Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the Outer Continental Shelf

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Scope and Objectives

Phase 1:

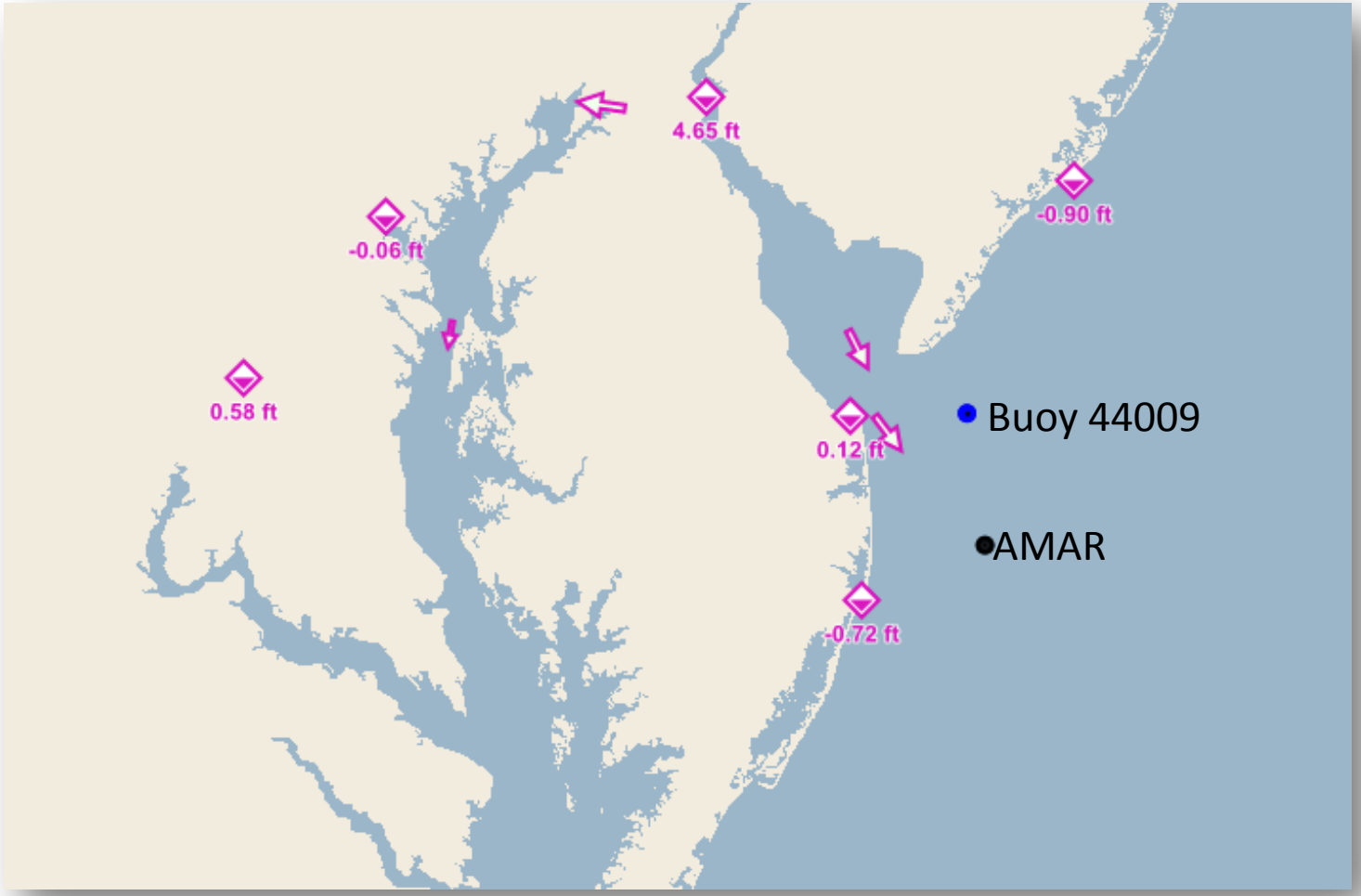
Pre-construction assessment of the ambient acoustic environment

Phase 2 (Optional): Acoustic monitoring during construction of renewable power generation facility

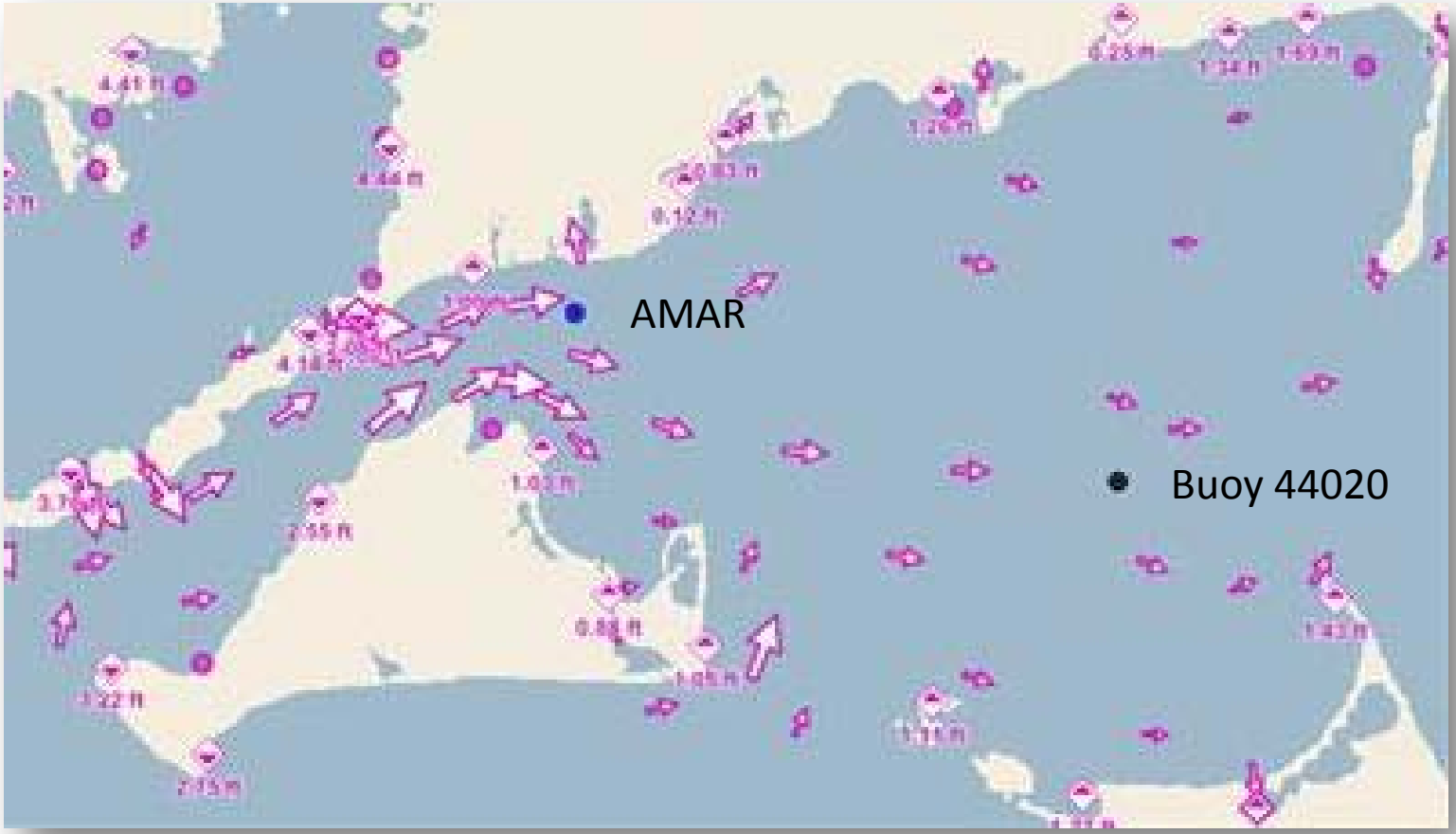
- Phase 1: Objective
  - Analyze ambient (background) noise in areas of the OCS that may be developed for renewable power generation
  - Retain data for further analysis of biological inhabitants in study areas

- Phase 1: Scope
  - One-year study to record and analyze the ambient sounds at two BOEMRE-selected sites:
    - 1) mouth of Delaware Bay
    - 2) Nantucket Sound

Delaware Bay



Nantucket Sound



AMAR

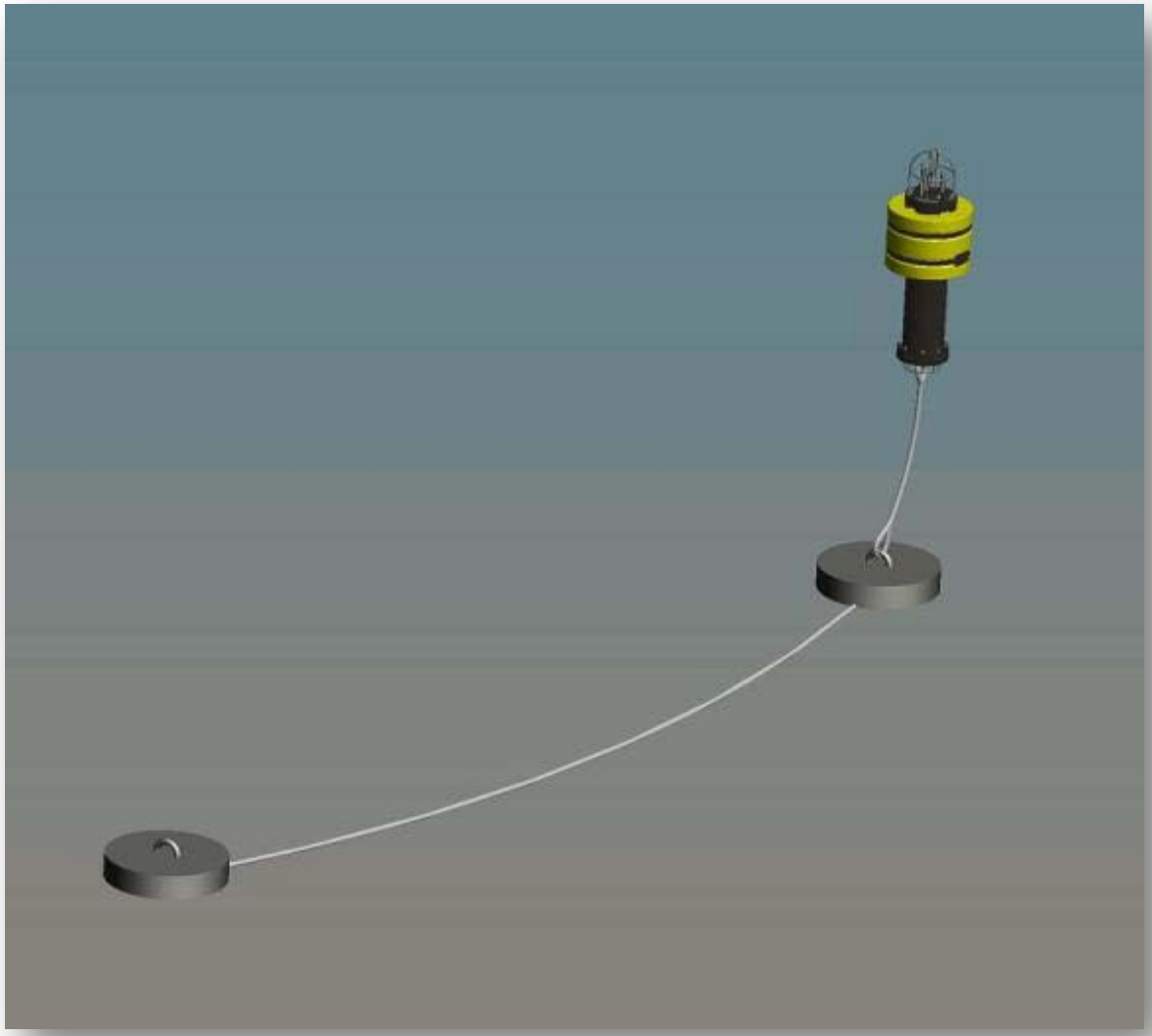
Float-on-a-rope style, grapple recovery

Geospectrum M15B or M8E hydrophones

24-bit resolution (low noise floor)

32 kHz sampling rate, (5 – 15,040 Hz)

768 GB solid-state storage



Methods – Recorders

4 three-month deployments:

June– Oct

Oct – Jan

Jan – Apr

Apr – Jun

Recording Sites in Delaware Bay (69’) Nantucket (55’)

NDBC Buoys 44020 and 44009 used for meteorological data.

