Print

T. Aran Mooney: Soundscapes and Passive Acoustics

Soundscapes

Introduction

Numerous fish, marine mammals and invertebrate species use sound in the ocean to communicate, navigate, find prey, and listen for or avoid predators. Sound in the ocean is a useful sensory modality because it can travel efficiently over long distances, and is available in deep, dark and murky waters, when light and other cues might not be. The diverse assemblage of sounds in the ocean are often referred to as the “soundscape”. Humans also produce a substantial amount of ocean noise, which can influence and change a local soundscape, and consequently could affect animal behavior.

Our soundscape research investigates spatial and temporal variability in the sounds produced by marine animals and humans in a range of marine ecosystems. Specifically, we are interested in the relationship between the sounds produced in a given habitat and the animals that live there. One of our major research questions is – do the variety and abundance of sounds recorded in a given habitat accurately reflect that habitat’s animal biodiversity? Currently, our we are carrying out research in St John, US Virgin Islands, Maui, Hawaii, and Nantucket Sound, Massachusetts. These projects are detailed below.

Aran inspecting a coral in the USVI.

(Photo: M Kaplan)

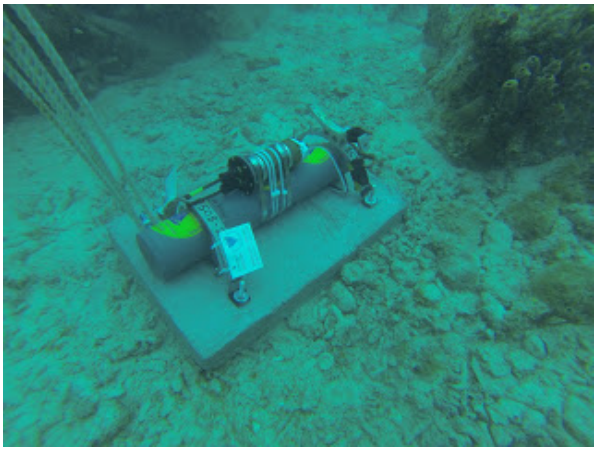
Aran deploying acoustic recorders on a

reef in the USVI. (Photo: M Kaplan)

Coral reefs soundscapes

Coral reef soundscapes

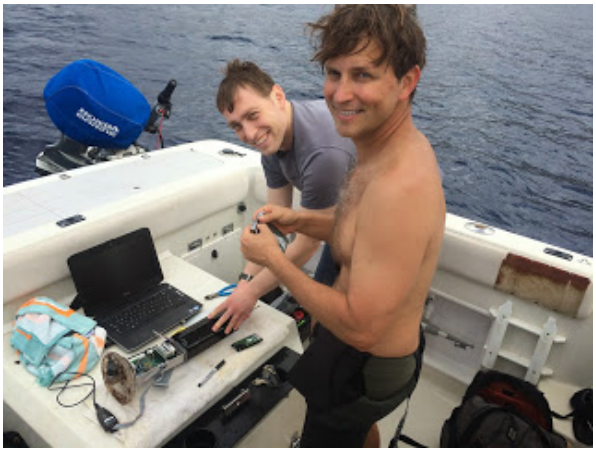
We deployed broadband digital passive acoustic recorders developed at WHOI to assess species richness and relative animal abundance in the US Virgin Islands National Park in 2013. The goal of that project was to use short- (24 hour) and long-term (4 month) measurements to evaluate the spatial and temporal variability in the local soundscape of coral reef habitats across multiple sites. These acoustic recorders were deployed in a range of healthy and impacted coral reef sites in order to collect baseline recordings from locations with varying biological diversity. Those data were the basis of two recent publications. This approach may provide a novel means to assess both spatiotemporal heterogeneity and monitor marine ecosystem health, as well as track human activity in an area. More broadly, this investigation can help the managers and government agencies to identify changes in animal abundance and distribution, to designate key areas for protection, and to highlight areas that may be vulnerable to a changing environment.



Deployed DSG (large grey cylinder) and DMON (above DSG) on a reef in the USVI.

(Photo: M Kaplan)

We are currently carrying out a follow-up project on a much larger scale in Maui, Hawaii, in collaboration with Dr. Marc Lammers of the Oceanwide Science Institute. We have eight reefs instrumented with acoustic recorders and temperature loggers and have been carrying out concurrent visual surveys. The recorders are due to be retrieved in January 2016, yielding a total of 16 months of data collection.



Marc Lammers and Max refurbishing an EAR acoustic recording on the OSI Vessel in Maui, HI.

(Photo: A Mooney)

Cape Wind

Project summary

This work includes monitoring the marine soundscape on and near Horseshoe Shoals, Nantucket Sound, the proposed Cape Wind windfarm site. The goal is to establish baseline passive acoustic monitoring of this ecosystem and identify the occurence of different types sounds (and hence, biological activity and physical events). We're looking for a motivated graduate student to assist with this project.

This early work is novel and critical to establish the baseline soundscape of the Nantucket Sound environment. Deoployments began in April (2012) using WHOI's innovative acoustic recording device called the DMON (Digital acoustic Monitors). This records broadband (up to 60 kHz). As part of this project, we are going out to Nantucket Sound on a weekly basis to change out DMONs and download the data. We also developed a simple mooring to deploy the DMON.

