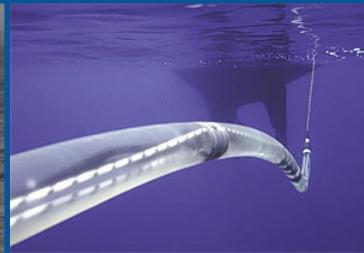




Passive Acoustic Research Program & Acoustic Telemetry

Dr. Sofie Van Parijs, Northeast Fisheries Science Center

Dr. John Kocik, Northeast Fisheries Science Center

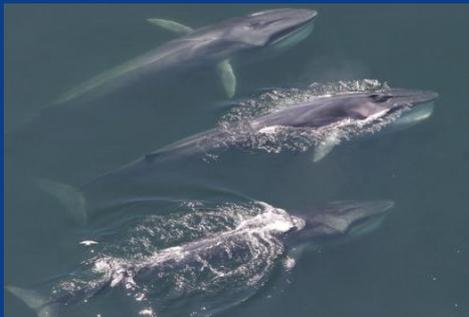


PROGRAM OVERVIEW



Passive Acoustics for Monitoring, Mitigation and Assessing Impacts

Marine Mammal Acoustics



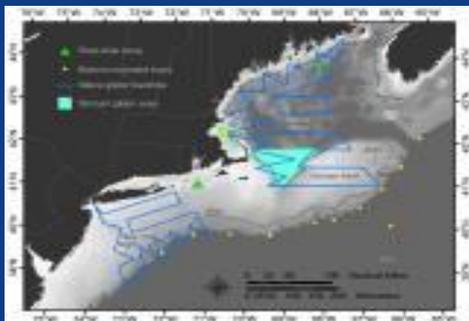
Real Time Information



Fish Acoustics



Broad Sensing Networks



Ocean Noise



Data Archiving



Outreach



PASSIVE ACOUSTICS PROGRAM



Sofie Van Parijs – Program leader (FTE)

Dr. Danielle Cholewiak
Senior Acoustician
(Contractor)
All Projects

Genevieve Davis
Junior Acoustician:
(Contractor)
Sensing Networks

Annamaria Izzi
Junior Acoustician
(Contractor)
Marine Mammals/Fish

Chris Tremblay
Junior Acoustician
(Contractor)
Large Whales

Dana Gerlach
Database Manager
(Contractor)
Data Archiving

Julianne Gurnee
Junior Acoustician
(Contractor)
Real time Acoustics

NOS/NEFSC Postdoctoral
Scientist
(Funded by NOS)
Ocean Noise

Eric Matzen
Fisheries Biologist
(Contractor)
Field Work Support

Chris Tholke
Fisheries Biologist
(Contractor for PopDy)
Fish Acoustics

Grace Simpkins: Outreach & Sabena Saddiqui: Large Whales
(Volunteers)

SCIENCE NEEDS IDENTIFIED BY GARFO



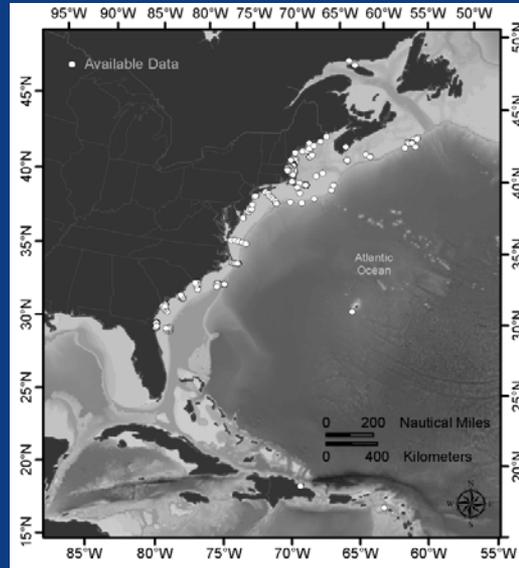
Passive Acoustics

- Estimate density of vocalizing animals (e.g., whales)
- Identify spawning grounds based on breeding calls of fishes
- Track movements of species via vocalizations or acoustic tags
- Assess impacts of noise on species (e.g., BACI approaches)
- Provide real-time monitoring of species in areas of concern to inform dynamic management decisions
- Predict future impacts of noise on species, given development

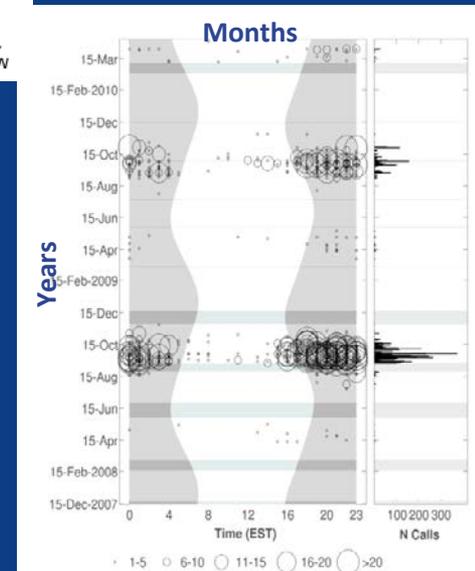
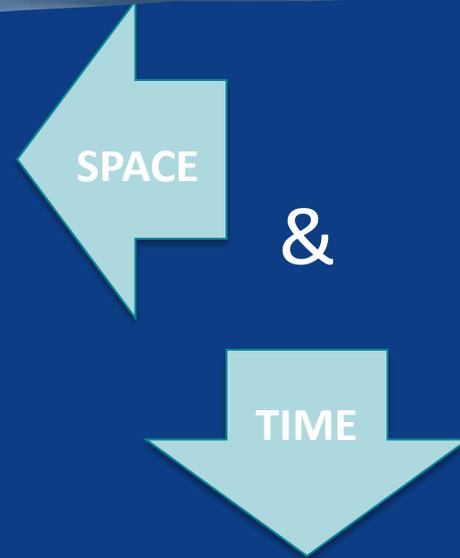
WHY PAM?