Methods – Deployments

Deployment Status

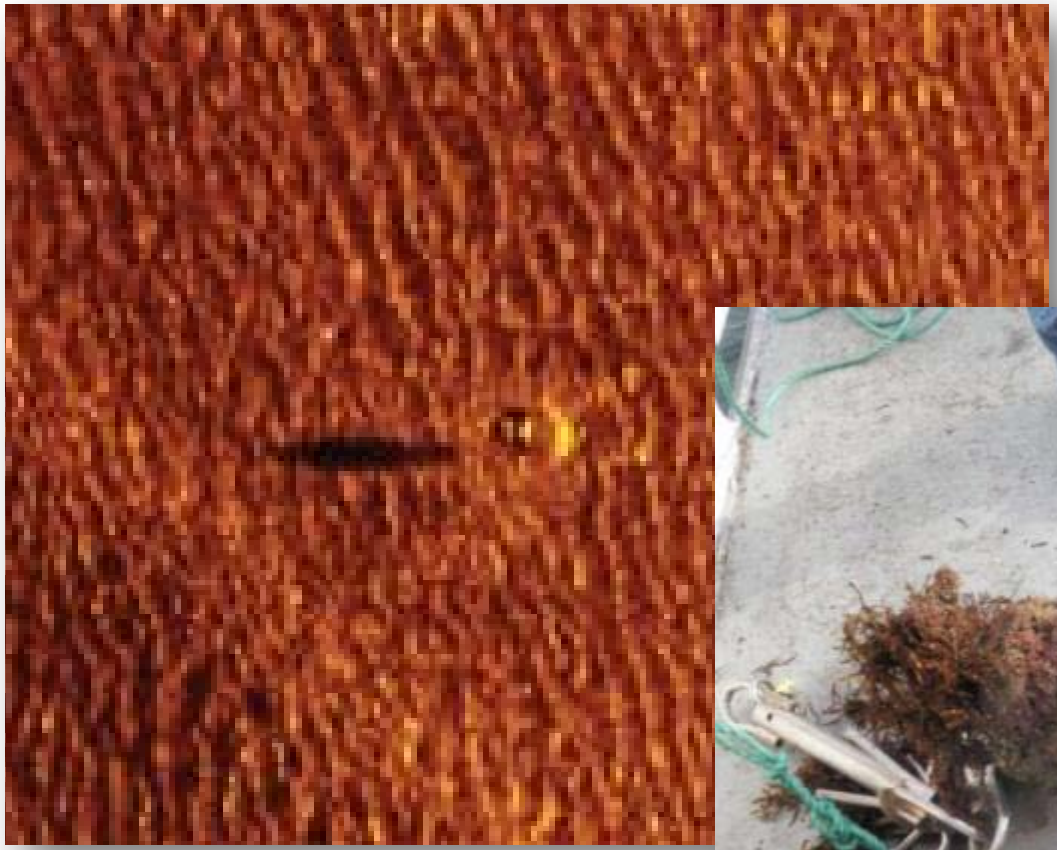
Jun – Oct 2010

- Delaware Bay
  - Successful AMAR recovery
  - Successful data recovery
- Nantucket
  - Unsuccessful AMAR recovery
  - Successful recovery in January
    - found with side-scan sonar
    - recovery line was tangled
  - Unsuccessful data recovery
    - unit failed after deployment

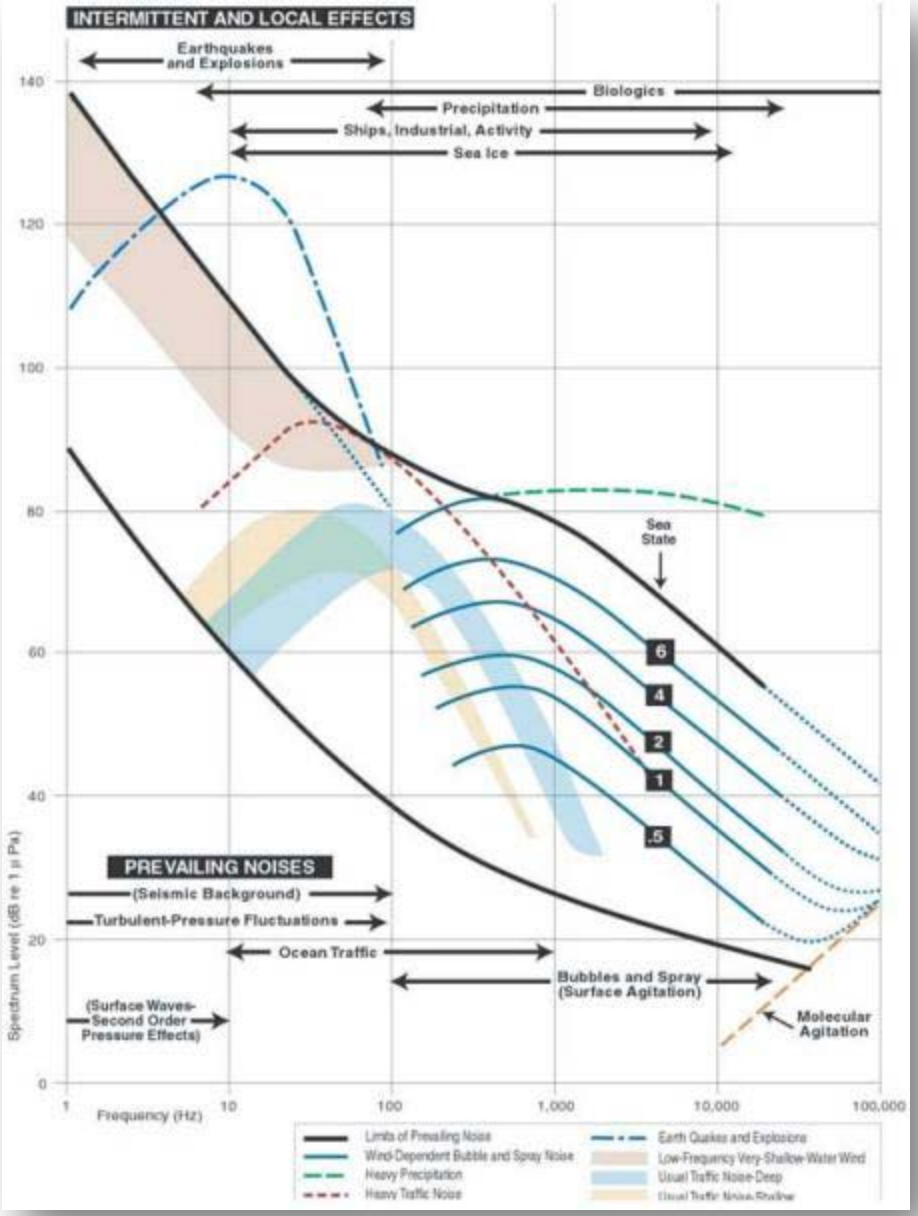
Oct 2010 – Jan 2011

- Delaware Bay
  - Unsuccessful AMAR recovery
    - will attempt recovery in April
- Nantucket
  - Successful AMAR recovery
  - Successful data recovery

AMAR Recovery at Nantucket (January)



Wenz Curves



Wenz (1962) JASA

National Research Council (2003)

Methods for Ambient Acoustic Analysis

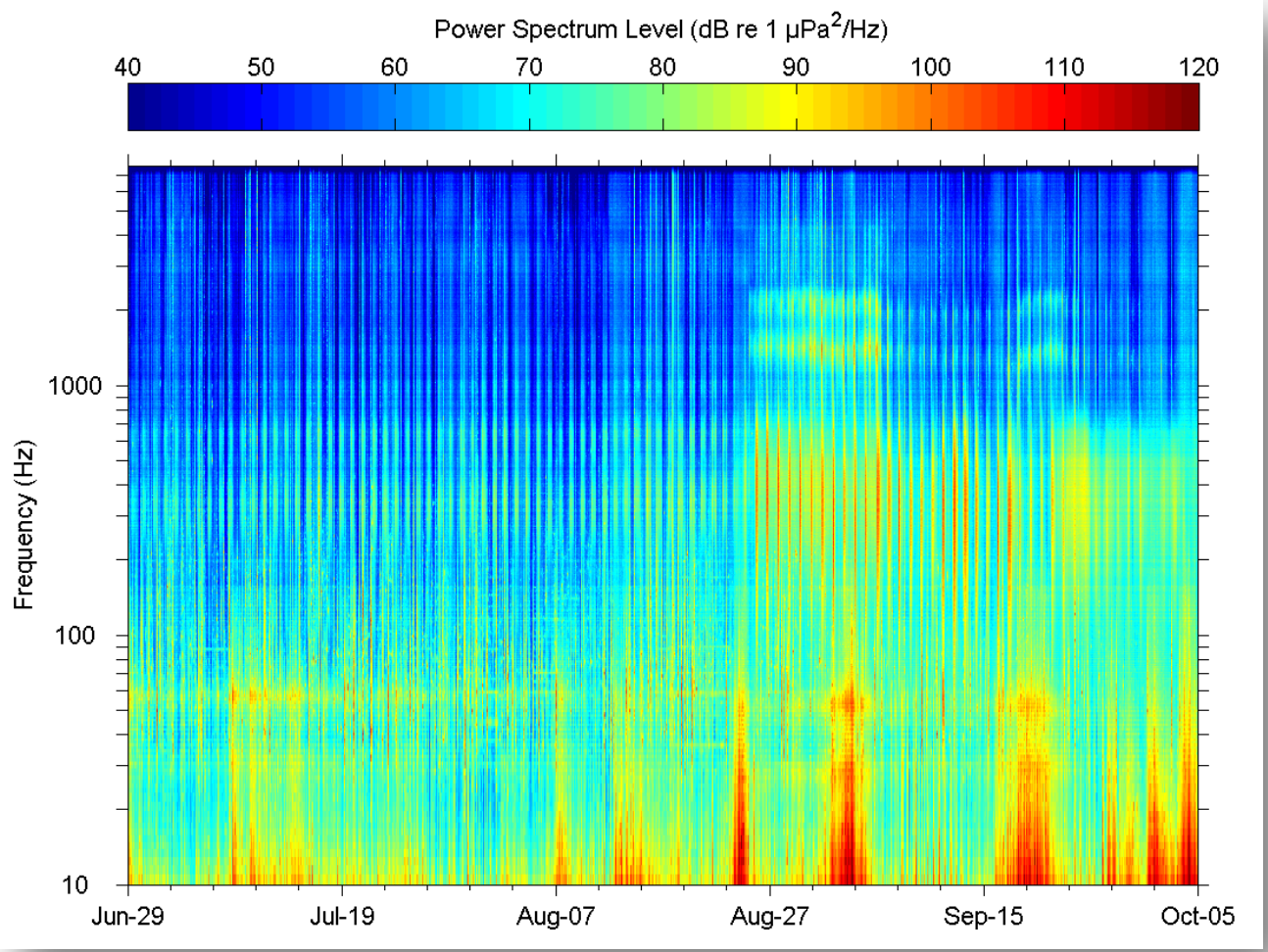
- Spectral Analysis
  - Fast Fourier Transform (FFT) on 1 s windows with 50% overlap
  - Averaged at 1 min intervals
- Presentation of Results
  - Spectrograms & band-level plots
  - Quartile-distribution plots for entire duration of recording

