (CEE), fixed range hydrophones and other passive acoustic monitoring (PAM) equipment, such as various types of monitoring tags that are attached to animals of interest. The monitoring tags used during most CEEs to date have relied on high-resolution but short-duration archival tags. An identified need to support the Navy's knowledge base includes deploying longer-duration monitoring tags that will collect more high-resolution data to help to define behavior of and risk to marine mammals in Navy training and testing areas.

SOLUTION

This project proposes to use high-resolution, medium-duration tags to record behavioral responses of Cuvier's beaked and fin whales during Navy exercises. This opportunistic approach will not require scheduling with Navy ships. The overall goal is to collect data needed to develop defensible risk functions for use in impact assessments. This would encompass deploying medium-term (days to weeks), high-resolution, behavior-recording tags on species of particular concern in the training and testing area.



Fin whale.

Jeff Foster, permit 16111

METHODOLOGY

The primary tag the project will deploy 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, along with standard depth and temperature sensors, all within a more hydrodynamic package that is expected to remain attached for longer periods.



Cuvier's beaked whale.

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.

The team will deploy the high-resolution, behavior recording tags on Cuvier's beaked whales (*Ziphius cavirostris*) and ESA-listed fin whales (*Balaenoptera physalus*) around actual exercises on the Southern California Offshore Range (SCORE). The efforts will document the behavior of these two species before, during and after actual Navy exercises, with a goal of recording sufficient individual baseline data. This will increase the sample of high-resolution data during Mid-Frequency Active Sonar (MFAS) exposures from multiple platforms (e.g., ships, helicopters) across a range of distances previously collected using lower-resolution, longer-term dive reporting satellite tags.

The primary analytical approach for this work will be to combine whale movements and diving behavior from tags, tracks from ships and helicopters participating in exercises provided by SCORE or Pacific Fleet, and archived acoustic data from the range hydrophones and/or acoustic recording tags in a

unified framework. Bringing these pieces together 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 vessel, and duration, pattern or frequency of exposure. Where MFAS platform track data are unavailable, source positions will be derived from passive acoustic data if the ship is on Southern California Anti-Submarine Warfare Range (SOAR). All these data sources require considerable processing before they can be used in analyses.

SCHEDULE

The first year of this five-year effort will focus on planning and equipment purchase. The second year will include refining tag technology and attachment methods, developing data analysis tools and models, conducting field efforts and documenting methods. During the third and fourth years the team will continue field work, data collection and data analyses. Year five will focus on completing field work, providing preliminary data for Navy criteria efforts and documenting results in peer-reviewed publications.

NAVY BENEFITS

The project will demonstrate significant tag technology improvements over the technologies currently being used to study behavioral responses in free-ranging cetaceans. Methods that include these tags will be readily transferrable to other species and geographic regions where the Navy needs similar data to estimate the effects of its activities.

Additionally, the effort will generate significantly larger samples of high-resolution behavioral data, including accurate movements surrounding real MFAS exposure, particularly for beaked whales. This approach will support assessment of a broader range of factors than simply received level. The additional factors include source distance, type, and higher number/longer duration tag deployments. Such opportunities for multiple exposures to the same individual over time could provide insight into individual response variation and cumulative effects of repetitive exposure.

The results will allow the Navy to better estimate the potential effects of sonar use on Cuvier's beaked whales and fin whales within the Southern California ranges. Large sample sizes over broad temporal and spatial scales around real exercises will yield results that are directly applicable to risk function development for Navy compliance efforts.

TRANSITION

Project results will be provided through annual reports, methodology and results publications, and data sets to support empirical risk function development for Navy compliance efforts.

ABOUT THE PRINCIPAL INVESTIGATORS

Greg Schorr, a research biologist at the Foundation for Marine Ecology & Telemetry Research, has been studying marine mammals for 18 years. Much of his research has been focused on telemetry studies and has included deploying a wide variety of tags. His most recent focus has been using remotely deployed satellite tags to study beaked whale ecology and behavioral responses to anthropogenic sources of sound. Greg earned his geology degree from Colorado College.



Erin Falcone, a research biologist at the Foundation for Marine Ecology & Telemetry Research, is proficient in all aspects of cetacean satellite telemetry and deployment of suction cup-attached archival tags. Her current research focuses heavily on the effects of military training activity on cetaceans and has been a Co-PI on marine mammal studies at the Southern California Offshore Range since 2006. Erin earned her degree in zoology at Humboldt State University.



Key collaborators include Dave Moretti from the Naval Undersea Warfare Center; Stacy DeRuiter from Calvin College, and Russ Andrews and Alex Zerbini from the Foundation for Marine Ecology & Telemetry Research.

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 www.lmr.navy.mil.

