



LIVING MARINE RESOURCES PROJECT 34

Standardizing Methods and Nomenclature for Automated Detection of Navy Sonar

NEED

The Navy needs standard automated detectors for identifying U.S. Navy sonar sources within data sets used for passive acoustic monitoring (PAM) of marine mammals. The multiple automated sonar detectors currently in use by different researchers each produce varying results that are difficult to compare. To evaluate detection performance, the outputs from existing automated sonar signal detectors need to be statistically compared. Comparing the algorithms' performance using passive acoustic datasets with known occurrence of sonar signals (i.e. ground truthing) would provide a benchmark for assessing the probability of missed and false detections. In addition, there is a need to uniformly characterize sonar signal types into standardized groupings and terminology. This work will enable more comparable data analysis of behavioral responses observable within passive acoustic data. These results can then be used for criteria development and impact assessments.

SOLUTION

This project is a collaborative approach to develop a set of standardized detectors and classifiers, along with standardized nomenclature, for Navy sonar signals. The project team includes Navy investigators who will assess the efficacy and broad applicability of existing sonar detectors provided by non-Navy researchers. The group also will ensure that the greater research and signal detection communities are involved in developing a standardized and generalizable sonar detector.

METHODOLOGY

Project responsibilities are carefully defined to protect classified information while working toward standardized non-classified methods. Literature



USS Arleigh Burke (DDG 51) and USS Forrest Sherman (DDG 98).
MC3 Gitta Schirmmacher

reviews will identify existing detectors and identify issues regarding the detection and classification of sonar signals. Reviews will also identify sonar descriptions currently in the public domain (e.g. within environmental impact statements or published papers). The Navy sonar classification guidelines will inform selection of descriptive nomenclature. During this phase, and during the compilation and validation of datasets with sonar, the Naval Undersea Warfare Center sonar warrant officer will be consulted to ensure that investigators know what the source properties of each sonar signal should be and that any nomenclature used is unclassified. An unclassified standardized descriptive nomenclature for sonar signals will be developed.

Navy members of the project team will compile a standardized passive acoustic dataset from both Navy range data (from three different locations) and non-Navy recorded data (from two or three different types of recorders). The dataset will include three or four examples of Navy sonar, such as hull-mounted sonar (e.g. AN/AQS-53C) operating in two different modes,

helicopter-dipping sonar (e.g. AN/AQS-22) and an active sonobuoy sonar (e.g. AN/SSQ-62 DICASS). Working with multiple types of sonar sources will help to set a benchmark of the necessary characteristics of broadly applicable sonar detectors.

Navy members of the project team will process the dataset using two to four non-Navy detectors alongside the Space and Warfare Center detector. Results will be summarized using standardized performance metrics to help to quantify and evaluate the performance of the existing detectors against known sources in multiple environments. From this evaluation a new detector (or set of detectors) can be developed, or an existing detector can be adjusted. The final detector(s), recommended features and classifier(s) will be made available to the participating organizations and the wider acoustics research community.

SCHEDULE

Year one of this three-year project will focus on identifying existing detectors and signal data in the public domain and identify sonar classification issues, as well as working with non-Navy participants on detectors and data. Year two efforts will include compiling data subsets for initial comparisons, running analyses and analyzing results. The final year will focus on developing and testing standardized sonar detectors and standardized unclassified sonar nomenclature.

NAVY BENEFITS

This effort will provide validated automated detectors/classifiers for detecting the presence of sonar in marine mammal PAM datasets. It will also provide recommendations on tuning the characteristics of these detectors for optimal use. In addition, standardized sonar nomenclature, without reference to classi-

fied information, will be made available to researchers. This will promote comparability of results of independent research on the effects of Navy training and testing activities, including Navy sonar, on marine life.

TRANSITION

The final detector(s), recommended features and classifier(s) will be made available to the participating organizations and the wider acoustics research community. The evaluation procedures and descriptive nomenclature will be submitted for publication in a peer-reviewed journal and made available to the public. The transition process may include a demonstration of the detector(s) and how to tune the environmental parameters to best match a given environment.

ABOUT THE PRINCIPAL INVESTIGATORS

Elizabeth Henderson is a bioacoustic scientist with the Navy Marine Mammal program at the Space and Naval Warfare Systems Center.

Dr. Henderson earned her Ph.D. in marine biology and biological oceanography at the University of California, San Diego. She focuses on bioacoustic and noise impact analyses for environmental compliance.



Susan Jarvis is an electronics engineer at the Naval Undersea Warfare Center, Newport and an assistant teaching professor at Worcester Polytechnic Institute, Worcester, Massachusetts. Dr. Jarvis earned her Ph.D. in computer engineering at the University of Massachusetts, Dartmouth. Her work focuses on real-time acoustic signal processing for real-time detection, classification and localization of marine mammals.

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>.