- Collect long term year round data
- Not limited by weather or daylight
- Wide spatial coverage
- Value added when used in combination with our existing core surveying/monitoring approaches



Map: Mike Thompson, NOAA/SBNMS



WHO AND HOW?

Species and Data Collection Methodologies



MULTI-SPECIES FOCUS



- ESA listed large whales:
2 sei, fin, humpback, blue, sperm, right whales

- Minke whales
- Beaked whales
- Small odontocetes

(delphinids)

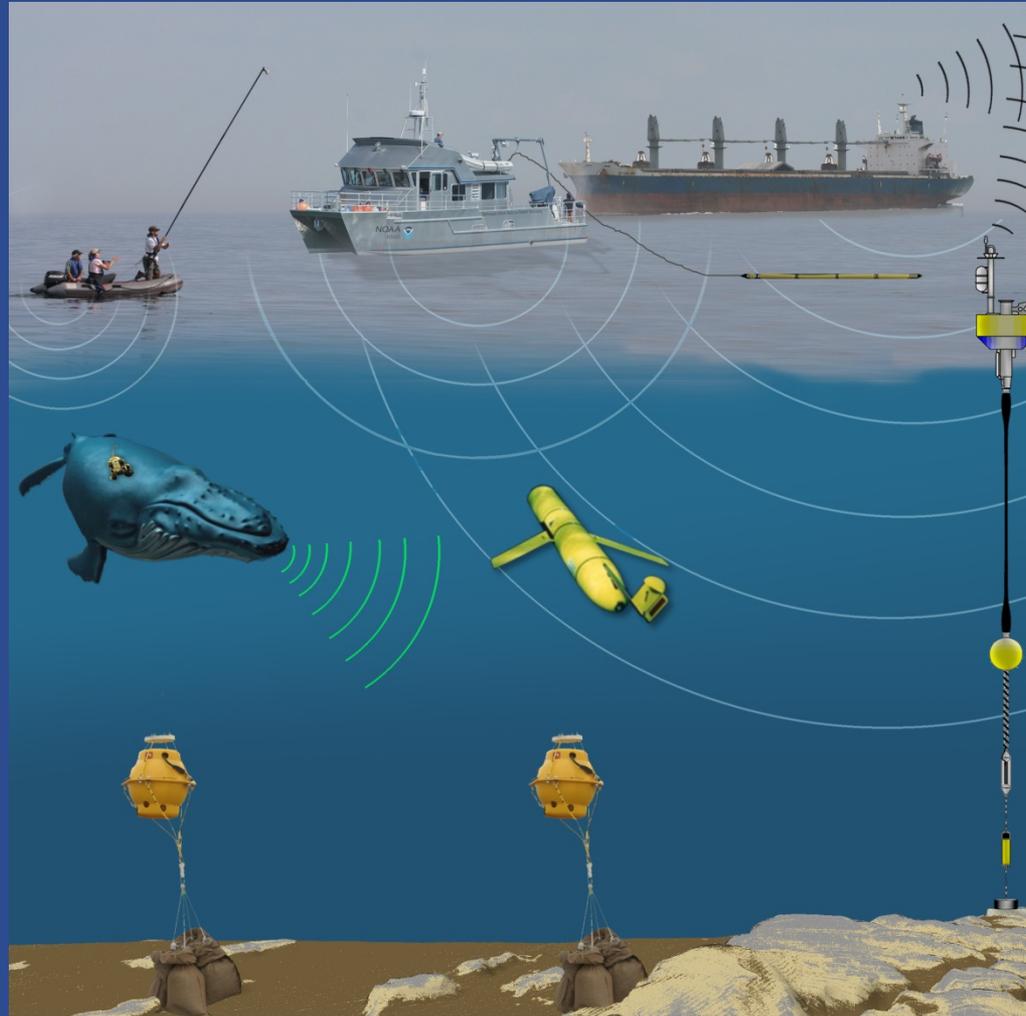
- Fish
- Anthropogenic Sounds

DATA COLLECTION:

ARCHIVAL:

**Bottom
Mounted
Fixed**

Acoustic Tags



REAL TIME:

