Designing an Investigation on the Effect of Ship Sound on the North Pacific Fin Whale

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Background

- Very few acoustic studies have been conducted on the effects of ship sound on fin whales and all have small data sets
- Increasing shipping traffic in the Pacific Ocean
- Most characteristic call is a 20 Hz, 1 sec chirp from males during breeding
- 40 Hz call has been linked to feeding
- Low-frequency ship signals overlap with fin whale calls and may cause masking or behavioral disruptions

Hypothesis

- Fin whales change their call rate in the presence of ship sound

$$H_1: \Delta|callrate| > 0$$

Null Hypothesis

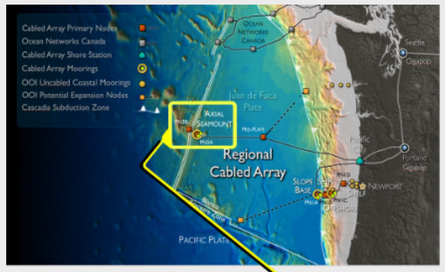
- There's no change in the fin whale call rate in the presence of ship sound

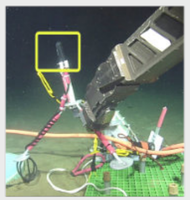
$$H_0: \Delta|callrate| = 0$$

$$callrate = \frac{\#\ calls}{30\ mins}$$

Study Area

- Ocean Observatories Initiative's (OOI) Regional Cabled Array (RCA) off the Pacific Northwest coast is an untapped resource with years of low frequency acoustic data
- Current study using low frequency hydrophone at Axial Seamount Base (OO:AXBA1:HDH)

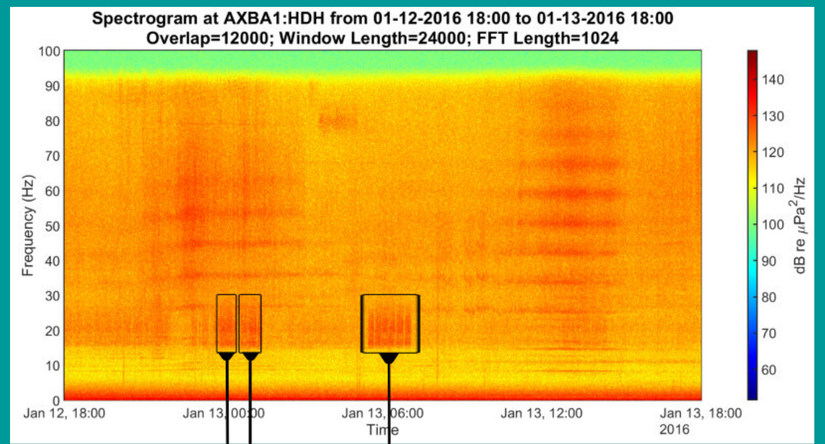


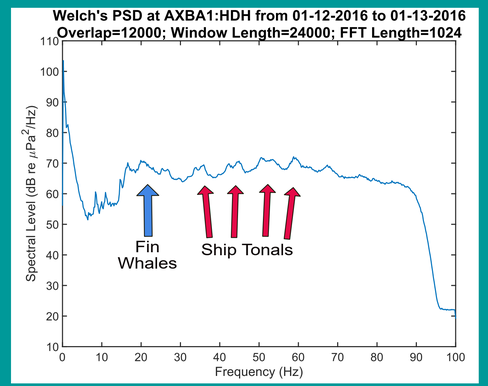


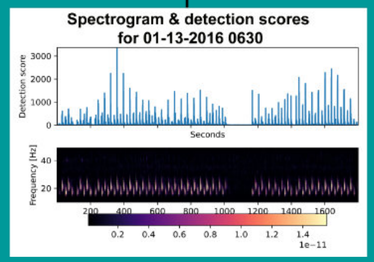
Oregon Slope Base
Low Frequency Hydrophone
Photo Credit: NSF-OOI/UW/CSSF, Drive R1751, VISIONS14

Modified figures from Ocean Observatories Initiative (OOI)

OOI RCA provides a long-term data set to understand the effect of ship sound on fin whale call production



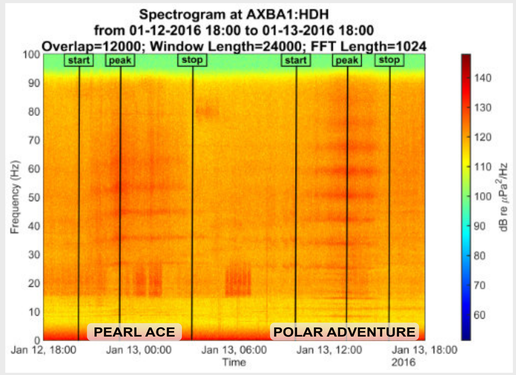


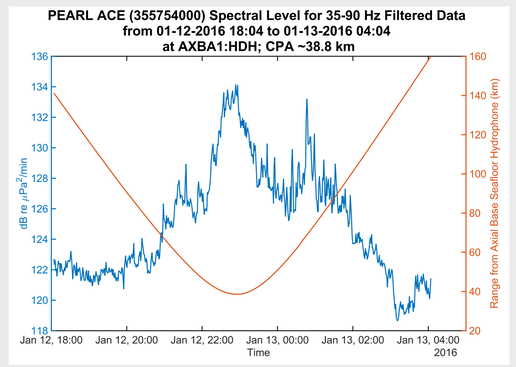


Fin whale detection output

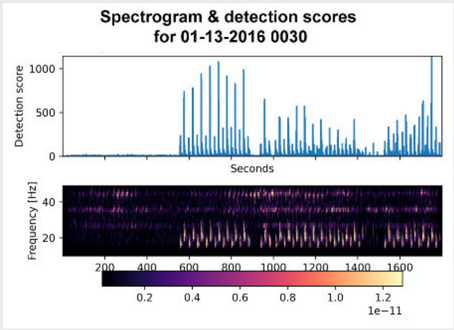
Methods

- Ship detections were visually selected using spectrograms
- Additional verification can be made using data from the Automated Identification System (AIS)





- To avoid fin whale calls at ~15-30 Hz, data were filtered with 5-13 Hz and 35-90 Hz Bandpass filters
- Background noise was estimated through a linear interpolation of the noise averages before and after ship passage
- Fin whale detections were gathered using existing software, whaletracks (Ref. Rose Hilmo, https://github.com/rosehilmo/whaletracks)



Next Steps

- Identify minimum fin whale amplitude detectable during periods of high noise
- Calculate call rate
- Develop Graphical User Interface (GUI) software to make ship detections
- Implement statistical methods to test for a correlation between ship sound and fin whale call rates
- Scale software to perform analyses on multiple years data

Limitations

- Fin whale received level measured at low frequency hydrophone rather than at the whale
- Uncontrolled environment near main shipping lane