U.S. Navy Marine Species Monitoring Program

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Please visit the US Navy Marine Species Monitoring Program web portal for additional information on this project – www.navymarinespeciesmonitoring.us

US Navy Marine Species Monitoring Program – Atlantic Technical Review Meeting
Virginia Beach, VA *30-31 March 2015*

Autonomous Real-Time PAM of Baleen Whales in the Gulf of Maine

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US Navy Marine Species Monitoring Program Meeting
March 30 – 31 2015

NAVFAC Naval Facilities Engineering Command

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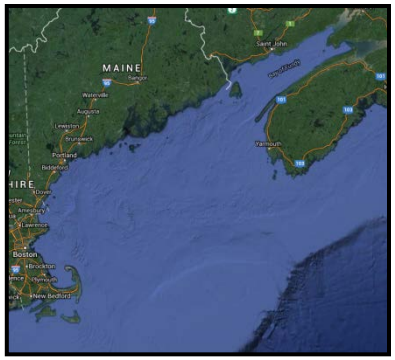
NOAA FISHERIES

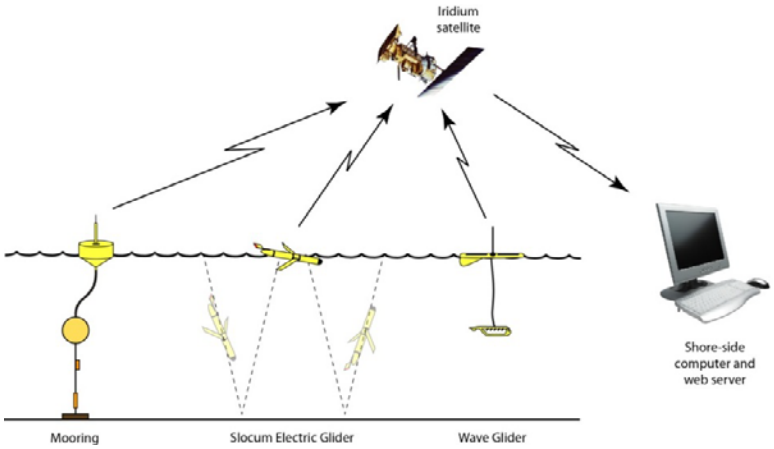
Background

- Technology validation project funded by:
  - DOD's Environmental Security Technology Certification Program (ESTCP)
  - US Navy's Living Marine Resources Program (LMR)
- Ultimate goal of transitioning the technology into use by the Marine Species Monitoring Program

Technology Validation Objectives

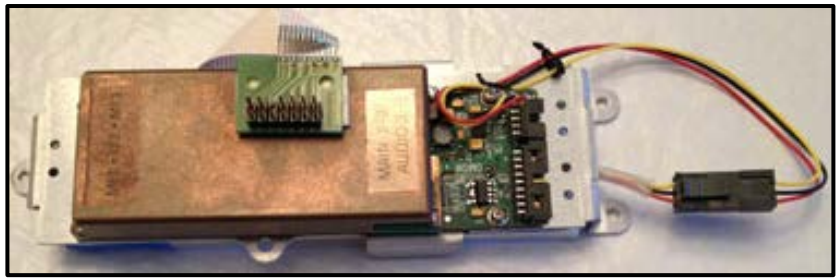
- Demonstrate the use of autonomous platforms over different temporal and spatial scales for detection and classification of baleen whale vocalizations in near real-time
  - Validate acoustic detections visually and across platforms





Digital Acoustic Monitoring Instrument (DMON)

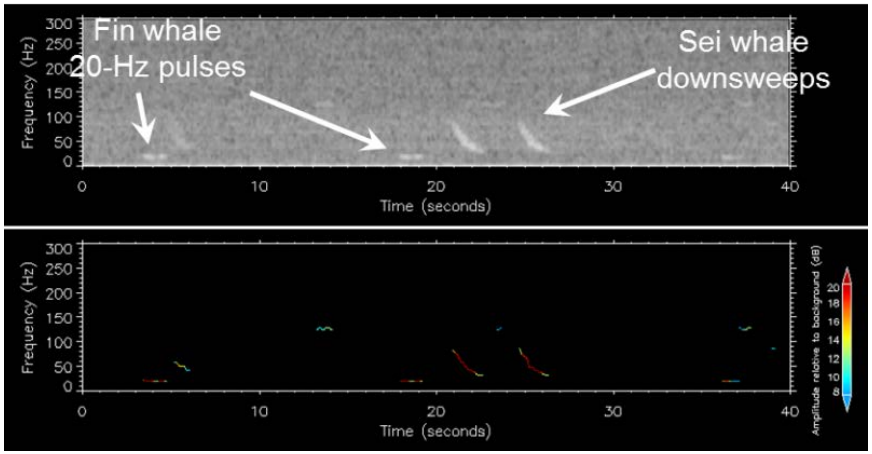
- Developed at WHOI (Johnson & Hurst 2007)
- Low-power acoustic sensor & data acquisition system
  - 3 hydrophones (**low (10 Hz – 7.5 kHz)**, mid- (0.1 – 50 kHz), high-frequency (1 – 160 kHz))
  - 32 GB FLASH memory
- Platform agnostic