**Towed Array -
Mobile**

**Autonomous
vehicles –
Mobile**

**Surface
Mounted
Fixed – Real
time**

Figure: Mike Thompson, NOAA/SBNMS

RESEARCH DIRECTIONS

Marine Mammal Acoustics

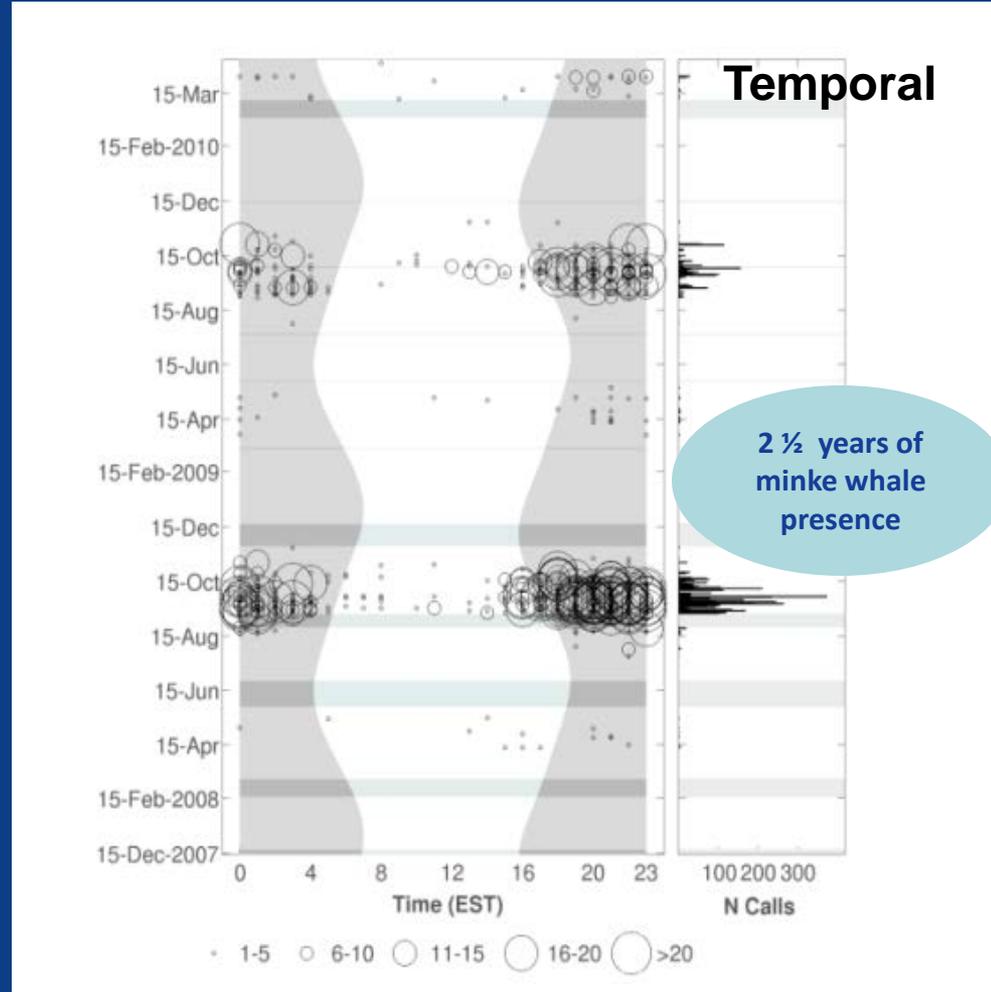
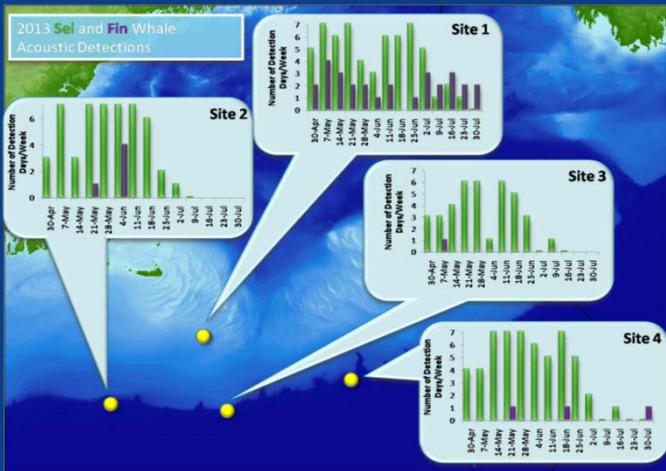
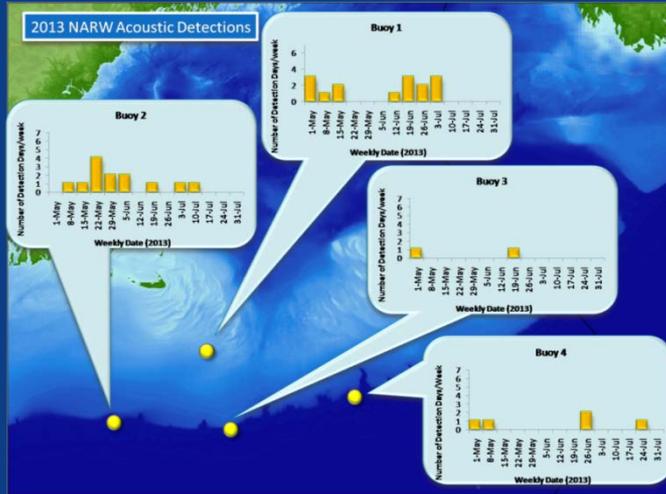