Ambient Analysis Results

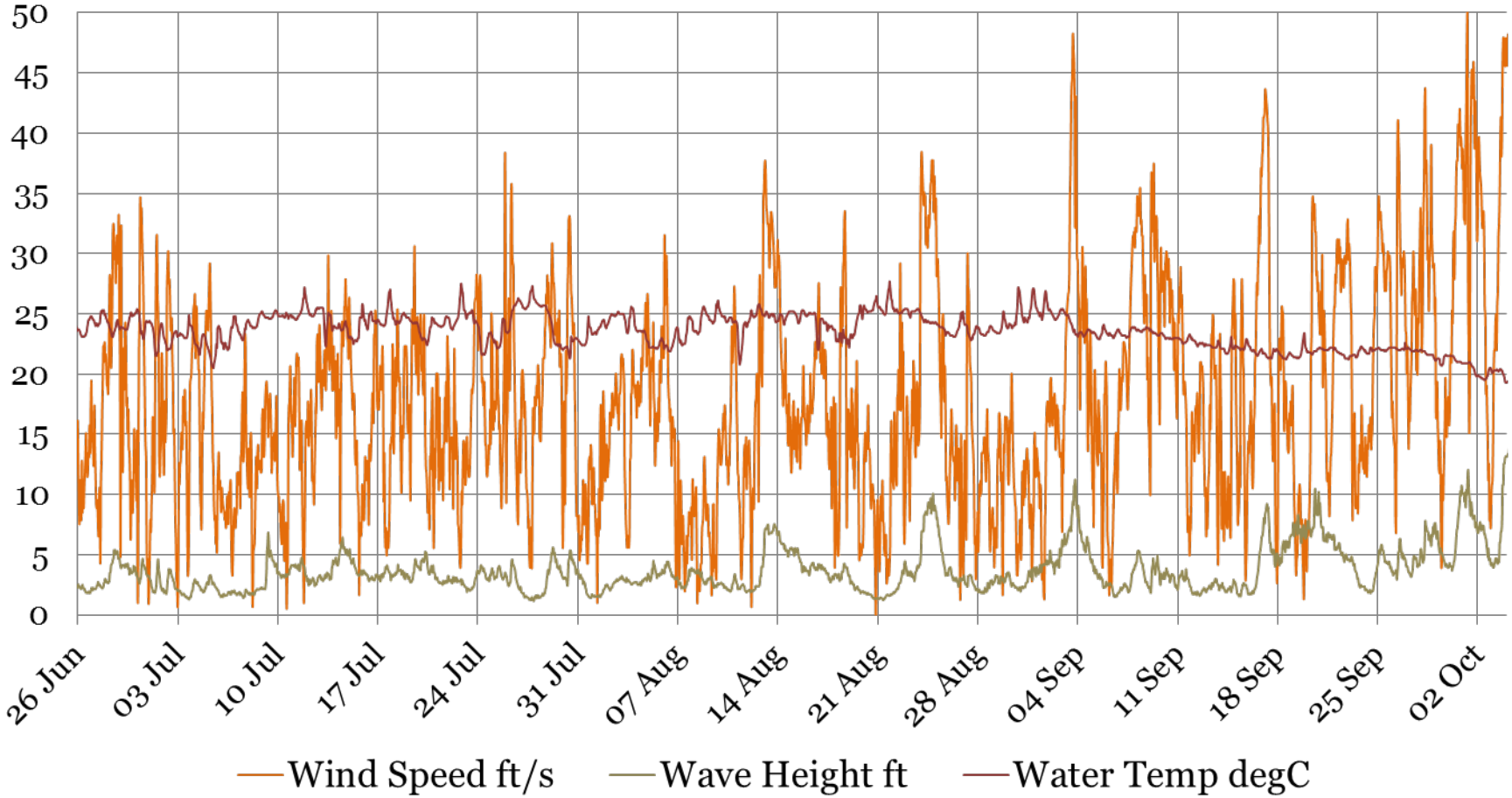
DELAWARE BAY

(JUNE – OCTOBER, 2010)

Ambient Acoustic Results – Spectrogram

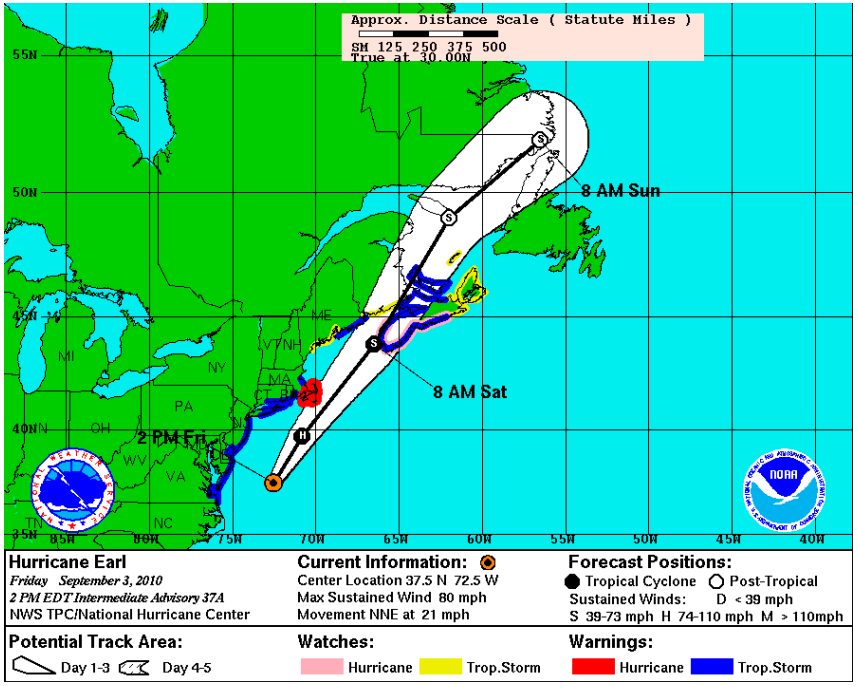


Meteorological Data (Buoy 44009 Jun – Oct)

