Acoustic Moorings for Integrated Cetacean-Prey Studies

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LONG-TERM GOALS

Develop acoustic moorings that will allow concurrent passive and active acoustic data collection to be used in the SCB, an area of high naval use, for refinement of predictive models of cetaceans and their prey.

OBJECTIVES

Procure components for acoustic moorings consisting of passive and active components, as well as conductivity-temperature-depth (CTD) recorders. Assemble two moorings to be used for concurrent collection of cetacean and prey long-term time series.

APPROACH

The moorings will consist of a passive acoustic component for monitoring of cetaceans, active acoustic echosounders at two depths to monitor both baleen whale and beaked whale prey, CTDs at the same depths as the active echosounders, and a redundant acoustic release system. The passive acoustic component will be a High-frequency Acoustic Recording Package (HARP), consisting of data logger and battery cases, and a hydrophone for passive acoustic monitoring of cetaceans (Wiggins & Hildebrand 2007). The HARPs will be able to record continuously at high enough bandwidth to monitor the full acoustic repertoire of cetaceans likely to occur in the area. The HARP will be mounted near the bottom of the mooring at approximately 1,000 m depth. The HARPs are made in-house at the Scripps Institution of Oceanography (SIO).

The active acoustic component to measure temporal and vertical spatial distribution of zooplankton and nekton in the water column will consist of two echosounder systems per mooring deployed at different depths. One unit will be fixed at full depth, just above the HARP, and the other 300 m from the surface. Deployment of these systems at different depths will allow abundance estimation of krill and other baleen whale prey in shallow water, as well as estimation of beaked and sperm whale prey (primarily squid) in deep waters. Initially, active acoustic system proposed for this work was the Acoustic Zooplankton Fish Profiler (AZFP), commercially available from ASL Environmental Sciences. AZFP consists of multiple-frequency (38 and 200 kHz most suitable for this work) echosounders. Another active acoustic option that recently became available is Wide-Bandwidth Autonomous Transceiver (WBAT) developed by Simrad. A combination of the two types of systems

may be used in the final mooring setup. Both of these autonomous active acoustic systems are self-contained, battery operated, and have programmable sampling periods.

Temperature, salinity, and pressure measurements will be collected using MicroCAT systems at 300 m (SBE37-SMP) and full mooring depth (SBE37-SM). The systems will collect data every hour. The system at 300 m will be equipped with an additional, integral pump that runs for 1 s each time the MicroCAT samples. This will allow improved conductivity measurement and decrease biofouling, which can be an issue for long-term deployments at shallower depths. The MicroCATs will provide information on changes in water masses over time, giving a crucial link to wider environmental conditions at the site. MicroCATs are available commercially from Sea-Bird Electronics.

WORK COMPLETED

This project just started and thus no work has been completed yet. Final decisions on active acoustic system to be procured are still being made.

RESULTS

This project just started and thus there are no results to report.

IMPACT/APPLICATIONS

These moorings will be used in the SCB, an area of high naval use, for refinement of habitat use and predictive models of cetaceans and their prey. In addition, the new moorings will lead to an increased ecosystem monitoring capability of HARPs, which are currently used in multiple Navy ranges for monitoring (Hildebrand et al. 2011, Baumann-Pickering et al. 2012, Hildebrand et al. 2012, Širović et al. 2012, Kerosky et al. 2013). This upgrade to a multi-faceted system will mean that research is no longer limited to cetacean taxa, but will allow studies of cetaceans and prey in an integrated way. Beyond their utility for cetacean-prey studies and marine mammal monitoring, these systems will also be integral for continued education of young marine mammal scientists and oceanographers by allowing a truly multidisciplinary perspective, by merging acoustics, biology, and oceanography to answering a suite of ecological questions.

RELATED PROJECTS

The proposed moorings will lead to research that represents a natural next step from several currently funded projects. In two recently completed projects (ONR grant N000141210904 to PIs Širović and Hildebrand and N000141210273 to PIs Baumann-Pickering and Hildebrand), habitat use models were developed for blue and fin, as well as beaked, whales, respectively. In these projects, long-term passive acoustic data collected in the SCB were used to describe, at a very fine scale, the temporal variation, as well spatial variability in cetacean presence in this area (Širović et al. 2015). A limitation of the current approach, however, is that the only environmental data that are available at the same temporal scale are based on remote sensing (Širović et al. in prep). Prey information, however, cannot be estimated from remotely sensed data, and thus the developed models are missing that direct link between cetaceans and their prey which will be brought in with these moorings.

REFERENCES

Baumann-Pickering S, Širović A, Hildebrand JA, Cummins A, Gottlieb R, Johnson S, Kerosky S, Roche L, Solsona Berga A, Wakefield L, Wiggins SM (2012) Passive Acoustic Monitoring for Marine Mammals in the Gulf of Alaska Temporary Maritime Activities Area 2011-2012. MPL Technical Memo #538. La Jolla, CA.

Hildebrand JA, Baumann-Pickering S, Širović A, Bassett H, Cummins A, Kerosky S, Roche L, Simonis A, Wiggins SM (2011) Passive Acoustic Monitoring for Marine Mammals in the SOCAL Naval Training Area 2010-2011. MPL Technical Memo #531. La Jolla, CA.

Hildebrand JA, Baumann-Pickering S, Širović A, Buccowich J, Debich A, Johnson S, Kerosky S, Roche L, Solsona Berga A, Wiggins SM (2012) Passive Acoustic Monitoring for Marine Mammals in the SOCAL Naval Training Area 2011-2012. MPL Technical Memo #537 La Jolla, CA.

Kerosky S, Baumann-Pickering S, Širović A, Buccowich JS, Debich AJ, Johnson SC, Roche LK, Thayre B, Wakefield L, Wiggins SM, Hildebrand JA (2013) Passive Acoustic Monitoring for Marine Mammals in the SOCAL Naval Training Area during 2012. MPL Technical Memo #544. La Jolla, CA.

Širović A, Hildebrand JA, Simone Baumann-Pickering, Buccowich J, Cummins A, Kerosky S, Roche L, Solsona Berga A, Wiggins SM (2012) Passive Acoustic Monitoring for Marine Mammals in the Northwest Training Range Complex 2011. MPL Technical Memo #535. La Jolla, CA.

Širović A, Rice A, Chou E, Hildebrand JA, Wiggins SM, Roch MA (2015) Seven years of blue and fin whale call abundance in southern California. Endangered Species Research 28:61-76.

Širović A, Chou E, Roch MA (in prep) Habitat use of calling blue and fin whales in Southern California Bight. Marine Ecology Progress Series.

Wiggins SM, Hildebrand JA (2007) High-frequency Acoustic Recording Package (HARP) for broad-band, long-term marine mammal monitoring. Proceedings of the International Symposium on Underwater Technology 2007 and International Workshop on Scientific Use of Submarine Cables and Related Technologies. IEEE, Tokyo, Japan.