SEASONAL AND SPATIAL

Long term seasonal trends and distribution in the Northeast Atlantic

Spatial

Multi-species

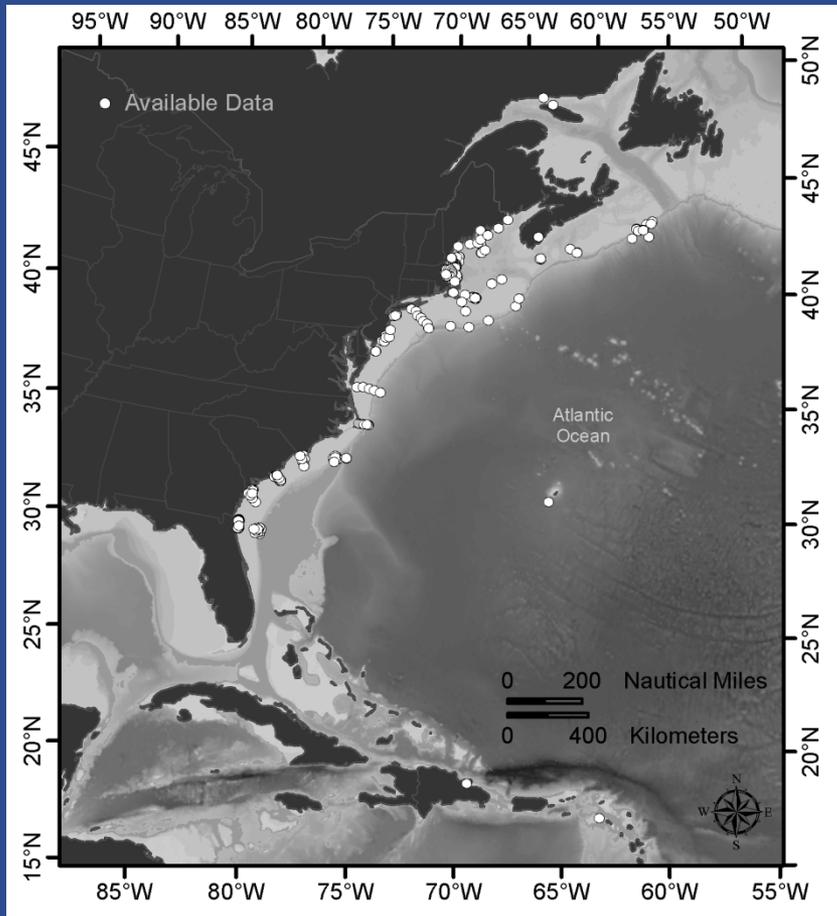


2 1/2 years of minke whale presence

MIGRATION CORRIDORS

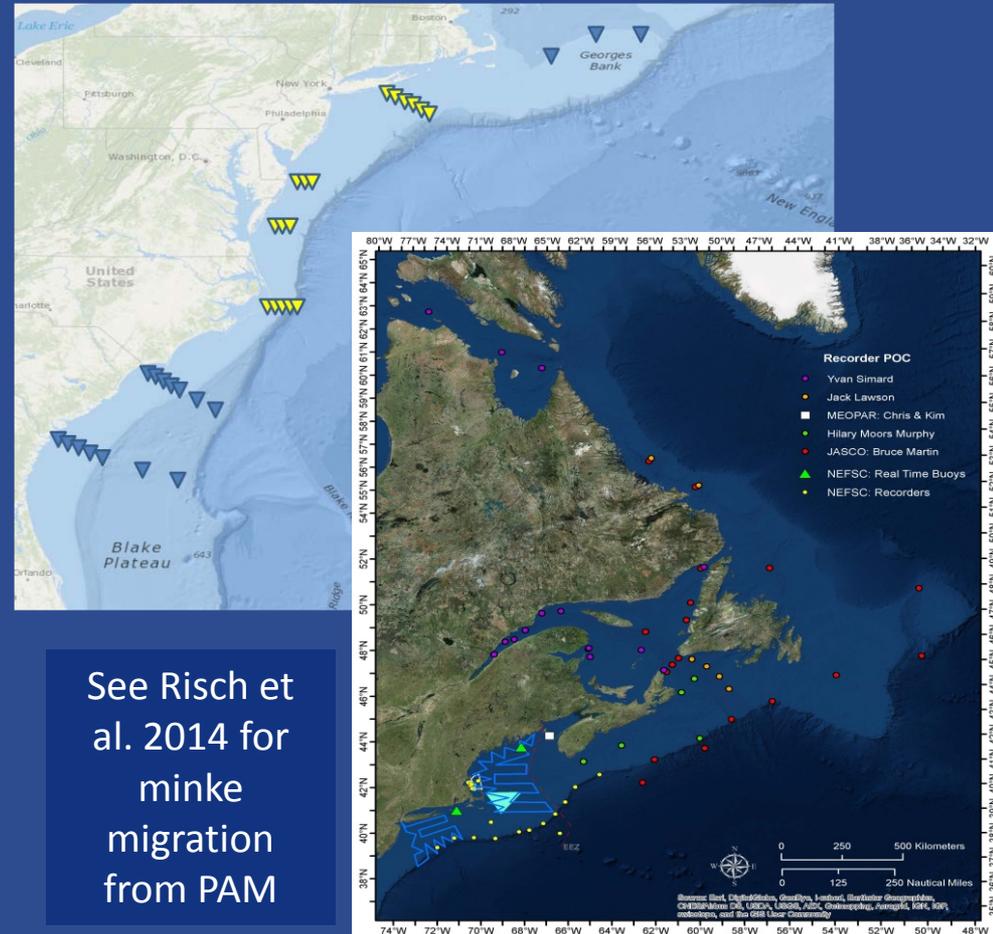
Defining migration corridors and presence of baleen whales

Archival data (2003 to 2014)



