



## LIVING MARINE RESOURCES PROJECT 13

# Standardization of AEP Audiometry Methods to Ensure Comparable Data Inclusion in a National Marine Mammal AEP Database

### THE 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. As part of the compliance process associated with these regulations, the Navy is responsible for implementing a marine species monitoring program to assess potential impacts from Fleet and System Command military readiness activities involving active sonar and underwater detonations from explosives and explosive munitions. To understand whether these sound sources are impacting hearing in marine mammals, it is necessary to understand the natural or baseline hearing in these mammals.

Marine mammal hearing thresholds have traditionally been measured using behavioral response paradigms. This requires weeks to months of training, and regular access to study subjects. As this is extremely difficult or impossible for many species of marine mammals, an electrophysiological approach—in which voltages produced by the brain in response to an acoustic stimulus are recorded—is an alternative. These voltages, termed auditory evoked potentials (AEP), can be quickly measured in subjects with minimal subject cooperation. However, to date basic hearing measures (AEP or behavioral) have only been compiled on less than 20 of the 85 cetacean species, and often with only a few individuals per species.

### THE SOLUTION

In addition to the relatively small number of species that have been tested for AEP, varied AEP methodolo-

gies can result in large differences in threshold estimates for the same species, or even the same individual. Differences may vary on the order of tens of decibels, which has serious ramifications for determining the range of audibility for Navy acoustic sources, as well as for estimating impacts within mid- to low-frequency ranges where variances will be the greatest. This project team seeks to standardize approaches for threshold audiometry in order to make threshold estimates comparable across laboratories and researchers.



Bottlenose dolphin undergoing an AEP hearing test.

### THE METHODOLOGY

The Principal Investigator, Dorian Houser of the National Marine Mammal Foundation (NMMF), is currently funded by the National Oceanic and Atmospheric Administration to develop a database for the storage of AEP audiometry data collected by stranding network personnel and researchers. Funding from

LMR will allow the project team to standardize data collection efforts among groups performing cetacean evoked potential audiometry. This will permit rapid analysis of population level audiometry without extensive quality analysis required to account for the levels of variability that result from different methodological approaches.

## THE SCHEDULE

The first task, currently underway, is the development and promotion of a standardized methodology for the collection and reporting of audiometric information from toothed whales (odontocetes) through AEP methods. The proposed standard for testing the frequency range of hearing and the hearing sensitivity of odontocete cetaceans has been approved for development by the Acoustical Society of America Committee on Standards.

Following completion of the standard, the portable AEP system currently in use, the Evoked Response Study Tool (EVREST), will be reprogrammed according to the consensus methodologies determined through the standardization process. EVREST was developed by James Finneran of Space and Naval Warfare Systems Center Pacific, and is currently stationed at historic stranding points across the United States.

During the course of the project, the investigators will also travel to sites where novel animal strandings and wild animal captures may be occurring in order to capture AEP measurements opportunistically.

## NAVY BENEFITS

Standardization of hearing threshold estimates will facilitate the analysis of species hearing ranges and

sensitivities as used by Navy environmental planners when executing impact analyses. Increasing the amount of audiometric data for already tested species increases the knowledge on the expected audiometric variability within a species, whereas testing of novel species addresses data gaps in Navy's current environmental analyses with respect to acoustic impacts. Both sets of data benefit the Navy by reducing uncertainty as to which Navy acoustic sources might potentially impact a marine mammal species.

## TRANSITION

Data collected from wild odontocetes with the AEP systems, under standardized methods, will be incorporated into the national AEP database, which will be made available to Navy environmental planners. Data collected from novel species and from individuals for whom sufficient information for population-level audiometry can be evaluated will be published in peer-reviewed scientific literature. Refresher training for EVREST users will ensure quality data acquisition.

## ABOUT THE PRINCIPAL INVESTIGATOR

Dorian Houser is the Director of Conservation and Biological Research at the NMMF. Dorian holds a Ph.D. in biology and is active in research involving marine mammal physiology and bioacoustics. Dorian has spent nearly two decades in the study of how anthropogenic sound affects marine mammals and has been involved in the development of numerous environmental impact statements for the U.S. government.



## 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](mailto:exwc_lmr_program@navy.mil) or visit [www.lmr.navy.mil](http://www.lmr.navy.mil).