Johnson, M., and T. Hurst. 2007. The DMON: an open-hardware/open-software passive acoustic detector. 3rd International Workshop on the Detection and Classification of Marine Mammals using Passive Acoustics, Boston, Massachusetts, USA.

Low Frequency Detection and Classification System (LFDCS)

- DMON application
- Estimates pitch tracks
- Matches attributes to known call library

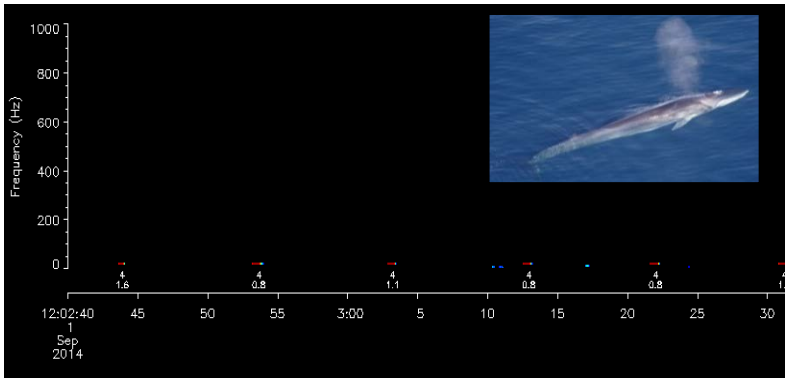


Baumgartner, M.F. and S.E. Mussoline. 2011. A generalized baleen whale call detection and classification system. Journal of the Acoustical Society of America 129:2889-2902.

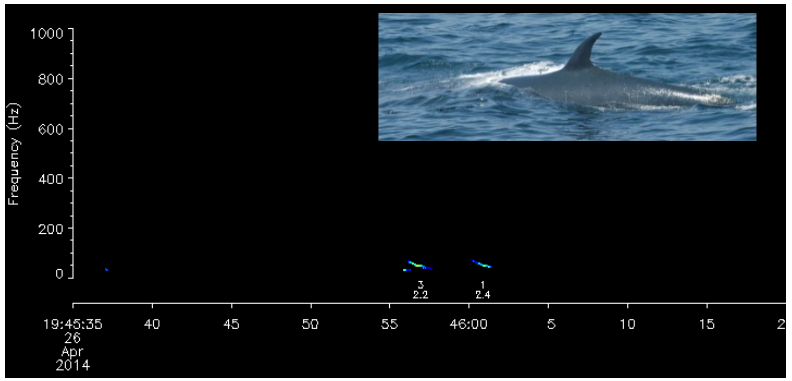
Baumgartner, M.F., D.M. Fratantoni, T.P. Hurst, M.W. Brown, T.V.N. Cole, S.M. Van Parijs, and M. Johnson. 2013. Real-time reporting of baleen whale passive acoustic detections from ocean gliders. Journal of the Acoustical Society of America 134:1814-1823.