Map: Mike Thompson, NOAA/SBNMS

New planned data collection

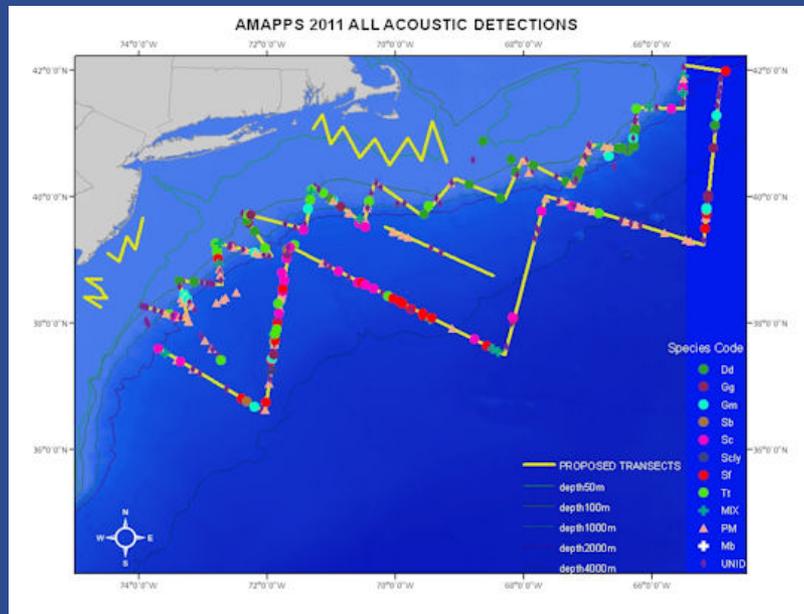


See Risch et al. 2014 for minke migration from PAM

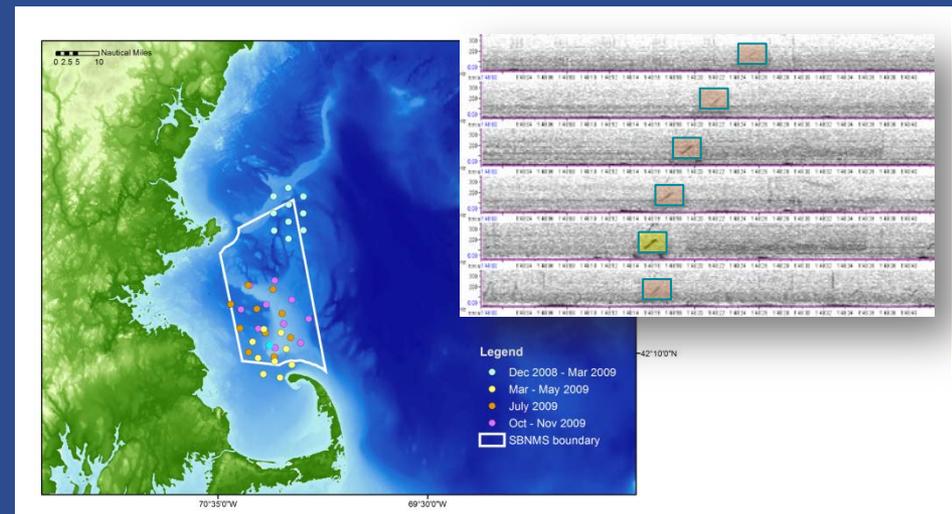
ACOUSTIC ABUNDANCE ESTIMATION

When can we use acoustics to estimate abundance?

Sperm and beaked whale abundance



Right whales – evaluating new methods



BIOLOGICAL REVIEWS
 Dec. Res. (2013), 88, pp. 287–309.
 doi: 10.1111/Rev.12001

Cambridge Philosophical Society 287

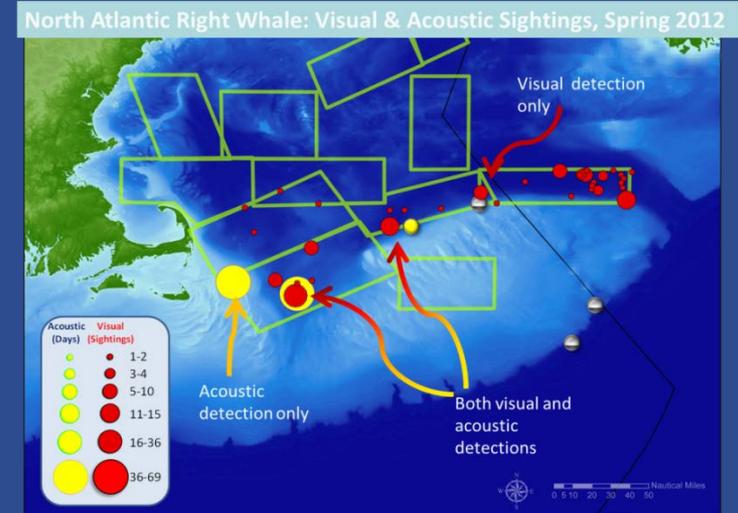
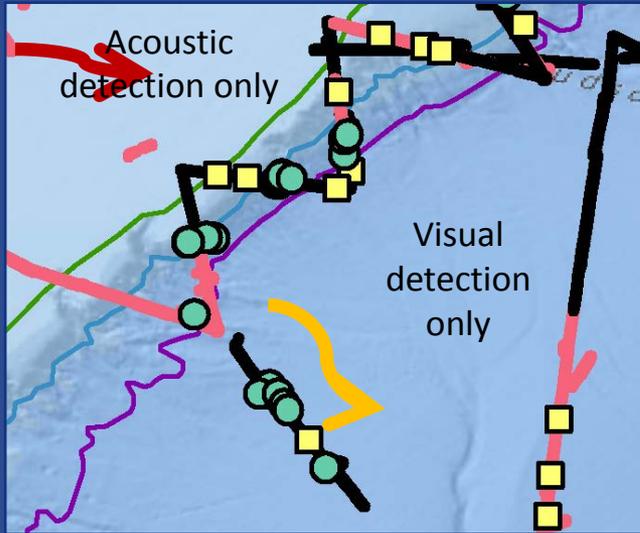
Estimating animal population density using passive acoustics