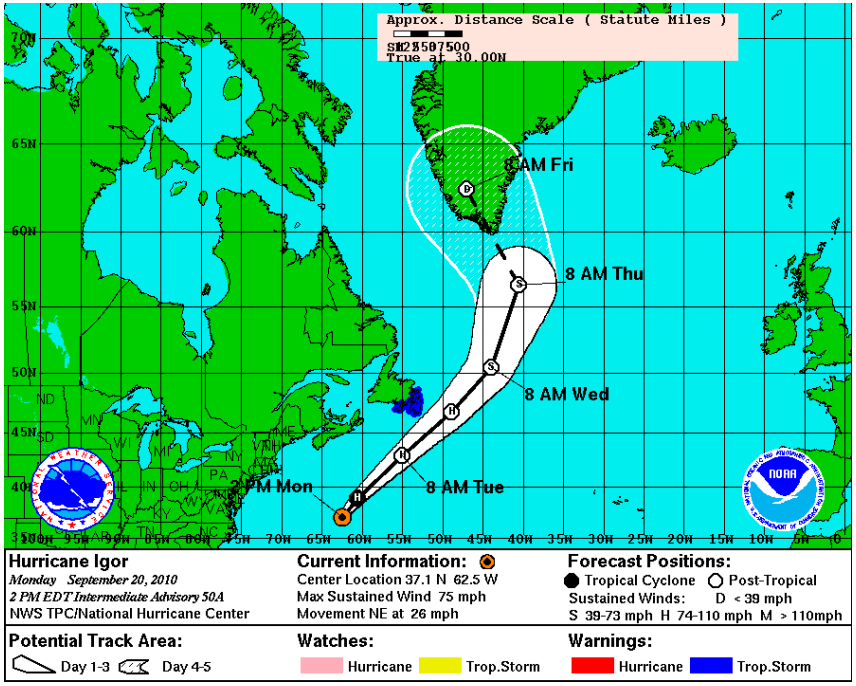


Hurricane Tracks

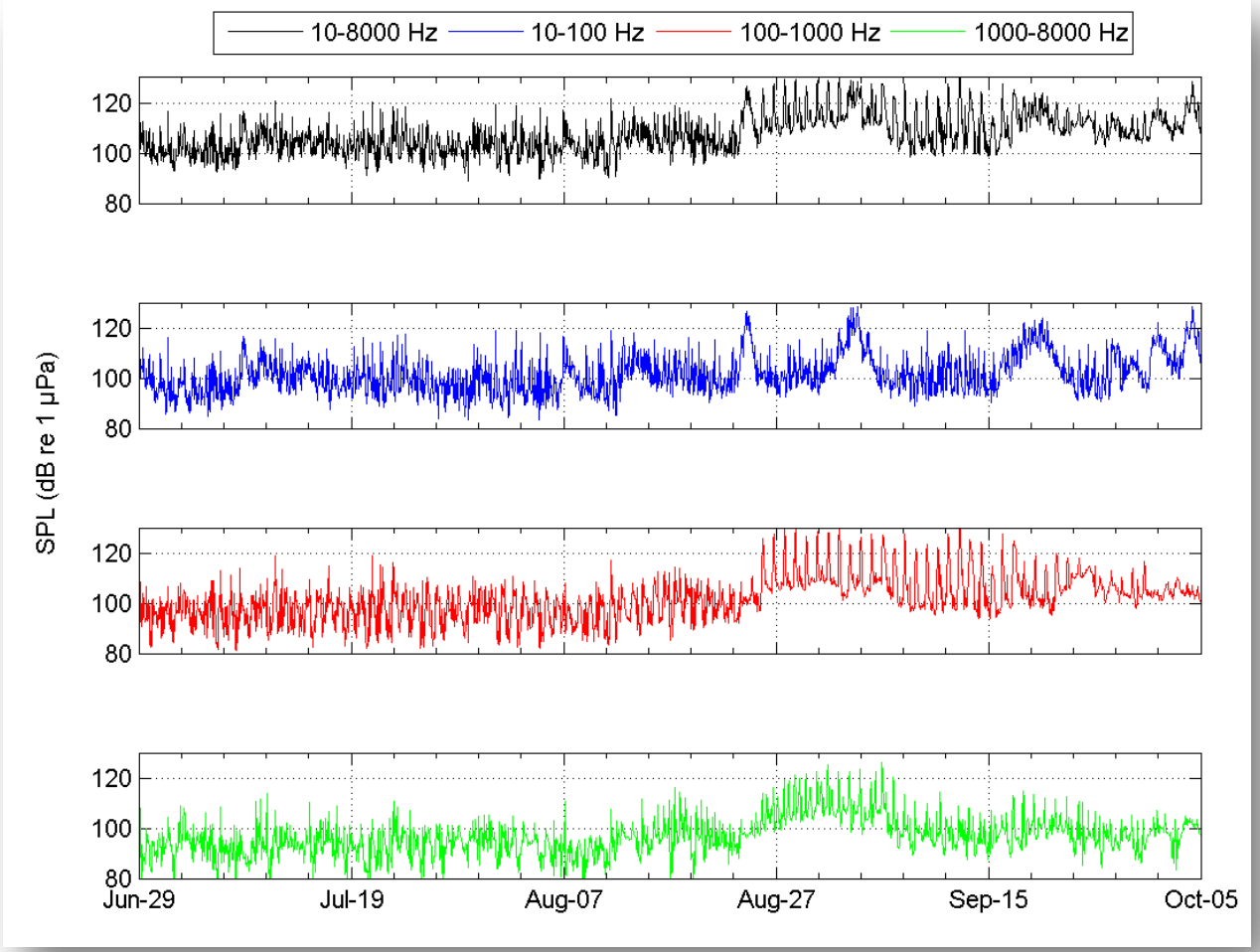
Hurricane Earl - Sept 3



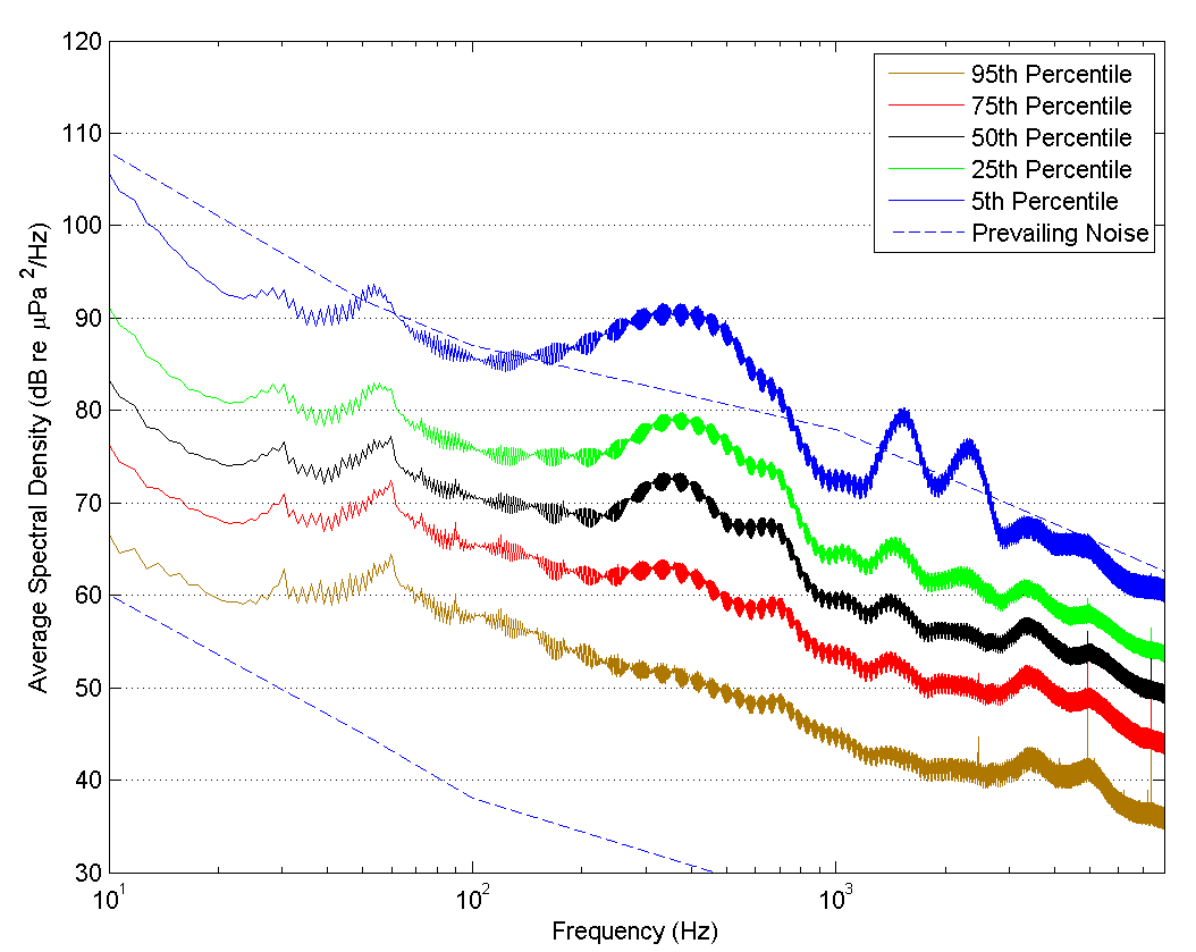
Hurricane Igor – Sept 20



Ambient Acoustic Results – Band Level Plots



Ambient Results – Quartile Distributions

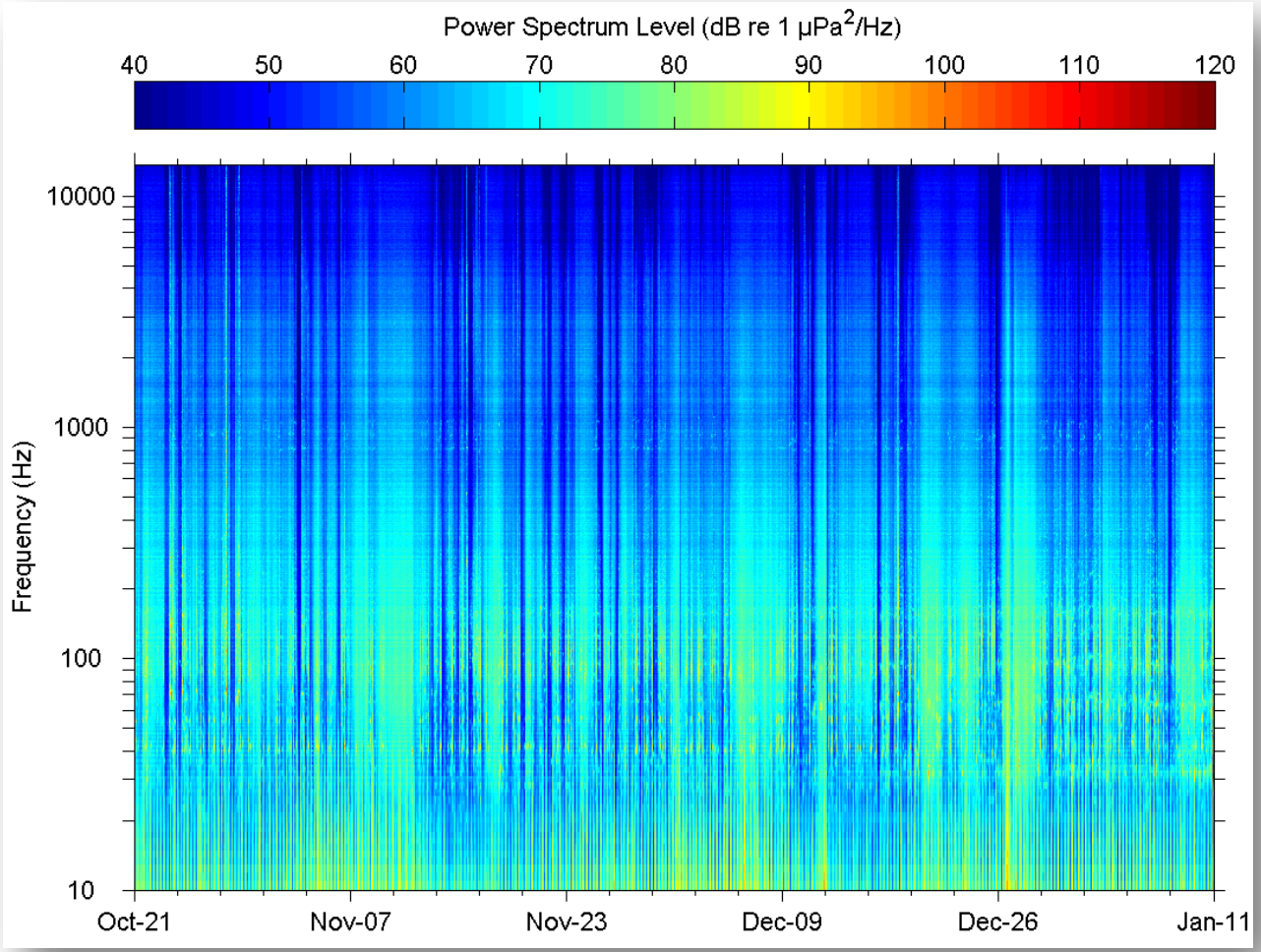


Ambient Analysis Results

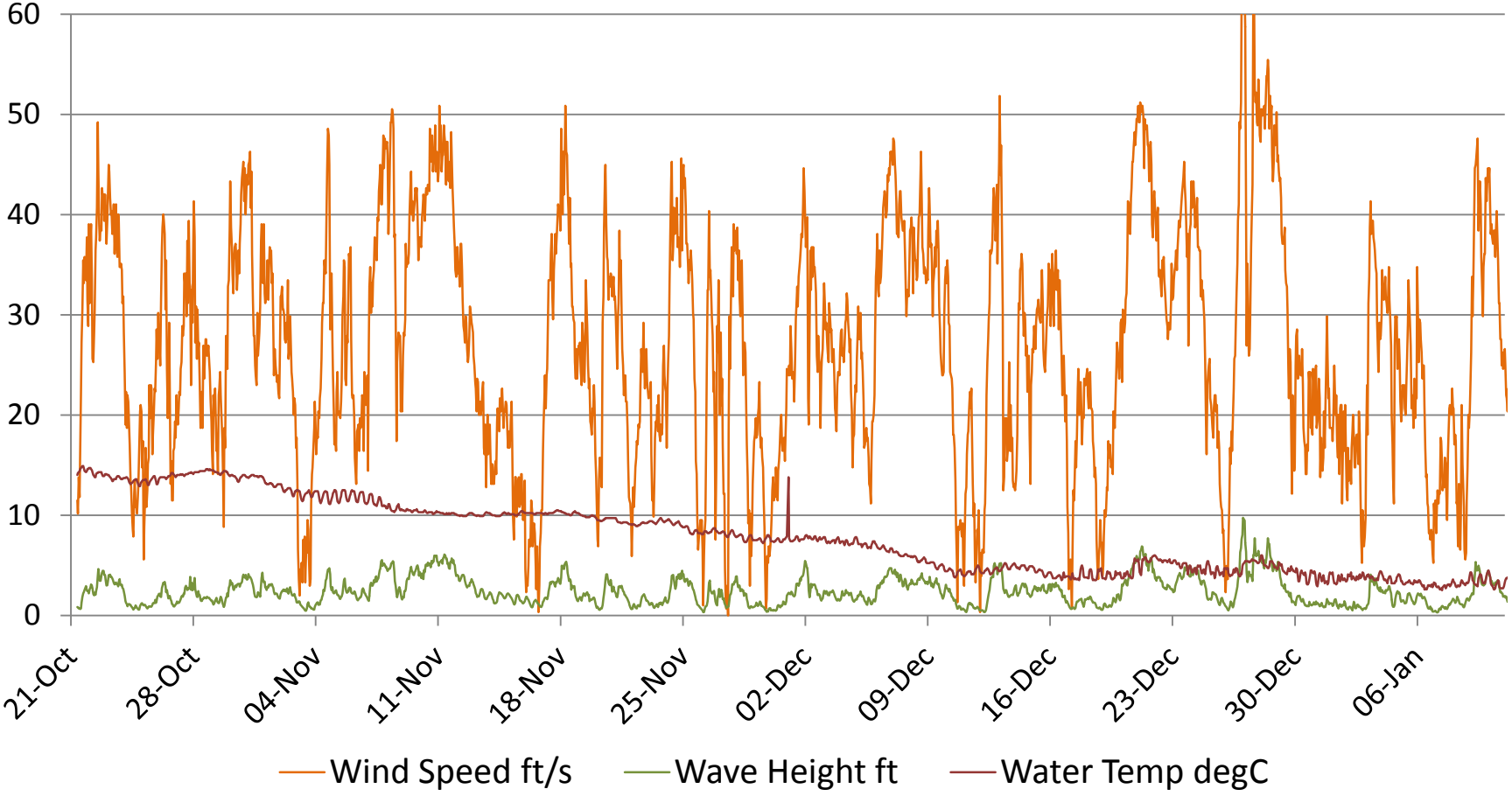
NANTUCKET

(OCTOBER 2010 – JANUARY, 2011)

