LIVING MARINE RESOURCES PROJECT 67

Measuring Behavioral Responses of Cuvier's Beaked Whales to Continuous Active Sonar in the Atlantic

NEED

It has been noted from previous behavioral response studies that signal type and duration of Navy sonar signals may play a role in observed responses in marine mammals. In 2017, LMR began investing in studying and collecting behavioral response data to continuous active sonar (CAS) as part of the third phase of the Sea Mammals and Sonar Safety (3S3) project (LMR Project 29). However, there is an expanded need to further understand the effects of CAS signals on marine mammals, particularly with additional marine mammal species.

Focal beaked whale.
Andy Read, permit 22156

SOLUTION

This project is designed to test and quantify the behavioral responses of the Cuvier's beaked whale (*Ziphius cavirostris*), also known as the goose-beaked whale, to Navy mid-frequency active sonar (MFAS) activities that employ CAS signals, using controlled exposure experiments (CEEs) off Cape Hatteras, North Carolina. The location, near but not on a Navy sonar training range, is expected to be populated by animals less habituated to Navy training activities than animals that live on or closer to sonar training ranges. The area also is used for the Navy's Marine Species Monitoring (MSM) program's Atlantic behavioral response study (Atlantic-BRS), which has focused on potential effects of traditional lower duty-cycle signals MFAS activities on Cuvier's beaked whales and pilot whales.

METHODOLOGY

The project team will evaluate, on multiple spatial scales, three distinct categories of potential behavioral responses: avoidance, behavioral changes (e.g., interrupted foraging) and changes in social interactions or groupings. Detailed data over both long- and short-term response times will be collected using satellite-linked dive recording tags and multi-sensor high resolution archival tags, respectively. The multi-scale tagging approach mimics the approach successfully used in the Atlantic-BRS to test the responses of Cuvier's beaked whales to MFAS activities using traditional lower duty-cycle sonar signals. The team will also use visual and photographic confirmation of the composition of the beaked whale social groupings.

The experimental protocols include a pre-exposure period during which baseline behavioral data are collected prior to the CEE, followed by continued monitoring throughout the exposure and post-exposure periods. Experiments will be coordinated with operational Navy surface vessels capable of transmitting CAS signals and/or the project team will deploy a simulated CAS source. Protocols include full control CEEs (no CAS exposure) with focal tagged and followed animals where possible on days without CAS exposure. All operational parameters, general operating areas and experimental methods are strategically matched to past MFAS CEEs to enable comparisons of any behavioral changes as a function of signal type between conventional lower duty-cycle signals and CAS signals.

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

Data analyses will use tools developed during the Atlantic-BRS project and within the framework of the Double Mocha project, which was co-sponsored by LMR and the Office of Naval Research.

SCHEDULE

During years one and two of the four-year project, the team will coordinate with Navy ships and conduct CEEs. Initial reports will be submitted following each field effort and during the analytical phase in year three. A final report is scheduled in year four.

NAVY BENEFITS

The primary products of this study will be empirical measurements of behavioral responses of Cuvier's beaked whales to CAS signals within the specified response categories. Results of this effort will support direct comparison between responses to CAS signals and to conventional, lower duty-cycle MFAS signals. Published results on control behavior, which will be greatly enhanced by the previous years of Atlantic-BRS experiments, and responses to CAS signals will inform Navy environmental compliance as well as the broader scientific and conservation communities. The results will be directly available for use in future Navy behavioral risk functions and permitting processes.

TRANSITION

Project reports, scientific publications and presentations will make the methods and results available for the Navy MSM program, Navy environmental compliance community, federal regulators and the broader scientific community.

ABOUT THE PRINCIPAL INVESTIGATORS

Douglas Nowacek, Distinguished Professor of Marine Conservation Technology in the Nicholas School of the Environment and the Pratt School of Engineering at Duke University, has been conducting sound exposure experiments since 1993. His work has been with both odontocete and mysticete cetaceans and has included large scale, multi-vessel experiments. He also has consulted widely on assessing behavioral responses of cetaceans to various industrial and naval sound sources. Dr. Nowacek's Ph.D. in biological oceanography is from the Massachusetts Institute of Technology-Woods Hole Oceanographic Institution joint program.

Brandon Southall is President and Senior Scientist for Southall Environmental Associates, Inc. and a research associate with the University of California, Santa Cruz. He has 30 years of research experience on marine mammal behavior, hearing and the effects of noise and has served as a lead or co-investigator in five major Navy-funded BRS projects over the past 15 years in the Bahamas, Mediterranean, Southern California and mid-Atlantic. Dr. Southall earned his Ph.D. at the University of California-Santa Cruz.

Andy Read, Distinguished Professor of Marine Biology in Duke University's Nicholas School of the Environment, studies the conservation biology of threatened and endangered marine mammals, seabirds and sea turtles. He has extensive experience conducting complex field experimentation with a variety of cetaceans and is co-PI of the Atlantic BRS project. Dr. Read's Ph.D. is from the University of Guelph, Canada.

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@us.navy.mil or visit exwc.navfac.navy.mil/lmr.