Tiago A. Marques^{1,2*}, Len Thomas¹, Stephen W. Martin³, David K. Mellinger⁴, Jessica A. Ward⁵, David J. Moretti², Danielle Harris¹ and Peter L. Tyack⁶

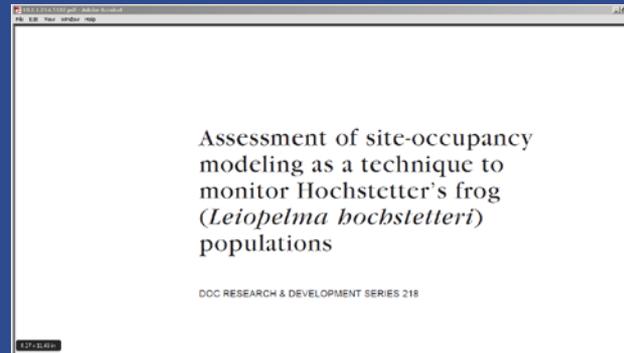
¹Centre for Research into Ecological and Environmental Modelling, University of St. Andrews, The Observatory, Buchanan Gardens, Fife, KY16 9EJ, UK
²Centro de Estatística e Aplicações da Universidade de Lisboa, Bloco C6, Piso 4, 1749-016, Lisboa, Portugal
³Space and Naval Warfare Systems Center Pacific, 53560 Hull Street, San Diego, CA 92152 USA
⁴Cooperative Institute for Marine Resources Studies, Oregon State University and NOAA Pacific Marine Environmental Laboratory, 2030 SE Marine Science Drive, Newport, OR 97365, USA
⁵Naval Undersea Warfare Center, 1176 Havelil Street, Newport, RI 02841, USA
⁶Sea Mammal Research Unit, Scottish Ocean Institute, University of St. Andrews, Fife, KY16 8LB, UK

INTEGRATING ACOUSTIC & VISUAL DATA

Exploring new approaches



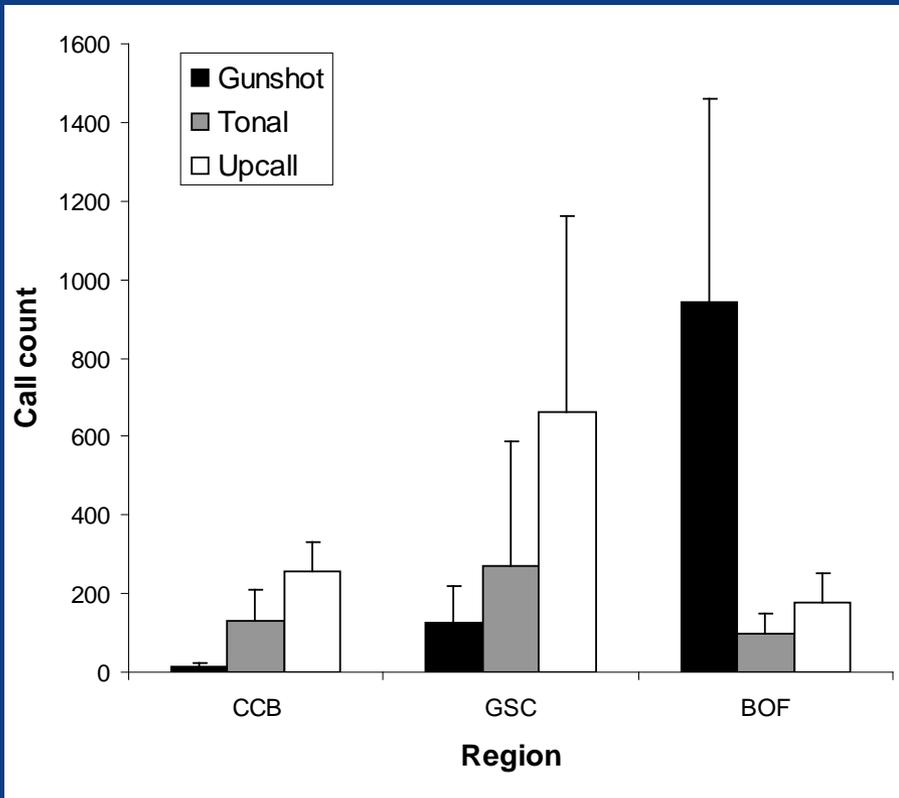
U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 13