Target Species

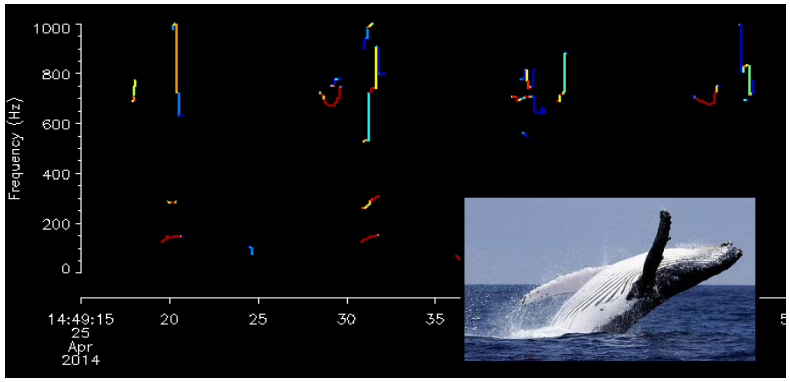
- Fin whale



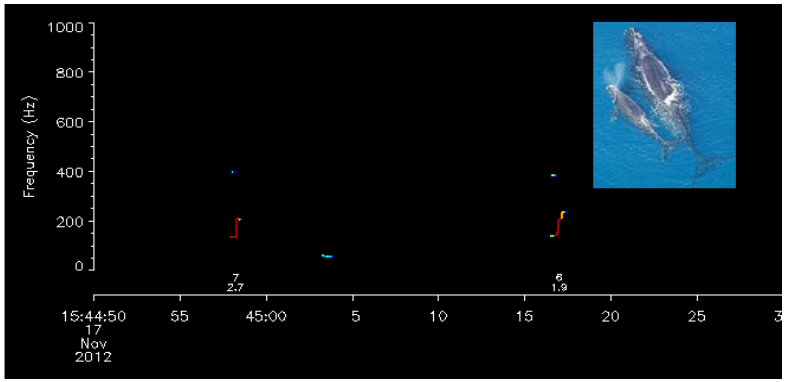
- Sei whale



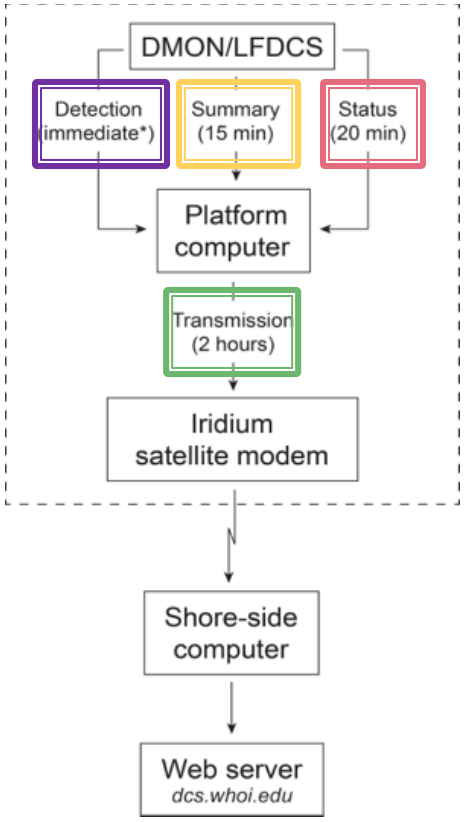
- Humpback whale



- Right whale



DMON/LFDCS



- Detection
  - Every sound with SNR ≥ 11 dB*
  - Pitch track, amplitude, classification and Mahalanobis distance
- Summary
  - Call type tallies per 15 min. reporting period
- Status
  - Battery information, LFDCS status
- Data limit for transmission – 8 kB of pitch track data per hour
  - Subset of calls get detailed information

*SNR is calculated as an envelope around the detected sound, rather than with the noise immediately adjacent to the call.

