

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 30-04-2011		2. REPORT TYPE Final Report		3. DATES COVERED (From - To) SEP 2009 - DEC 2010	
4. TITLE AND SUBTITLE Studies of noise compensation in marine mammals				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER N00014-09-1-1188	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Parks, Susan, E				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Pennsylvania State University, Applied Research Laboratory, Office of Sponsored Programs, 110 Technology Center Building, University Park, PA 16802-7000				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research, 875 North Randolph Street, Arlington, VA 22203-1995				10. SPONSOR/MONITOR'S ACRONYM(S) ONR	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The proposed research will address the fundamental theoretical issue of noise compensation mechanisms in the vocal communication of marine mammals. Noise compensation mechanisms are important for improving signal transmission with an energy limited source. A better understanding of marine mammal noise compensation mechanisms can potentially provide effective means of improving signal transmission in a noisy marine environment and for assessing the impact of man-made sounds on the use of sound by marine mammals.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 3	19a. NAME OF RESPONSIBLE PERSON Susan E. Parks
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER (Include area code) (814)865-7683

Final Report

Studies of Noise Compensation in Marine Mammals

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Award Number: N00014-09-1-1188

LONG-TERM GOALS

The proposed research will address the fundamental theoretical issue of noise compensation mechanisms in the vocal communication of marine mammals. Noise compensation mechanisms are important for improving signal transmission with an energy limited source. A better understanding of marine mammal noise compensation mechanisms can potentially provide effective means of improving signal transmission in a noisy marine environment and for assessing the impact of man-made sounds on the use of sound by marine mammals.

OBJECTIVES

The primary objective of this project is to test hypotheses regarding right whale vocal adjustment to compensate for noise with data from Southern right whales (*Eubalaena australis*).

APPROACH

The approach for this study is to test hypotheses about common mechanisms of noise compensation in marine mammals with data collected from Southern right whales using autonomous bottom mounted recording devices and suction cup acoustic recording tags. Commercial shipping activity is significantly lower in the Southern hemisphere, providing the opportunity to compare the vocal behavior of a single species of right whale in areas with very low human activity to areas with active commercial ports in the same region. The primary proposed location to study the Southern right whale population is in Argentina, in two adjacent gulfs, Golfo San José and Golfo Nuevo. Both gulfs experience similar weather conditions and are used by a single population of Southern right whales but differ in the level of human activity. Golfo San José has extremely low levels of human activity as it is an established marine sanctuary for the whales, and therefore is expected to have a close to 'natural' ambient noise structure. Golfo Nuevo in contrast has a commercial port (Puerto Madryn) on its western shore, with frequent transits of large container and transport vessels in and out of the gulf. Data collection is planned in both gulfs to compare the vocal behavior of individual whales in very low and moderate noise conditions. These data will then be used to further test the general noise compensation hypotheses.

WORK COMPLETED

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The equipment covered by this award has been ordered and the four DSG acoustic recorders and four Acousonde tags were received in 2010. Each DSG acoustic recorder and Acousonde tag has been bench tested and prepared for deployment. Applications for permits for acoustic data collection in Argentina were been submitted by the Instituto de Conservación de Ballenas, the Argentine counterpart. Government agencies that issue research permits in Argentina are the Dirección de Fauna y Flora Silvestres and Dirección General de Conservación de Áreas Protegidas from Chubut. Permits were not approved, preventing deployment of equipment in September 2010. An alternate site to conduct a comparative study of high and low noise right whale habitat areas has been located in Brazil and a collaboration agreement established with the Projeto Baleia Franca/Brasil. Permit applications are currently being processed to conduct the originally planned study in Brazil in August & September 2011. The DSG recorders were fully tested by collecting data of exhibit noise and calls from beluga whales at the Mystic Aquarium to determine if captive beluga whales modify their calling behavior in increased noise during the summer of 2010.

RESULTS

Each of the DSG acoustic recorders has been tested and measurements have been obtained for the noise floor for the each recorder. Recordings of beluga whales were collected at Mystic Aquarium in 2010 (Figure 1) at multiple sampling rates and the DSG units were deployed for up to 12 hours per recording session. The Acousondes have been bench tested (Figure 2).

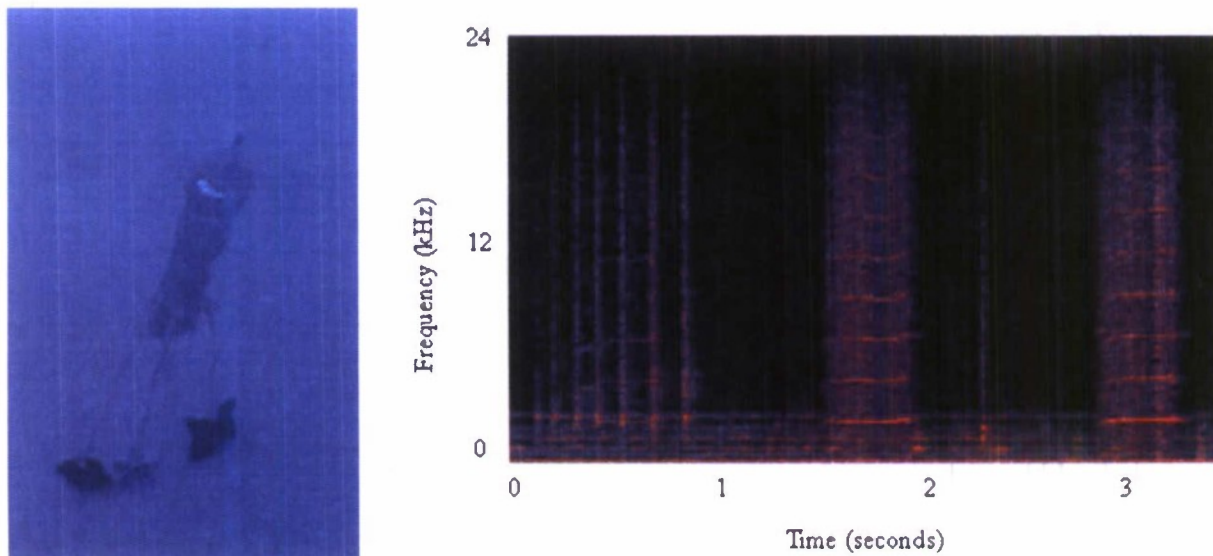


Figure 1. a) Photograph of the DSG deployed at the bottom of the beluga exhibit at the Mystic Aquarium and b) spectrogram sample of beluga whale calls recorded with the DSG.



Figure 2. Photograph of two of the four Acousondes.

IMPACT/APPLICATIONS

This study will lead to a better understanding of the existence of acoustic adaptations in right whale vocalizations and the types of vocal compensation mechanisms that they employ for coping with increased ambient noise conditions, including both natural and man-made sound sources. This project is a first step in developing a general theory regarding noise compensation mechanisms in marine mammal species.

RELATED PROJECTS

None