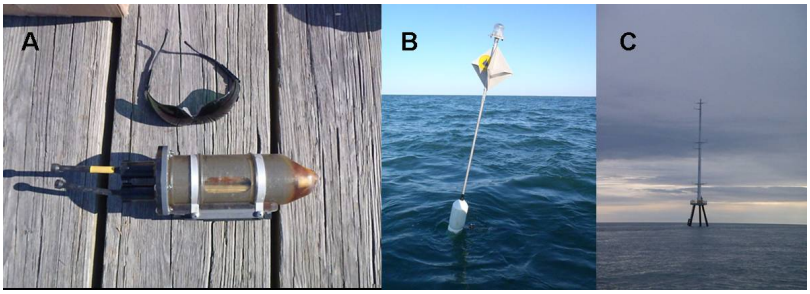


Figure 1. (A)The DMON on the dock after retrieval. This small device records sounds from low-frequency fish and construction sounds to ultrasonic dolphin signals. (B) Our mooring on Horseshoe Shoals, Nantucket Sound, site of the future Cape Wind windfarm. (C) The current CapeWind 'test' platform on Horseshoe Shoals. Our DMON is approximately 200 m from this platform.

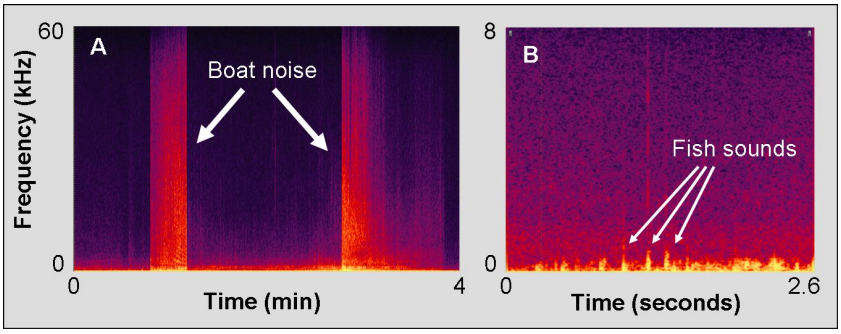
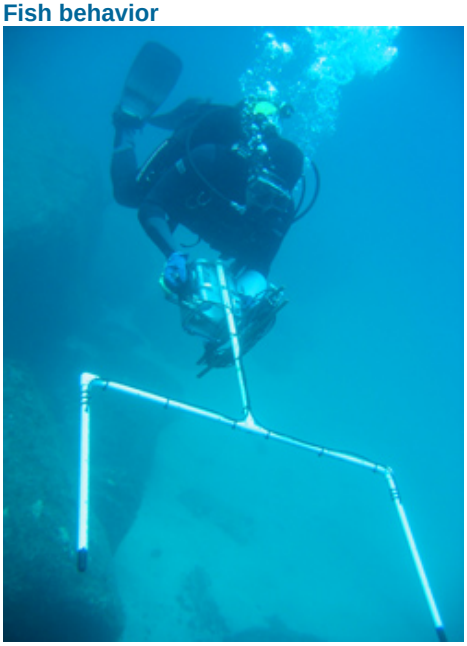


Figure 2. Sound recordings from the first DMON deployment on Horseshoe Shoals, Nantucket Sound. (A) Shows noise from nearby fishing vessels, but otherwise a relatively quiet environment. (B) Yet unidentified fish sounds.

This project was catalyzed by support from the Harrison Foundation, the John E. and Anne W. Sawyer Endowed Fund and continues with support from NOAA's Sea Grant.

Fish behavior



Project summary
Prior work has included developing an hand-held, diver-operated passive acoustic system to record fish sounds and associated swimming behaviors.

Mooney, TA, Lammers, MO, Santos, PA, and Nachtigall, PE. An underwater system to monitor ecologically important fish sounds: Characterization and diel trends of three species of Pomacentrids. 149th Meeting of the Acoustical Society of America. Vancouver, B.C., Canada. May 16-20, 2005.

The EAR

Enlarge image

Project summary

I contributed to the development of the EAR (Ecological Acoustic Recorder), a passive acoustic monitoring device used in reef and deep sea environments.

An Ecological Acoustic Recorder (EAR) for long-term monitoring of biological and anthropogenic sounds on coral reefs and other marine habitats

Keeping track of long-term biological trends in many marine habitats is a challenging task that is exacerbated when the habitats in question are in remote locations. Monitoring the ambient sound field may be a useful way of gauging biological activity because many behavioral processes are often accompanied by sound production. This article reports the preliminary results of an effort to develop and use an Ecological Acoustic Recorder (EAR) to monitor biological activity on coral reefs and in surrounding waters for periods of up to one year. The EAR is a microprocessor-based autonomous recorder designed to periodically sample the ambient sound field and also automatically detect sounds that meet specific criteria. The system was used to record the sound field of coral reefs and other marine habitats on Oahu, Hawaii. Snapping shrimp produced the dominant acoustic energy on the reefs examined and exhibited clear diel acoustic trends. Other biological sounds recorded included those produced by fish and cetaceans, which also exhibited distinct temporal variability. Motor vessel activity could also be monitored effectively with the EAR. The results indicate that acoustic monitoring may be an effective means of tracking biological and anthropogenic activity at locations where traditional surveys are impractical.

Lammers, MO, Brainard, RE, Au, WWL, Mooney, TA, Wong, K. 2008. An ecological acoustic recorder (EAR) for long-term monitoring of biological and anthropogenic sounds on coral reefs and other marine habitats. 123(3): 1720-1228. Journal of the Acoustical Society of America.

Last updated: September 8, 2015

Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.
E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000
Problems or questions about the site, please contact webdev@whoi.edu