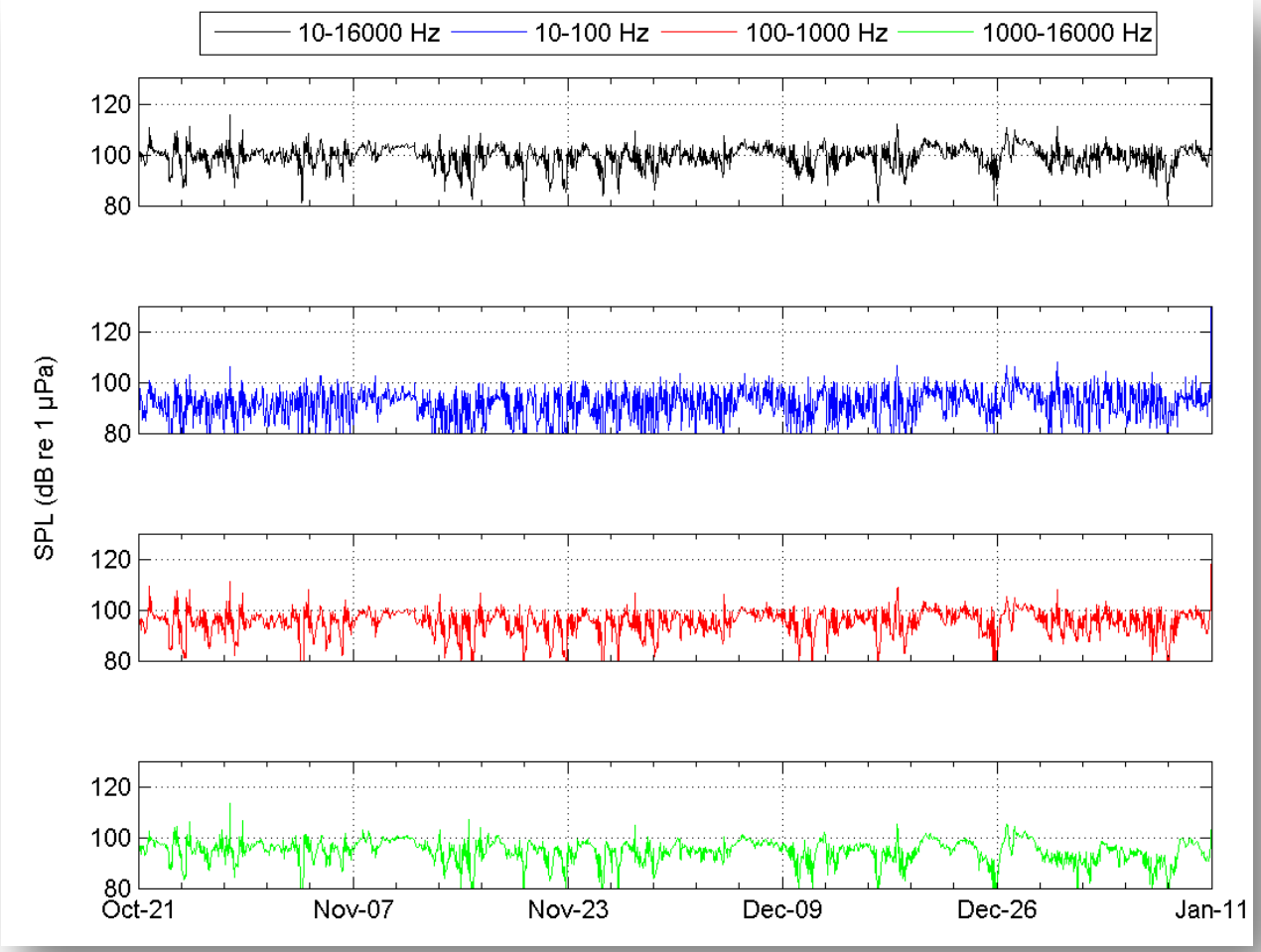
Ambient Results – Spectrogram



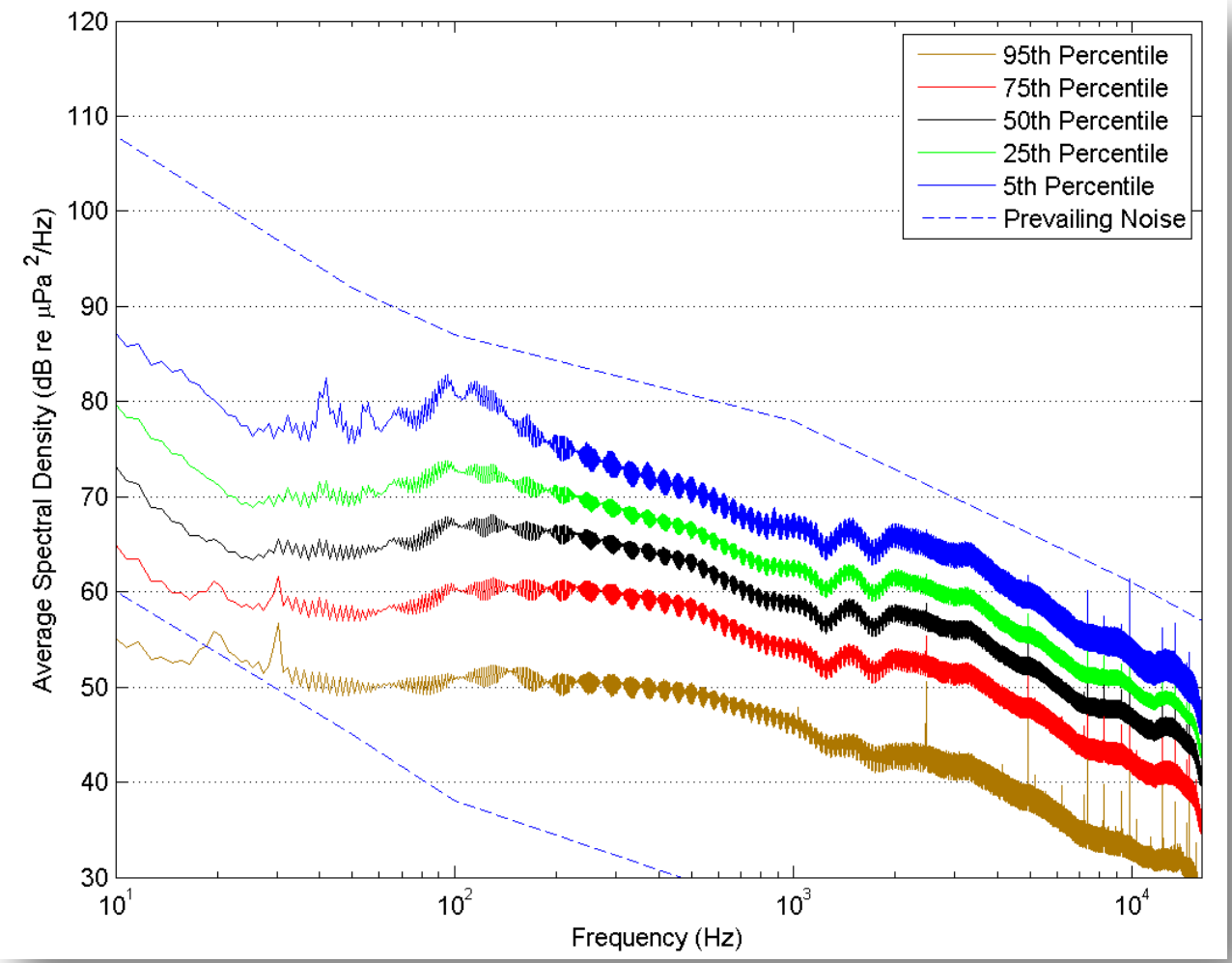
Meteorological Data (Buoy 44020 Oct – Jan)



Ambient Results – Band Level Plots



Ambient Results – Quartile Distributions



Additional Results (not in scope of Phase 1)

- Sample detection/identification of acoustic sources
  - Shipping and Boating
  - Biological sources (including protected species)
    - Whales
    - Dolphins
    - Fish

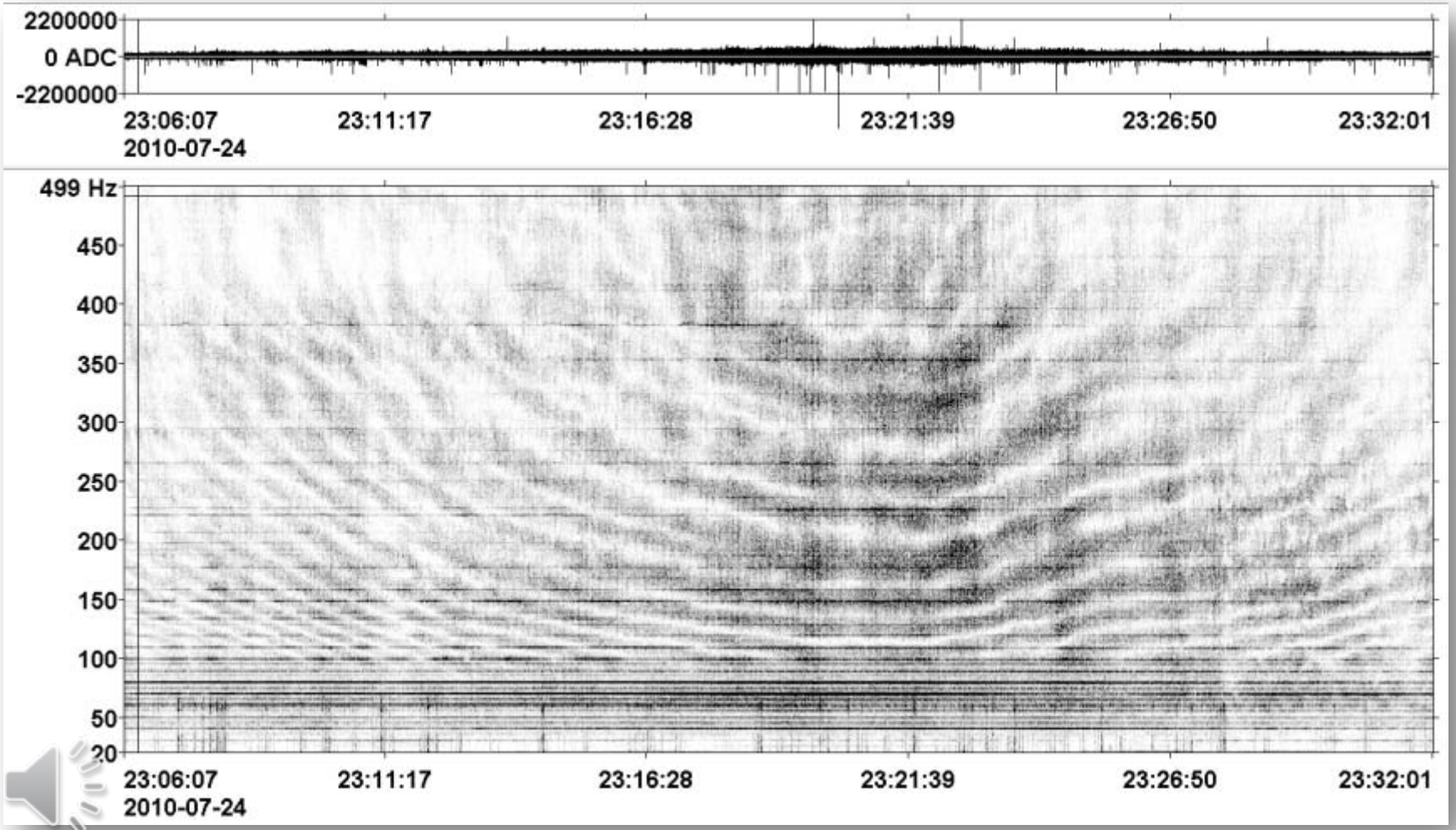
Methods for Additional Analysis

- Manual Detection by Experienced Analyst
  - Characteristics of recorded signal
  - Additional knowledge
    - e.g., species expected to be in the area
- Automated Detection
  - Search signal for specific criteria associated with a source
  - Can be validated against manual identification

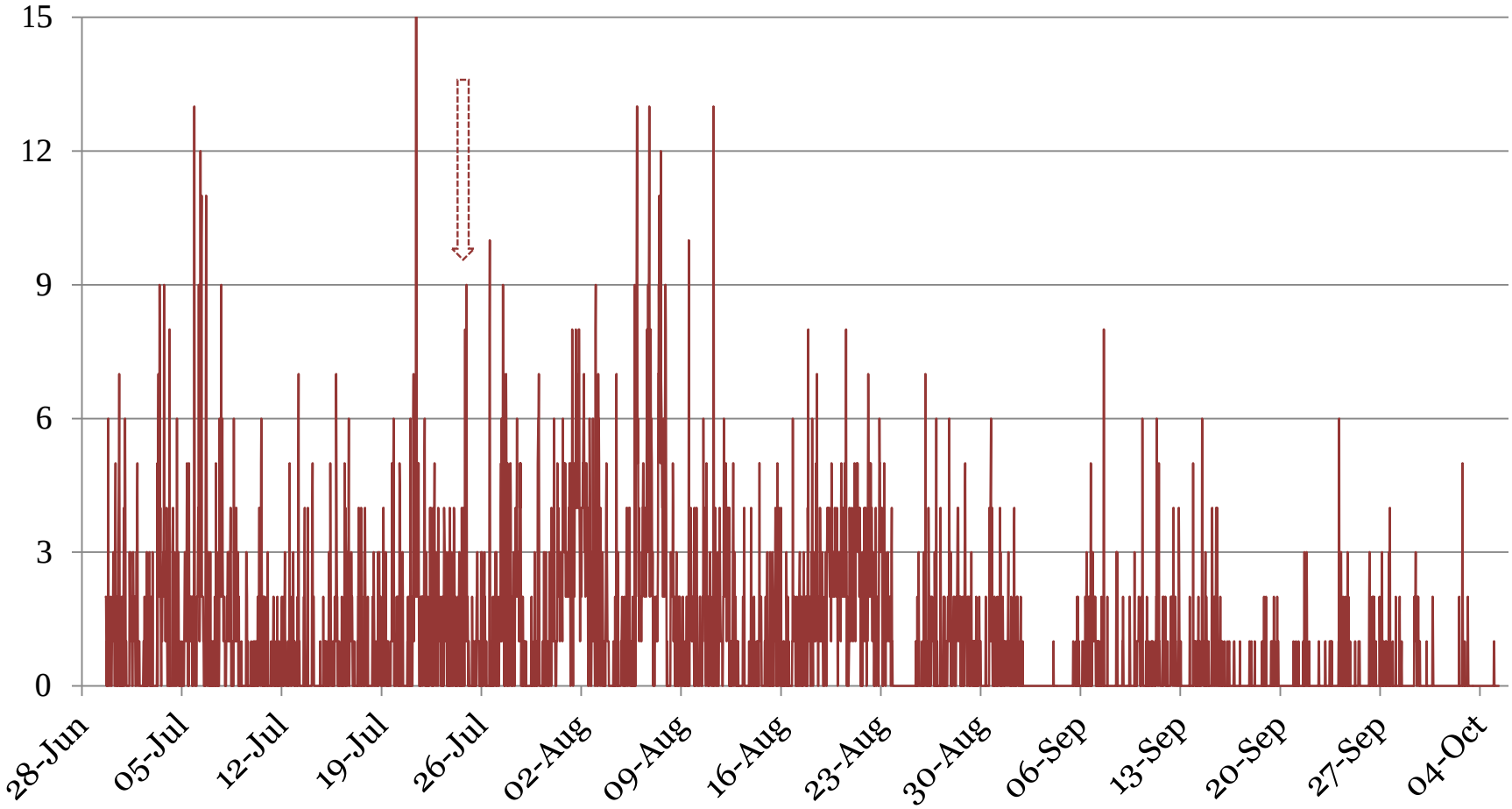
Search Criteria for Automated Detection

- Shipping Detection
  - Occurrence of at least 3 tonal signals in 3 out of 4 minutes in the frequency band between 0 – 1 kHz
- Boating Detection
  - At least 5 seconds with a minimum of 5 tones
  - Often occurring with rapid changes in frequency
- Marine Life Detection
  - Signal contour following used to determine duration, bandwidth, start and stop frequencies , and sweep rate
  - Match characteristics to defined call types