Autonomous Acoustic Platforms

Spring

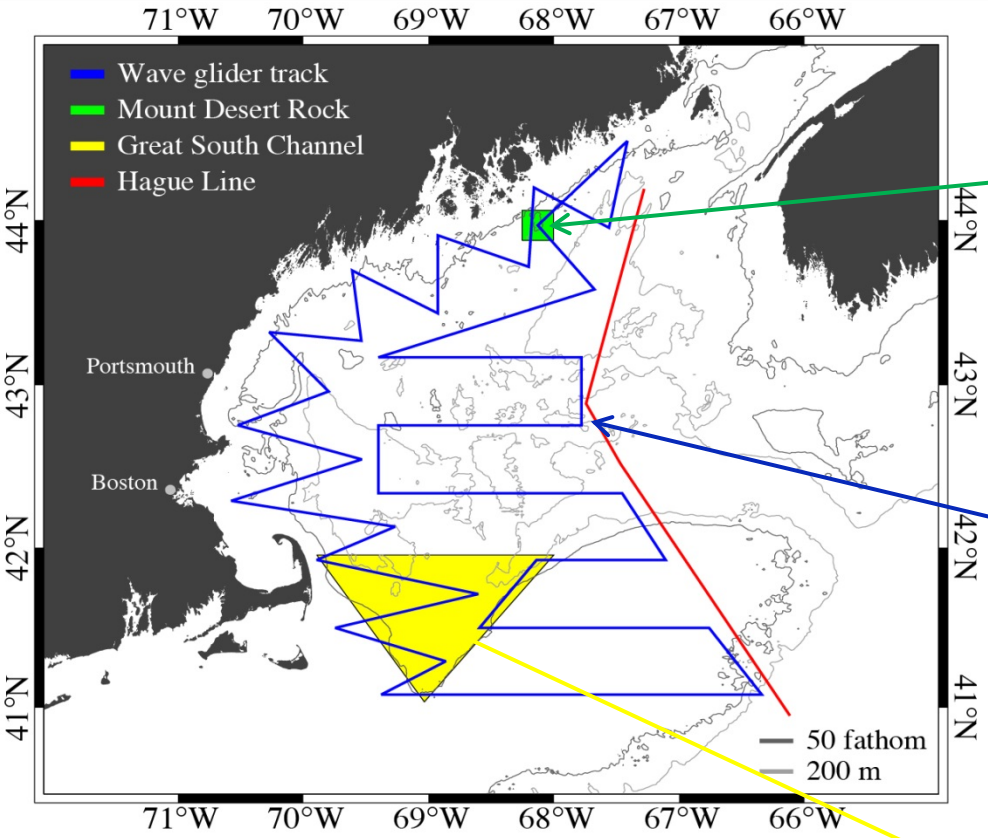
Year-round

Year-round

Platform	Spatial scale	Temporal scale	Mobility	Reporting interval (hours)
Slocum glider	10s to 100s km	1-3 months	Mobile (navigated)	2
Wave glider	100s to 1000s km	months - years	Mobile (navigated)	2
Moored buoy	10s m	months - years	Stationary	2

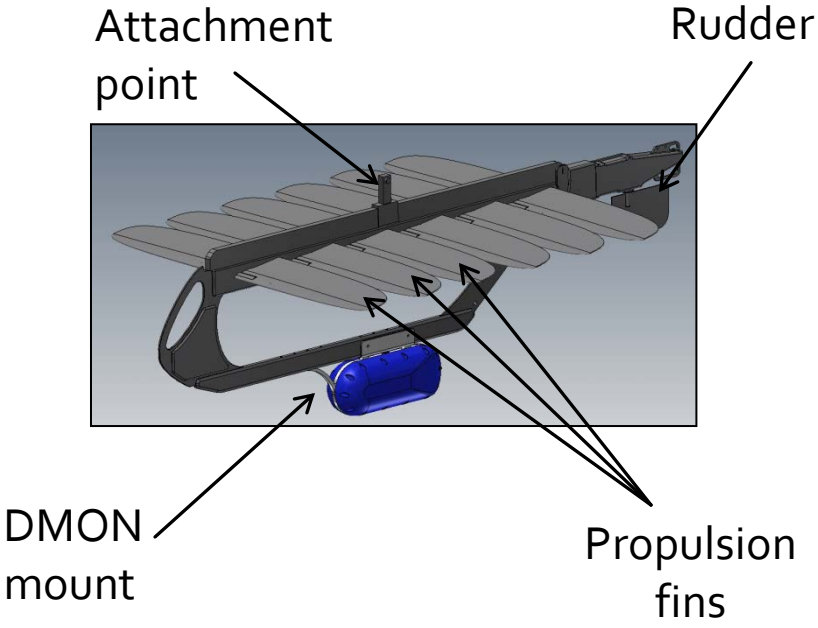
- All platforms archive acoustic data to validate reported real-time detections
  - Moored buoy archival data is 50% duty cycled
- Platforms are recovered and refurbished every few months; archival data recovered at this time

