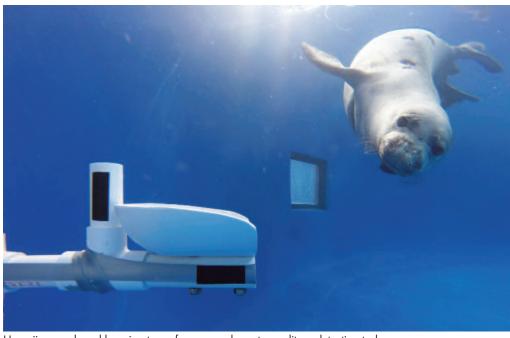# Behavioral Assessment of Auditory Sensitivity in Hawaiian Monk Seals

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 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.

Hawaiian monk seal learning to perform an underwater auditory detection task.
Colleen Reichmuth, NMFS authorization 19590

Many of the Navy's Pacific Fleet training and operation activities occur in waters surrounding the Hawaiian Islands, with some in areas overlapping habitat for the ESA-listed Hawaiian monk seal (*Neomonachus schauinslandi*). There is little bioacoustic information regarding the monk seal, including information about hearing abilities and production of underwater sounds. This lack of substantive information currently available for the species makes it difficult to make science-based decisions relative to possible effects of naval and other anthropogenic activities on these marine mammals. New data on monk seal hearing are needed to improve impact assessments of potential acoustic effects to monk seals resulting from Navy training and testing activities.

SOLUTION

This project will obtain reliable measures of underwater auditory sensitivity thresholds—across the full frequency range of hearing—for a specially trained adult male Hawaiian monk seal. The resulting data will be used to generate an underwater audiogram that will help to support impact assessments of the Hawaiian monk seal's sensitivity to sound.

METHODOLOGY

Researchers will work with an adult male Hawaiian monk seal currently in residence at the University of California at Santa Cruz's Long Marine Laboratory. The seal was previously trained for cooperative physiological research. The seal's hearing will be tested during auditory signal detection trials while diving in an acoustically calibrated pool.

The seal is trained to report the presence of a tone by touching a target, and to withhold responding in the absence of the tone. During the test, the tone's amplitude (generally considered to be the sound level) is progressively varied from an easily detectible level to an undetectable level. This approach makes it possible to measure the minimum sound levels reliably detected by the seal at a range of frequencies.

Experimental conditions are carefully controlled to minimize potential effects of environmental sounds or behavioral strategies. The resulting underwater hearing profile, or audiogram, will provide reliable information about the monk seal's ability to detect sounds that may be present in natural environments.

SCHEDULE

Environmental measurements and sound field mapping will be conducted in the seal's enclosure in fall 2017. Preparatory training of the monk seal for cooperative participation in audiometric research has already begun and will extend through winter 2018. Frequency-specific hearing thresholds measurements will be completed by fall 2018. Data analysis and manuscript preparation will be completed by winter 2019, and the underwater audiogram for the Hawaiian monk seal published by summer 2019, prior to the end date of the project.

NAVY BENEFITS

The results will allow the Navy to improve impact assessments and better estimate the potential acoustic effects on monk seals resulting from Navy training and testing activities.

TRANSITION

Project results will be provided through publication in a peer-reviewed journal and in data sets to support empirical risk function development for the Navy's at-sea environmental compliance efforts.

ABOUT THE PRINCIPAL INVESTIGATOR

Colleen Reichmuth is an animal behaviorist at the Institute of Marine Sciences, University of California at Santa Cruz. She has extensive experience conducting auditory research with marine mammals with a focus on behavioral psychoacoustic methods. Her expertise includes training marine mammals for voluntary participation in research, conducting field studies of animal acoustic communication and promoting best practices for the care and welfare of research animals Dr. Reichmuth earned her Ph.D. in Ocean Science at the University of California at Santa Cruz.

A key collaborator is Dr. Jillian Sills, a postdoctoral scholar at the University of California at Santa Cruz. She is a skilled bioacoustican that has conducted auditory research with harbor seals, spotted seals, ringed seals, bearded seals, sea lions, and sea otters.

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.