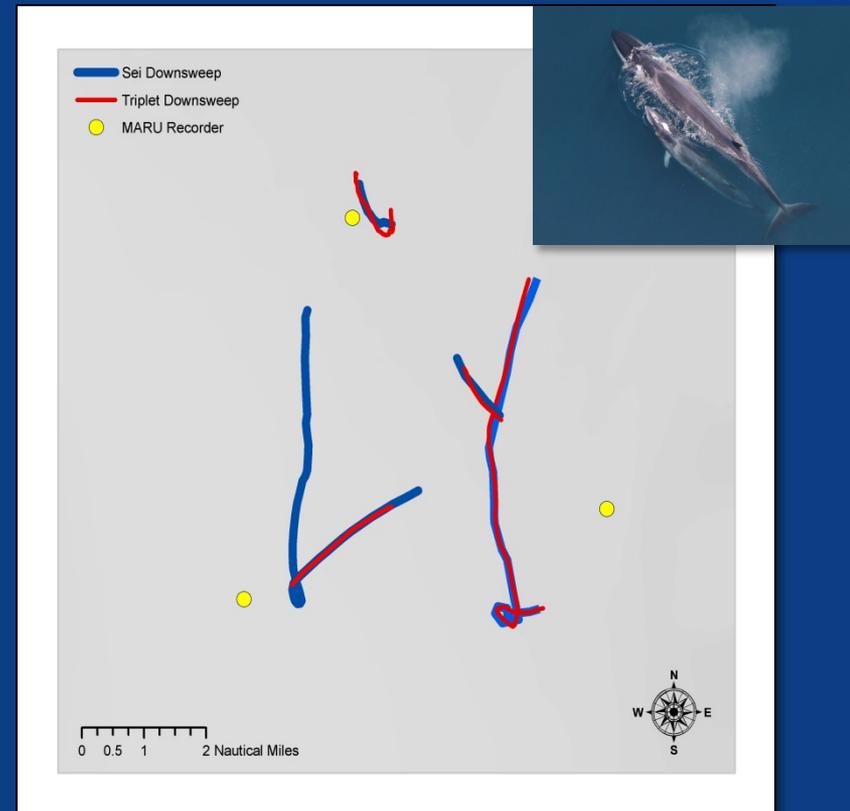
BEHAVIOR

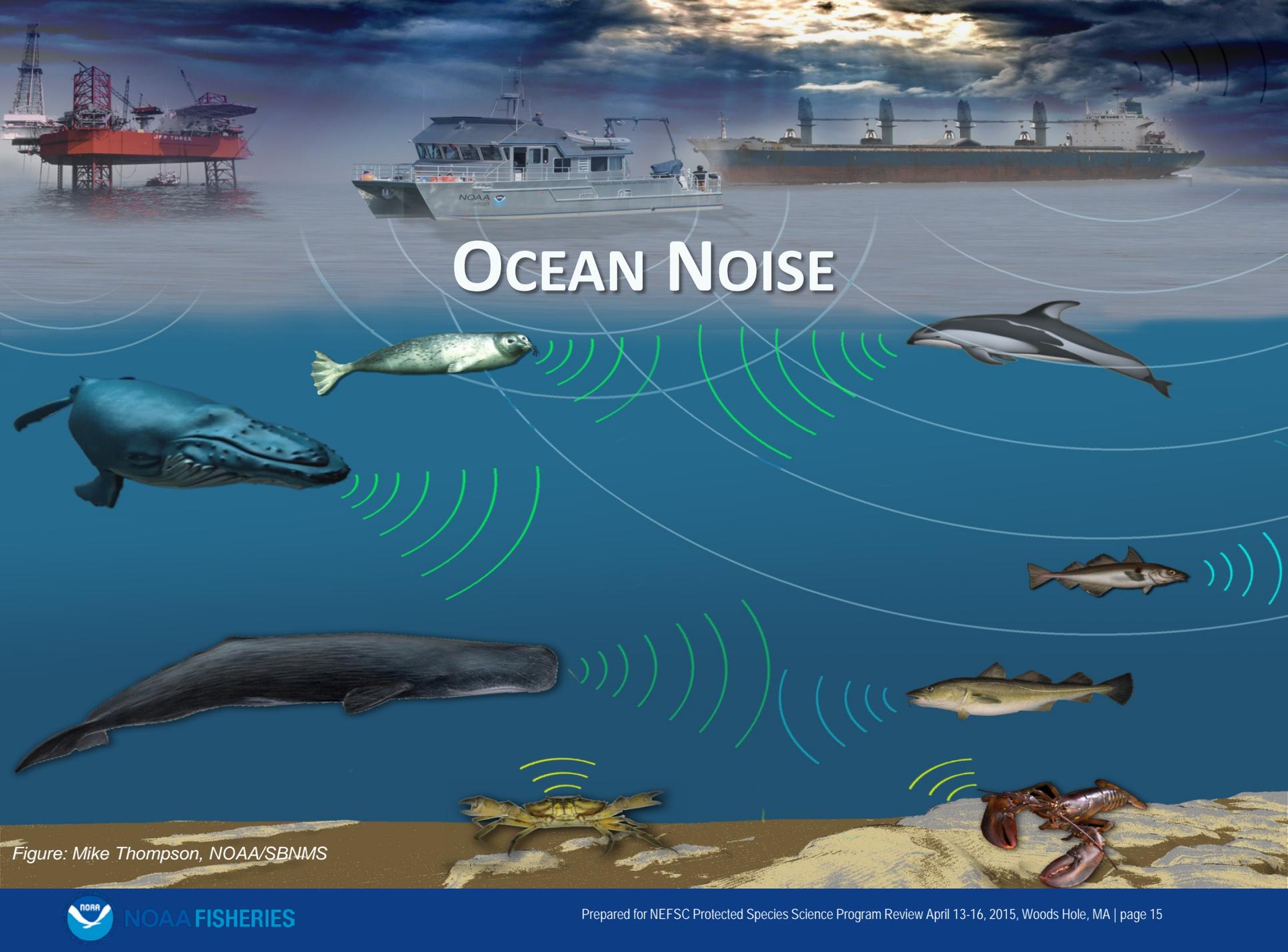
Understanding context to improve interpretation