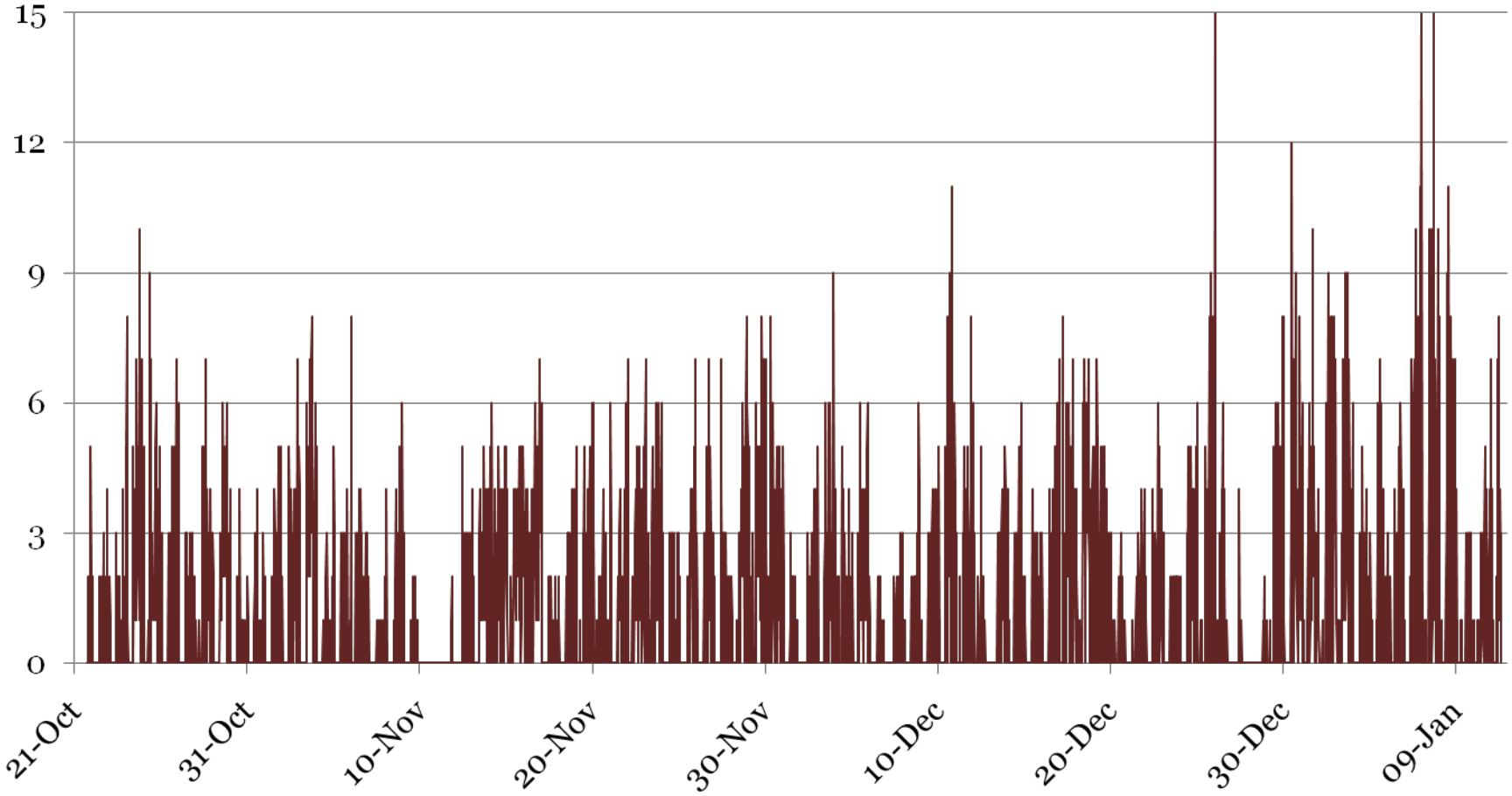
Shipping Sound Sample (at Delaware Bay)



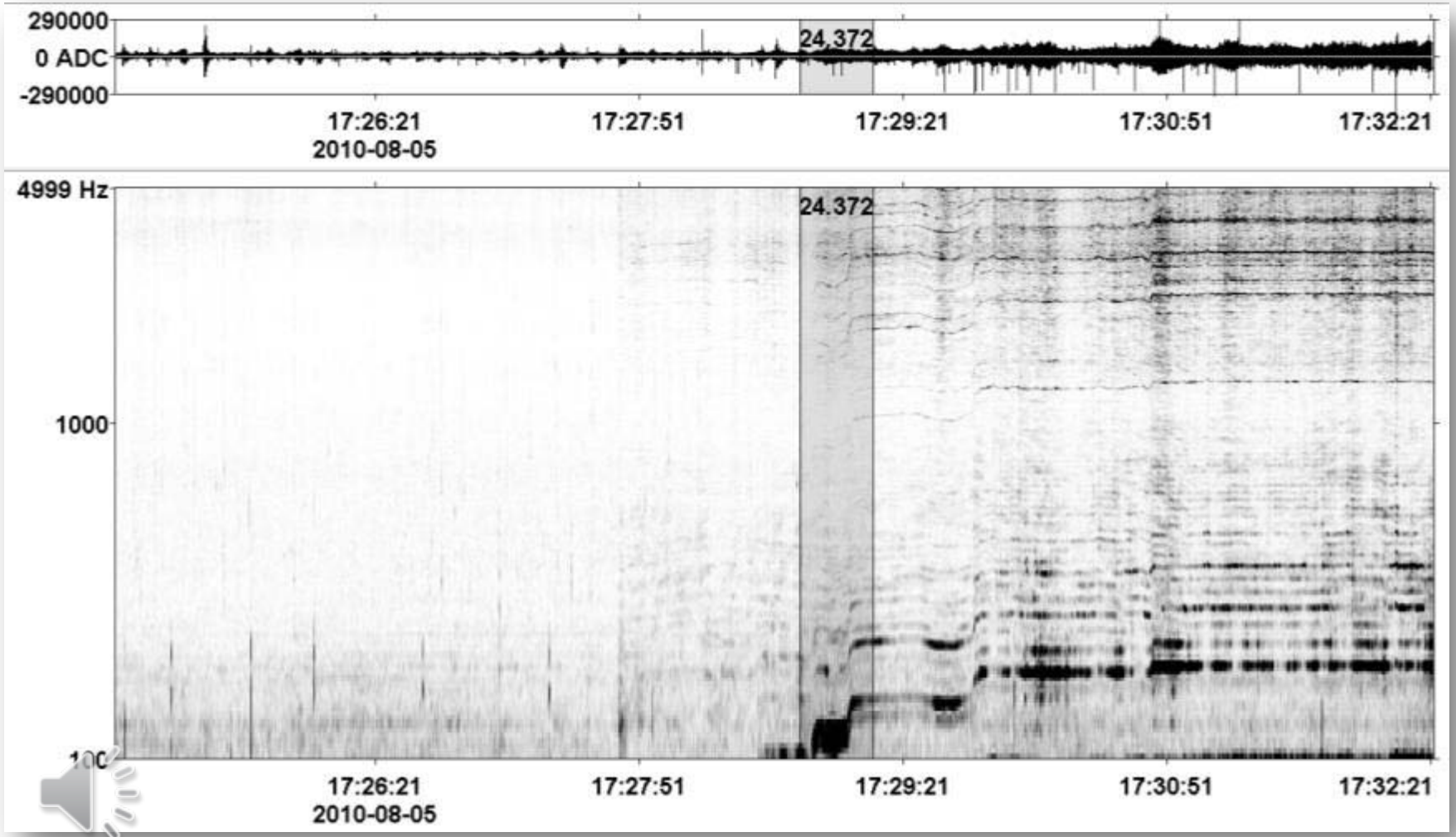
Shipping – Delaware Bay



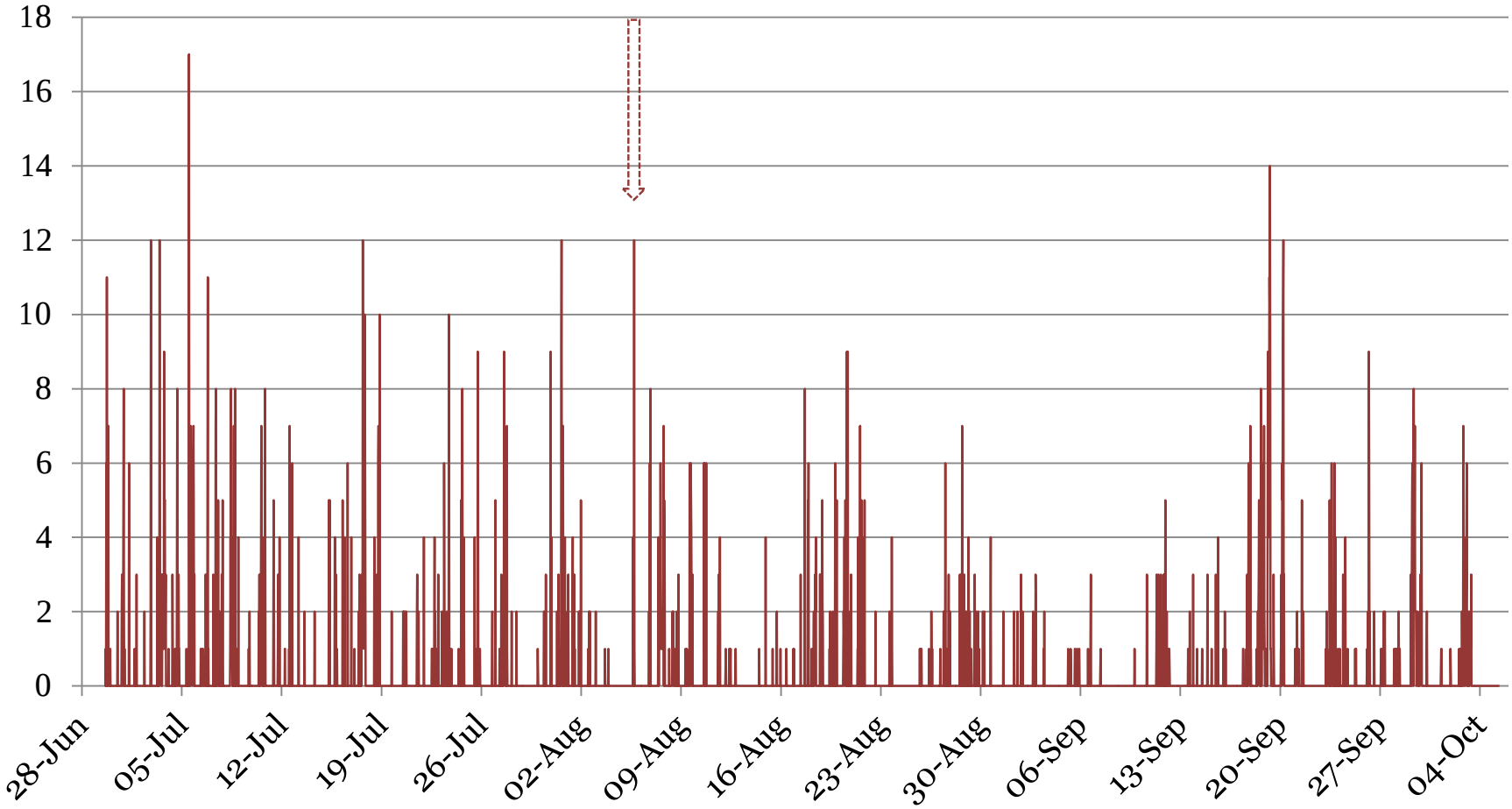
Shipping – Nantucket



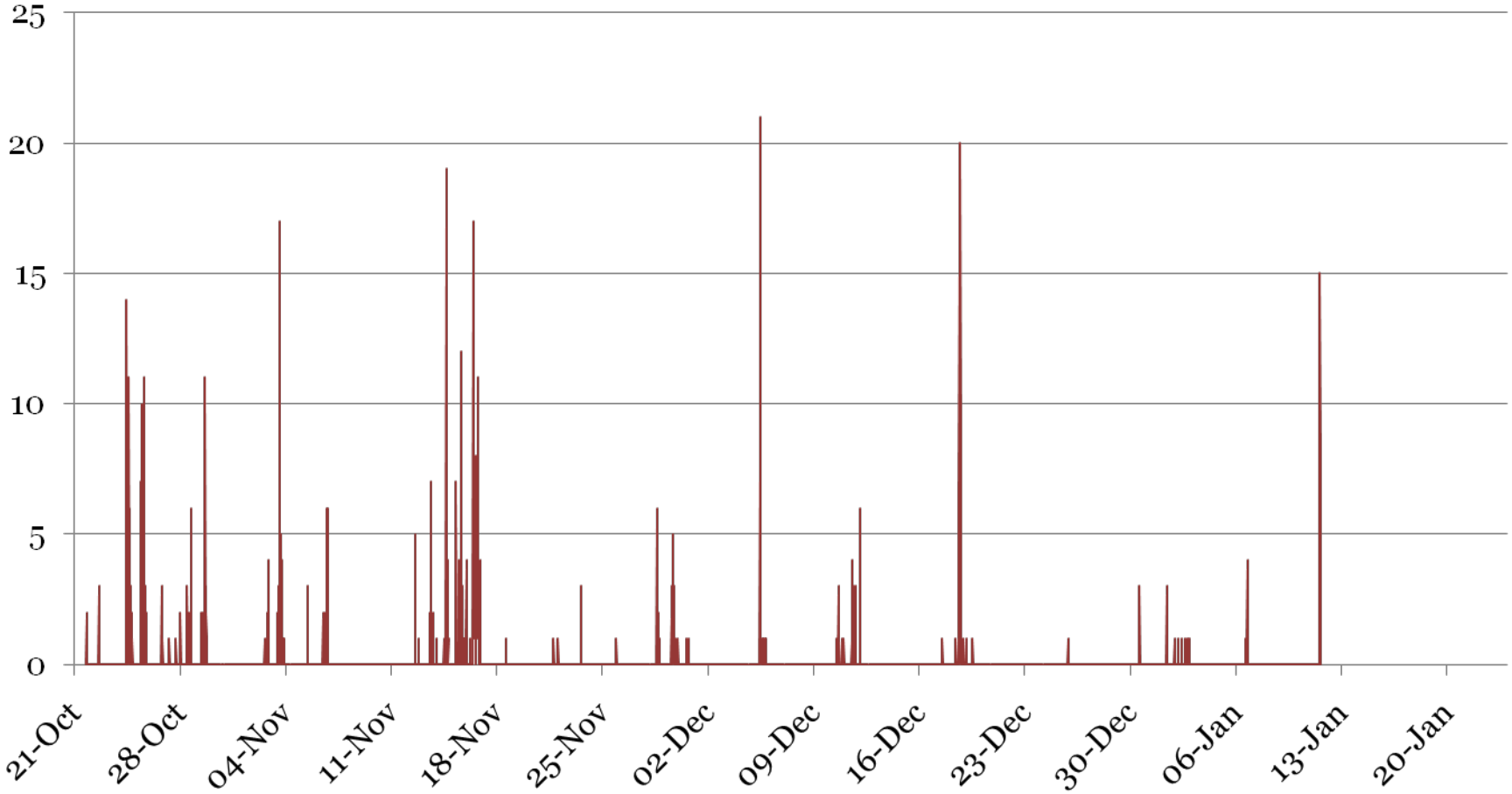
Boating Sample (at Delaware Bay)



