

WASHINGTON SEA GRANT PROGRESS REPORT
for the period 2/1/2007 – 01/31/2008

WSG Project Number: **R/Ac-15**
Project Title: Puget Sound Ambient Noise and its Relation to the Ecology of Marine Mammals

Principal Investigator(s) and Affiliation:
Peter Hans Dahl Univeristy of Washington, Applied Physics Lab.

1. ABSTRACT ELEMENTS

OBJECTIVES

The long term objectives are to: (1) quantify key physical properties of underwater ambient noise in Puget Sound and their temporal (daily, seasonal, and long-term) trends, (3) develop and explore new metrics of underwater sound that are more germane to managing the acoustic environment marine mammals are subjected to, (3) understand how this information relates to marine mammal ecology and behavior in Puget Sound. The emphasis is on Southern Resident Killer Whale (SRKW), which has recently been listed as endangered under the Endangered Species Act (ESA). The short term objective, within the scope of this proposal, is to carry out a limited pilot study consisting of underwater sound measurements at a site north of Smith Island, in northern Puget Sound. The site represents important SRKW habitat, and key auxiliary data on the environment and shipping activity are also available at this site.

METHODOLOGY

The methodology is based on obtaining measurements of ambient noise using four types of instrumentation in Puget Sound. These measurements were planned for summer 2007 at a site north of Smith Island and south of Lopez Island in marine sanctuary waters 100 m in depth. The measurements were to be carried out with the assistance of Washington Dept. of Fish & Wildlife who provided in-kind funding in the form a vessel and operator/biologist (Steve Jeffries).

The instruments are as follows:

- (1) Passive Acoustic Listening (PAL). This instrument consists of a single-hydrophone. The PAL device is well established in ambient noise studies and has been used in Puget Sound in studies in Haro Strait funded by the National Marine Fisheries Service (NW Fisheries Center).
- (2) DPAL, a dual-hydrophone version of the PAL. This device allows us to study ambient noise directional information.
- (3 and 4) Combined hydrophone/microphone buoy: A free drifting buoy consisting of a microphone for airborne noise source (primarily aircraft) combined with a hydrophone suspended directly below the microphone at a depth of approximately 1.5 m

RATIONALE

The ambient noise environment in Puget Sound has changed over the past 150 years owing to anthropogenic noise contributions following population growth and industrial activity. Southern resident killer whales are (ESA) listed as endangered, and it is accepted that their habitat is compromised in three ways: (1) reduced fish prey stalks, (2) water quality issues (e.g., PCBs), and (3) increasing levels of anthropogenic noise.

By addressing the third in an objective and direct manner this proposal provides an objective contribution to the dialogue on SRKW, habitat, and usage, in addition to contributing to a better understanding of acoustic ecology of Puget Sound. Graduate student training is part of this work, and users of the research include Navy region NW, marine operators, marine mammal researchers, and the general public.

The proposed work is appropriate for Sea Grant because: (1) it identifies and addresses important marine issues relating anthropogenic noise in Puget Sound, and noise at higher frequencies possibly more relevant to SRKW survival, (2) it develops and explores new metrics of underwater sound to provide better tools for management of the marine environment, and (3) it provides an opportunity for graduate student training in the are marine environmental technologies.

2. ACCOMPLISHMENTS AND OUTCOMES

A successful 4-day observation period was carried out from Aug 6-9, 2007 at site approximately 1 km north of Smith Island and 5 km offshore, in waters 100 m deep. Initial results were presented at the November 2007 meeting of the Acoustical Society of America in New Orleans.

3. IMPACTS

Food foraging by SRKW is done by echo location. This study will provide some of the first estimates of ambient noise within the frequency range used by SRKW populations in their echo location activities.

4. PERFORMANCE MEASURES

Measure 3: Percentage/number of tools, technologies, and information services that are used by managers (NOAA and/or its partners and customers) to improve ecosystem-based management.

Anticipated (12-month period following this reporting period):

New information on high-frequency ambient noise levels in SRKW critical habitat areas 1 and 3 as designated by the National Marine Fisheries Service (2006).

NMFS (National Marine Fisheries Services). 2006. Endangered and threatened species; designation of critical habitat for Southern Resident killer whales. Federal Register [Docket No. 060228057-6283-02, 29 November 2006] 71(229):69054–69070.

6. PRESENTATIONS - inc. Conference (Poster or Oral), Seminar & Public

Presentation: Dall'Osto D and PH Dahl, Environmental noise studies in Puget Sound, Presentation at the 154th Meeting of the Acoustical Society of America, New Orleans, November 2007

9. LIST ALL STUDENTS SUPPORTED BY OR AFFILIATED WITH THIS PROJECT

____ no students involved (check here if no students were involved in the project)

Student Name: David Dall'Osto

Department: Mechanical Engineering

Major/Degree field: Underwater acoustics

Major Professor: Peter H. Dahl

Student Type (Ph.D., M.S., M.A., B.S., B.A. J.D., etc): M.S.

Dissertation/Thesis title: TBD

Date of graduation (actual or anticipated): Jan 2009

Total support or affiliation period (e.g., Jan – June 2005):

Type of support (RA, research costs, conferences – list all that apply):

Current employment if applicable:

10. INTERACTIONS

This project has resulted in significant interaction with Steve Jeffries of the Washington Department of Fish and Wildlife who assisted in the 2007 field measurement effort.

We anticipated future significant interaction with the National Marine Fisheries Service, Northwest Fisheries Center, as we bring our results to their attention.

11. OUTREACH AND INFORMATION/TECHNOLOGY TRANSFER

A key follow up from this project will involve liaison with National Marine Fisheries Service, Northwest Fisheries Center, and NGO groups involved in SRKW conservation efforts.

12. FUTURE ACTIVITIES

We intend to complete a manuscript on our studies to be published in the *J. Acoust. Soc. Am.* We anticipate two main results emerging from this study (1) a measure of the ambient noise within

the frequency range most relevant to SRKW echo location (> 15 kHz), (2) a measure of the directional properties (in a vertical plane) of (a) background ambient noise and (b) more episodic noise originating from boats passing overhead.