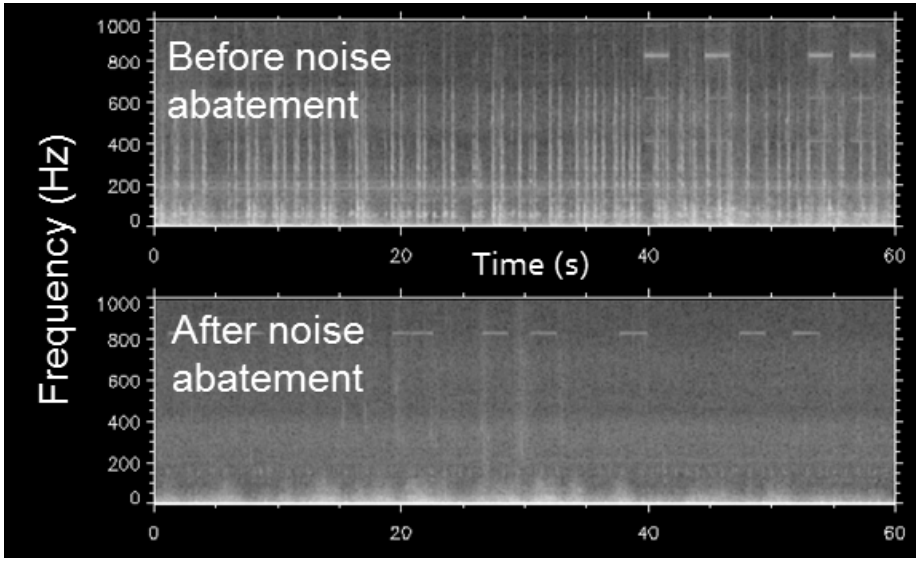
Survey Locations & Cross Validation



Noise abatement and hardware preparation

- Waveglider submarine has moving parts… Noise!
  - Noise abatement testing – WHOI Glider Lab





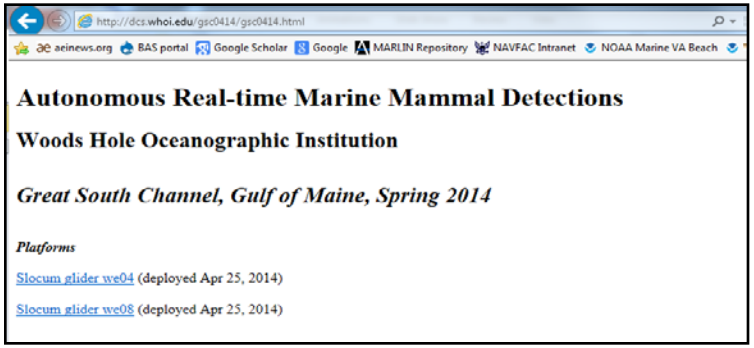
Upcoming data collection

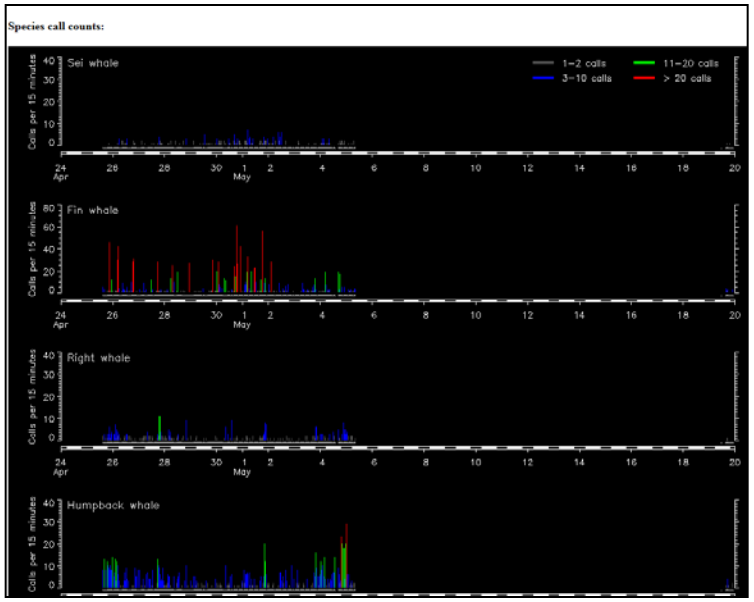
- Mid-April 2015 – 1st deployments!
  - Moored buoy at Mount Desert Rock
  - Slocum glider and Wave glider – southern GoM
- Ship based visual surveys in Great South Channel – May
- Land based visual surveys at MDR – July – September

Website and Analyst Tools

- http://dcs.whoi.edu

- WHOI and NOAA's Northeast Fisheries Science Center (NEFSC) will analyze all data





Acknowledgements

- Funding Sources
  - ESTCP (John Hall, Cara Patton, Andrew Blackmore)
  - LMR (Anu Kumar)
  - NOAA Aerial Surveys
- Field Crews and Analysts
  - WHOI development and field technicians
  - NEFSC analysts

ESTCP

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