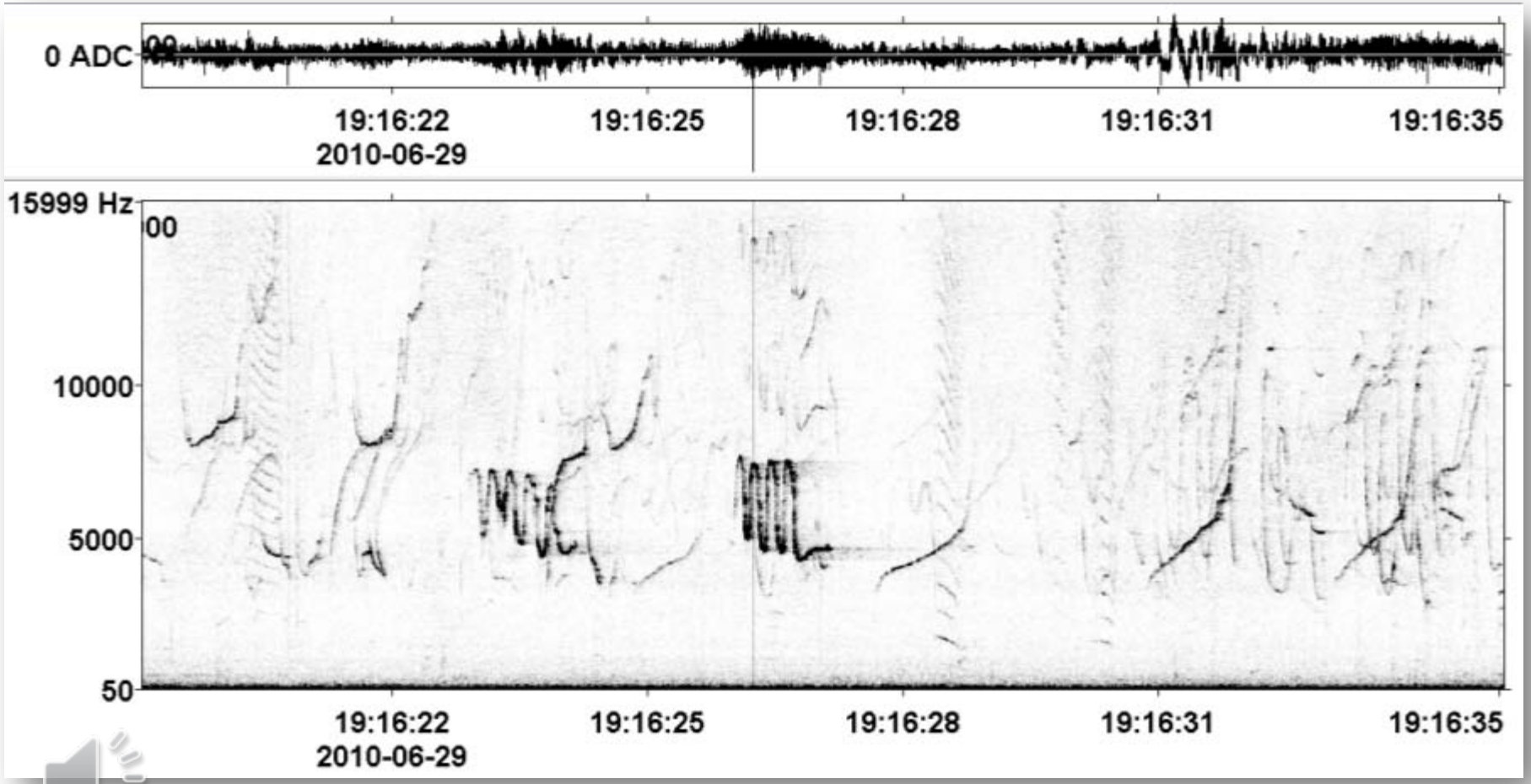
Boating – Delaware Bay



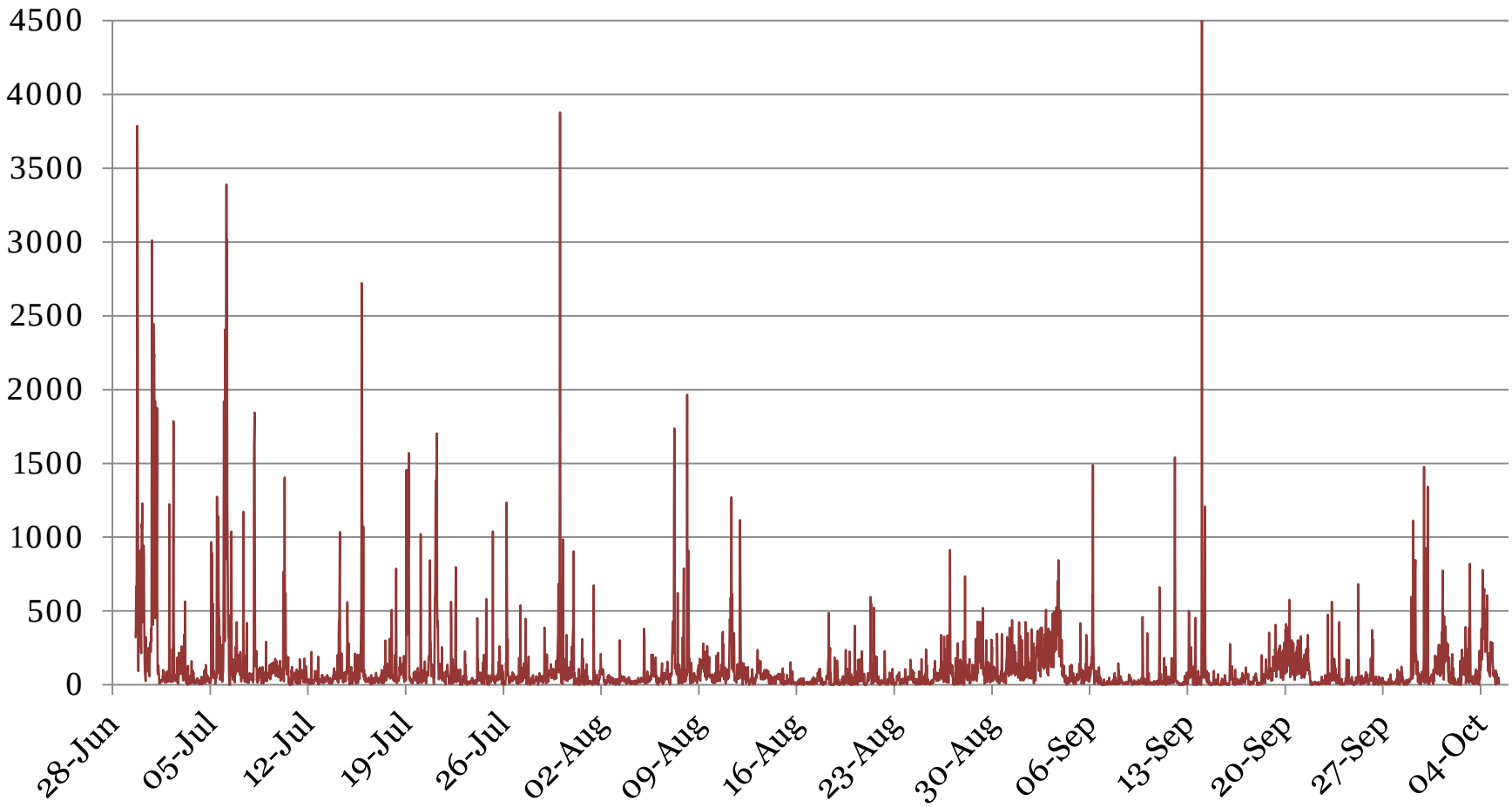
Boating – Nantucket



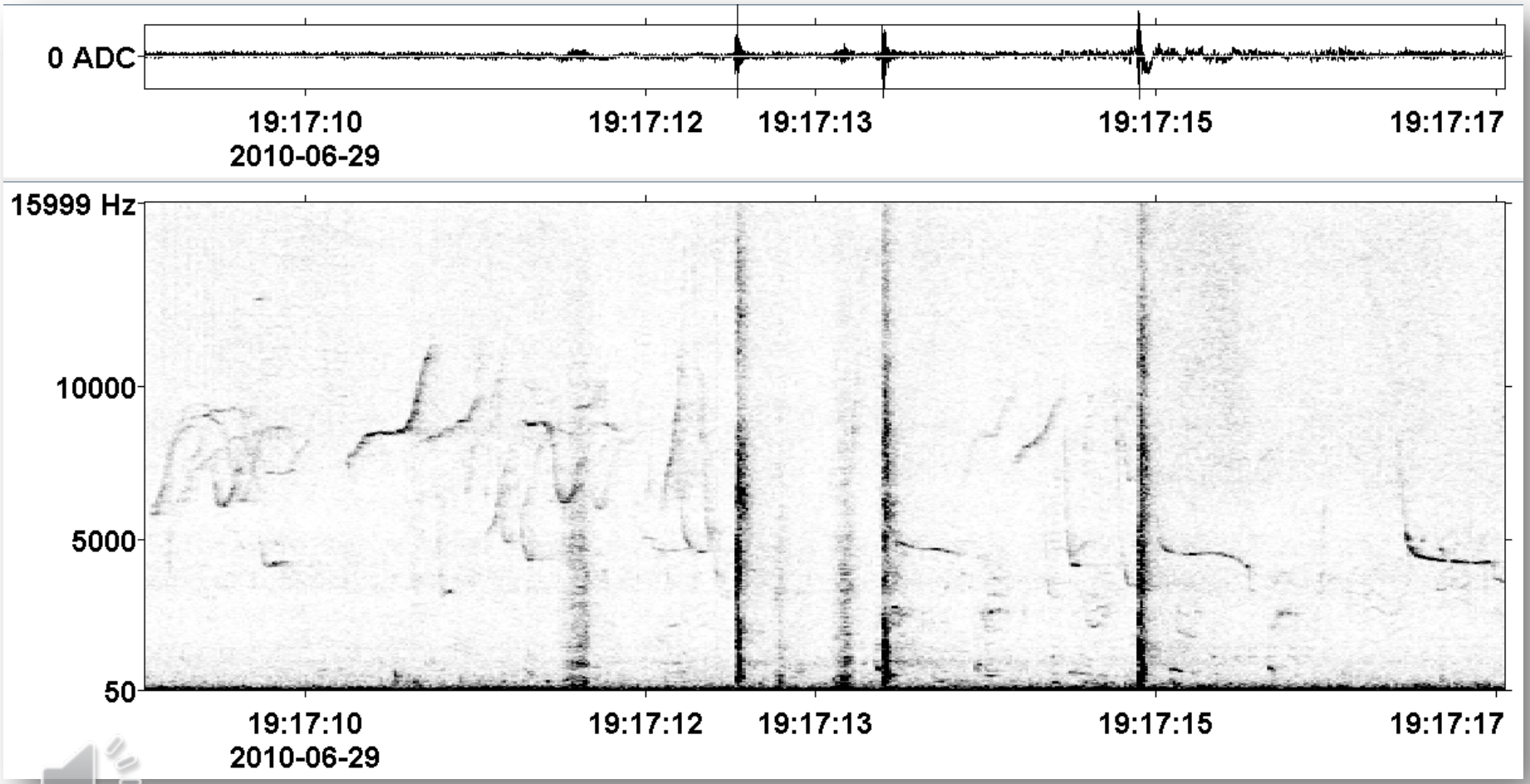
Sample Whistle (at Delaware Bay)



