Establishing a baseline for acoustic monitoring in the Waquoit Bay National Estuarine Research Reserve

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Introduction

- **Passive acoustic monitoring (PAM)** is a cost- and time-effective means of long-term remote monitoring.
- PAM may **complement existing methods of monitoring** and help **assess the success of restoration efforts** in the National Estuarine Research Reserve System and elsewhere
- To implement PAM, first need to establish baseline conditions and methodology for recording
- **Objective: Collect baseline data to understand characteristics of reserve soundscapes**

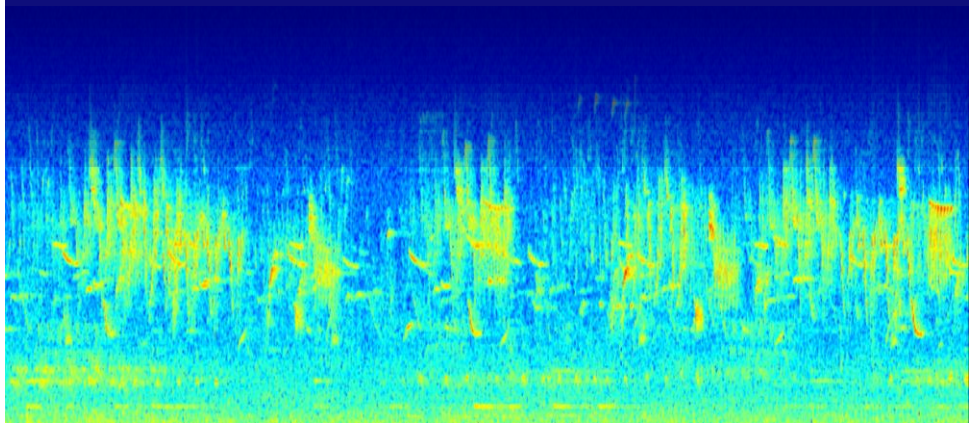
Methods

1) Is PAM effective and comparable among sites?
- Established **recording schedules**
- Tone playbacks to determine differences in **signal attenuation**

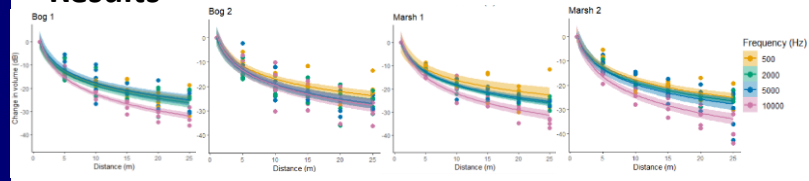
2) What patterns of activity are observed?
- Deployed recorders at 3 distinct habitats for 3 weeks
- Calculated **indices** to get **snapshot view** of soundscape characteristics

3) What signals are present?
- Deployed recorders for 2 months in **pre- and post-restoration** salt marsh and upland bog habitats
- **Identified signals** manually and using detectors

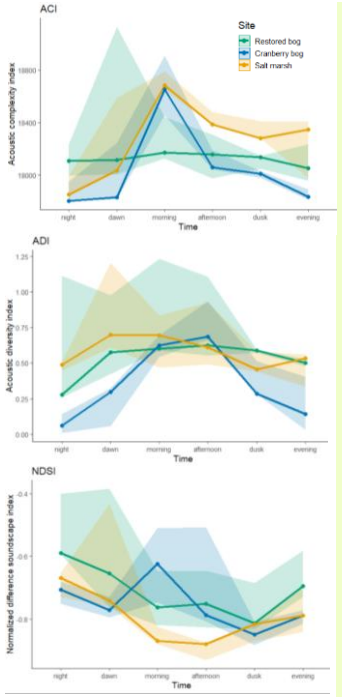
Acoustic monitoring reveals differences in biological activity between **degraded and restored habitats**



Results



1) Signal attenuation differs by **frequency** but **not by site**

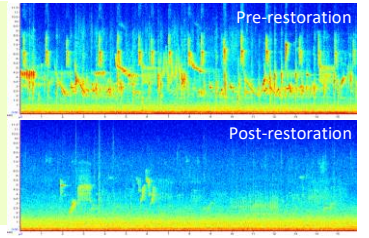


2) **Acoustic complexity:** measures irregularity in volume of sound, used as a **proxy for biodiversity**
- Differs by site and over time
- **Peaks with avian morning chorus**

Acoustic diversity: measures evenness of energy over different frequency band, **used as a proxy for biodiversity**
- Differs by site and over time
- Highest around **mid-day**

Normalized Difference Soundscape Index: ratio of anthropogenic sound to biological sound, where more **negative values indicate more anthropogenic sound**
- Differs by site and over time
- Most influence of anthropogenic sound **in afternoon/evening**

3) Numerous species of ecological importance identified, including **ospreys and coyotes**
- Pre- and post-restoration bogs have **distinct acoustic communities**



Conclusions

- PAM can remotely monitor sites in the long term with limited expense and personnel
- Differences in habitat quality can be determined through qualitative and quantitative analysis