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Behavioral Responses of Odontocetes to Playback of Anthropogenic and Natural Sounds

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LONG-TERM GOALS

The long-term goal of this research project is to safely study responses of beaked whales to naval sounds in order to understand the causal chain of events leading from sound exposure to risks of stranding and to measure the exposure required to elicit responses that are safe but indicate potential for risk. The project is designed to provide critical information required to develop measures to protect beaked and other whales from risk of exposure to sonar and other sounds.

OBJECTIVES

A critical objective for understanding possible links between sonar exposure and injury or stranding involves developing techniques to safely study how beaked whales respond to sound. This project will establish, test and refine new protocols for studying beaked whales using established sound playback experiment paradigms; define responses of beaked whales and other species of odontocete whales to mid-frequency active (MFA) sonar and natural sounds such as those from killer whales; and measure exposure parameters for sounds that evoke a behavioral response.

APPROACH

The approach for this study involves controlled exposures to tagged whales where the scientific team controls the sound source. The WHOI team helped design and plan the study, built, tested and calibrated sound and orientation recording tags (Digital Archival Tag – DTAG), tagged beaked and pilot whales, and is helping to analyze and write up the results. Field efforts were conducted at the Atlantic Undersea Test and Evaluation Center (AUTEK) on Andros Island, Bahamas, adjacent to the deep canyon of the Tongue of the Ocean (TOTO). AUTEK has a 600 square mile, permanent range of 82 bottom mounted hydrophones which can be used for detecting and locating cetaceans on the range using the NUWC marine mammal monitoring equipment. Working at AUTEK requires close collaboration with NUWC and the marine mammal monitoring team. Tagging research has been conducted on this site to establish baseline data and continued collaboration will occur with the Bahamas Marine Mammal Research Organization (BMMRO) for vessels and staff. This project requires extensive collaboration with biologists from the Sea Mammal Research Unit (SMRU) at the University of St. Andrews, and bioacousticians at Cornell University. NUWC, BMMRO, Cornell, and SMRU collaborations are covered under separate funding.

WORK COMPLETED

The Cruise Report from BRS-07 describes the details of field work and preliminary analyses conducted during the 2007 field work. One playback of MFA sonar and killer whale calls was performed to one tagged adult female Blainville's beaked whale, *Mesoplodon densirostris*, and one playback of MFA sonar and killer whale calls was performed to two tagged pilot whales. The 2008 cruise is ongoing. The series of tropical storms and hurricanes in late August and Early September caused significant problems with the field effort, and forced the RV Revelle to leave the Tongue of the Ocean and to take refuge in Tampa. However the last week has been quite successful with one playback of PRN to a tagged Blainville's beaked whale, a PRN/MFA playback to a pilot whale (the tag was lost and is still being sought), another playback to both a tagged pilot whale and melon-headed whale, and a playback to a false killer whale. The cruise is not complete so there may be several more tags and playbacks completed by early October.

RESULTS

A clear avoidance response was observed in the beaked whale tagged in 2007 to both stimuli. The response to MFA sonar was similar but less intense than the response to killer whale calls, and it took more sound exposure to evoke the response to MFA sonar than killer whales. By contrast, pilot whales exposed to the same experimental protocol in 2007 showed elevated calling rates, formed tighter groups, and did not show such a clear avoidance response as beaked whales. These results, coupled with observational study of broader-scale responses of whales to actual sonar exercises, will help establish the contexts and exposures that pose a risk to which species, and will help establish measures to reduce the risk.

IMPACT/APPLICATIONS

This study aims to reduce risks to whales and to foster the development of mitigation measures by defining the mechanisms by which beaked whales and other species are affected by sonars.

RELATED PROJECTS

SERDP: Acoustic Response and Detection of Marine Mammals on Navy Ranges Using a Digital Acoustic Recording Tag.

Naval Oceanographic Office: Behavioral Response Study (BRS-07) analysis

Marine Mammal Monitoring on Navy Ranges (M3R; David Moretti PI, NUWC-NPT)

PUBLICATIONS

Boyd, I., D. Claridge, C. W. Clark, B. Southall, and P. L. Tyack (November 2007) Behavioral Response Study-2007 (BRS-07) Cruise Report

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