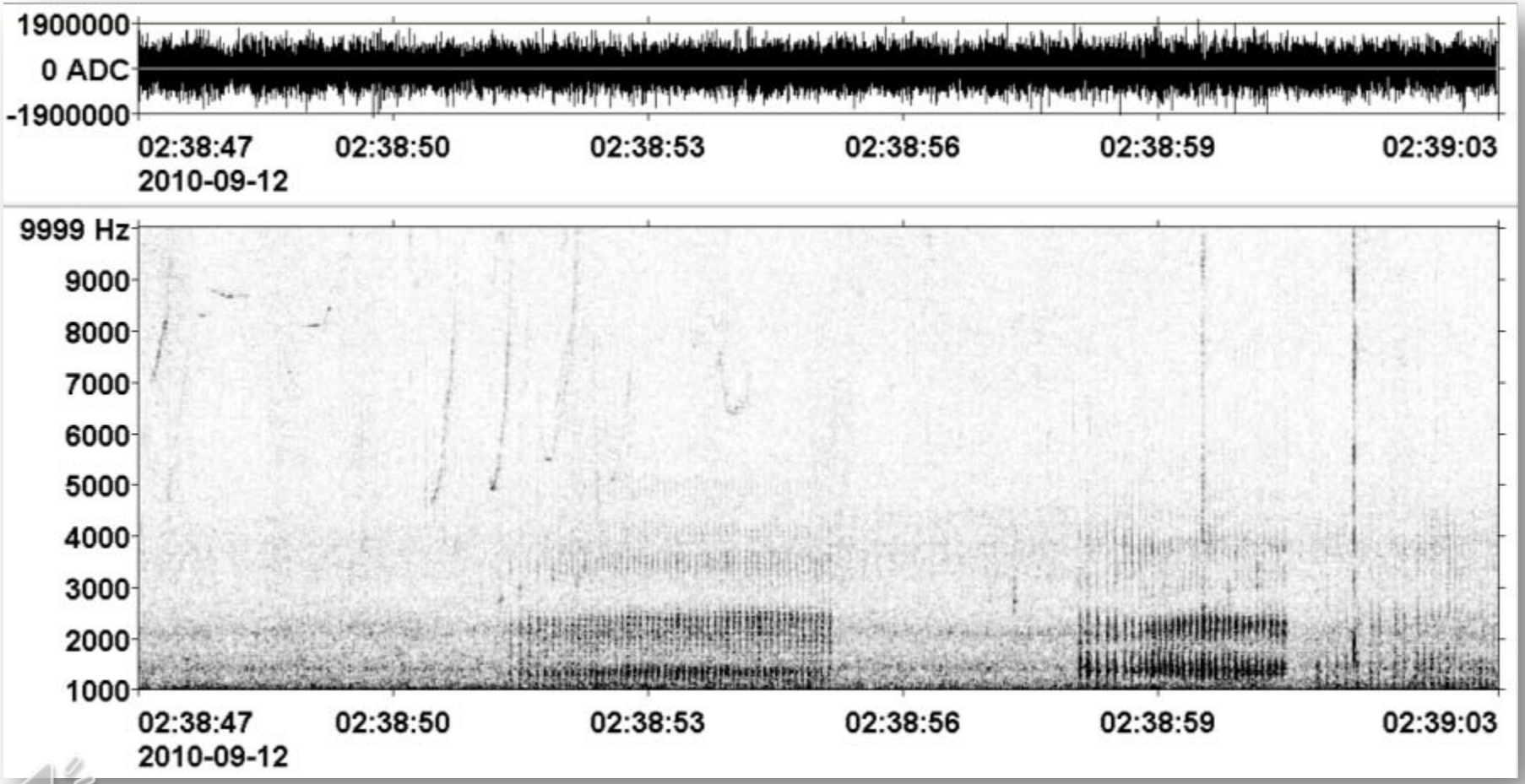
Whistle Detections – Delaware Bay



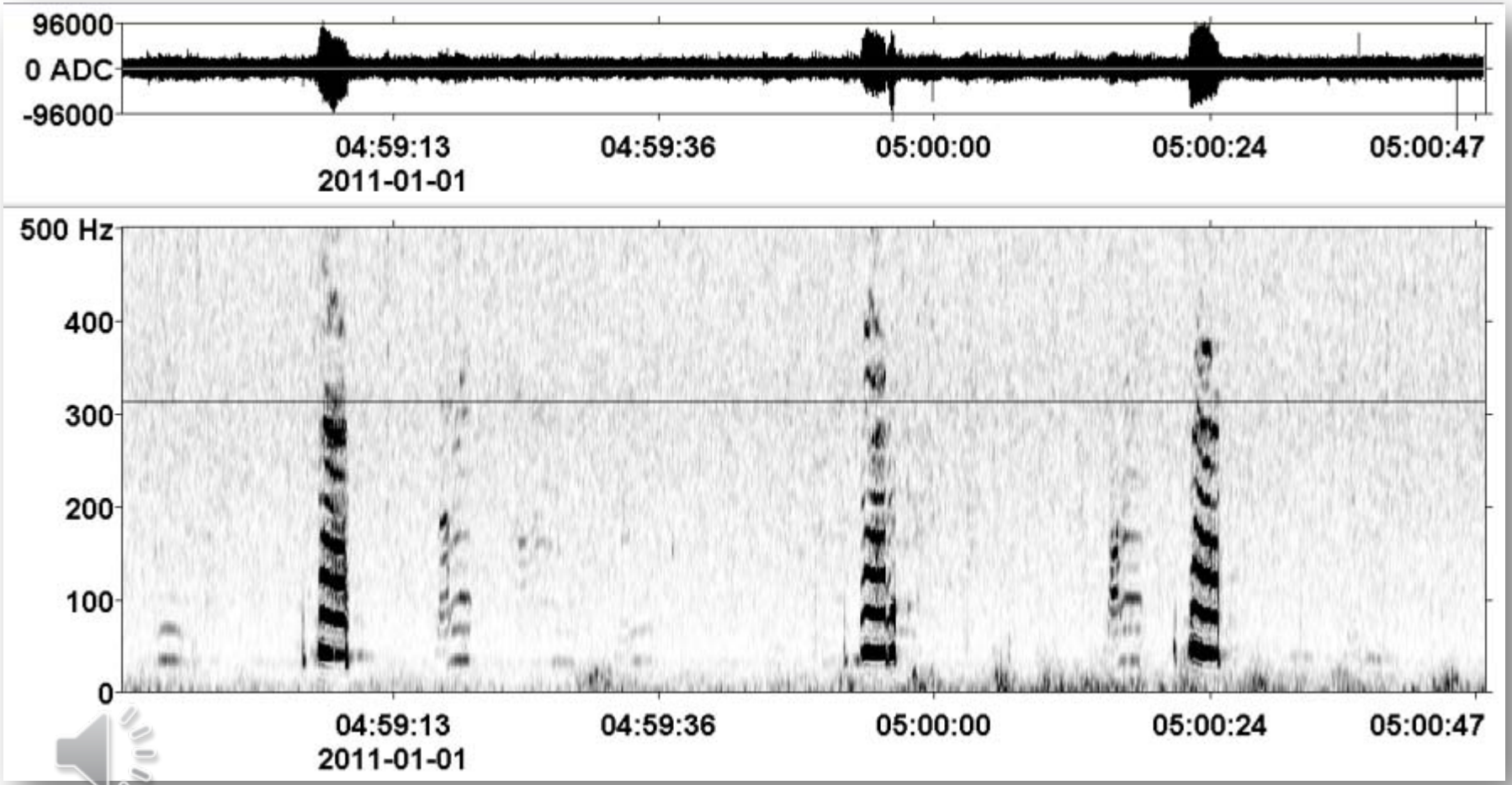
Right whale gun-shots? (at Nantucket)



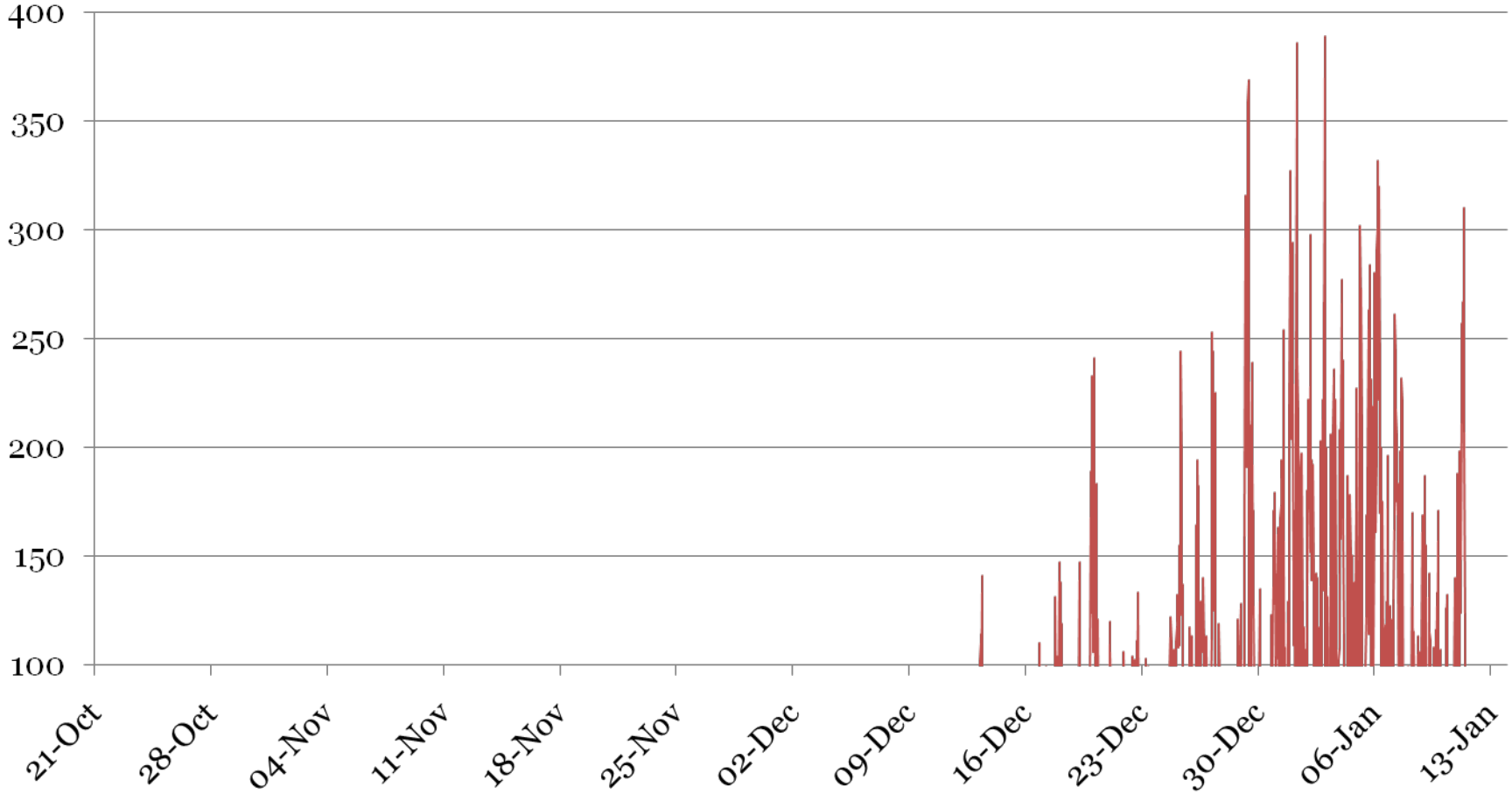
Fish (knocking) – (at Delaware Bay)



Fish Calls (at Nantucket)



Fish Call Detections – Nantucket



Interim Conclusions

- Ambient noise at both locations is well-predicted by the Wenz curves.
- Shipping and boating are present at both sites throughout the year.
- Fish produce sound levels that can dominate ambient noise in frequency bands around 100-2,000 Hz.
- These data are useful for monitoring / assessing protected and endangered species at the development sites.

Planned Work

- Recover AMARs from deployment #3, and deploy AMARs for deployment #4 (week of April 10)
- Final recovery late June 2011
- Report completion Oct0ber 2011
- Possible Phase 2 to monitor noise levels during construction

References

National Research Council 2003. Ocean noise and marine mammals. Washington, D.C.: The National Academies Press.

Wenz, G.M. 1962. Acoustic ambient noise in the ocean: Spectra and sources. Journal of the Acoustical Society of America 34:1936-1956.