SEASONAL & REGIONAL DIFFERENCES IN NARW CALLS



INDIVIDUAL MOVEMENTS AND CALLING RATES OF SEI WHALES





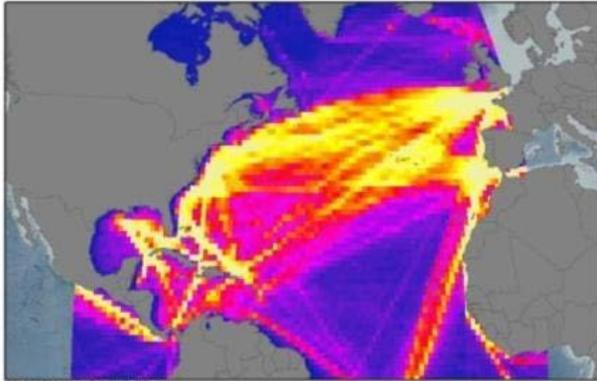
OCEAN NOISE

Figure: Mike Thompson, NOAA/SBNMS

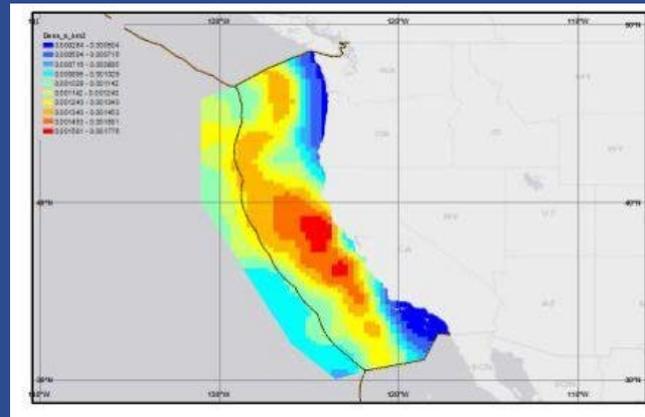
CETSOUND

Developing a NOAA Ocean Noise Strategy: focused on species, acoustic ecology and technology/data needs

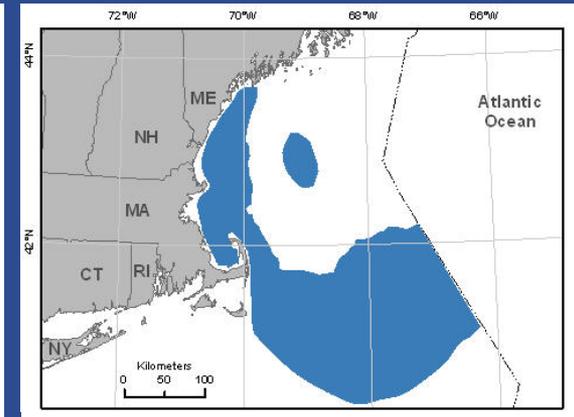
Anthropogenic sources



Cetacean distribution



Biologically Important Areas



Aquatic Mammals 2015, 47(1), 1. DOI 10.1578/AM.41.1.2015.1

Letter of Introduction to the Biologically Important Areas Issue

Guest Editor: Sofie M. Van Parijs, Ph.D.

NOAA Northeast Fisheries Science Center

This special issue on Biologically Important Areas (BIAs) has been a long time in the making. It has taken considerable effort from all of the authors involved, in addition to a large body of diverse reviewers, to produce these papers. This issue originated as a side bar to the Cetacean Density and Distribution Mapping (CetMap) Working Group, a part of the National Oceanic and Atmospheric Administration's (NOAA) CetSound program (<http://cetsound.noaa.gov>). The CetMap Working Group created a manuscript

from within and outside NOAA (both scientists and managers), including some of the CetMap Working Group members. Upon submission to *Aquatic Mammals*, Dr. Dudzinski reviewed all manuscripts with an eye to promoting consistency and accuracy across all the BIAs, in addition to soliciting reviews from two to three external reviewers for each chapter through the journal's review process.

These are eight chapters in this special issue, an

See special issue published March 1st

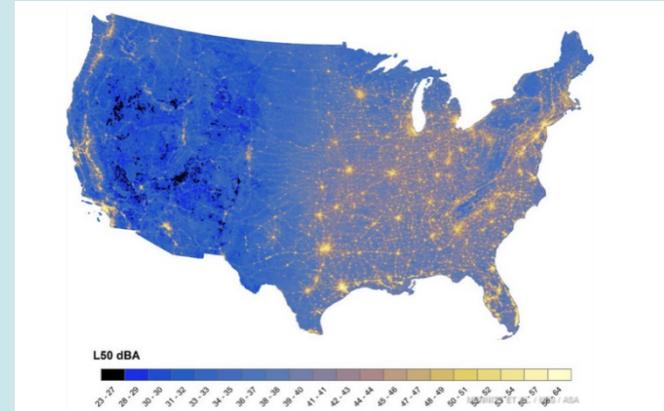
NOISE IMPACTS



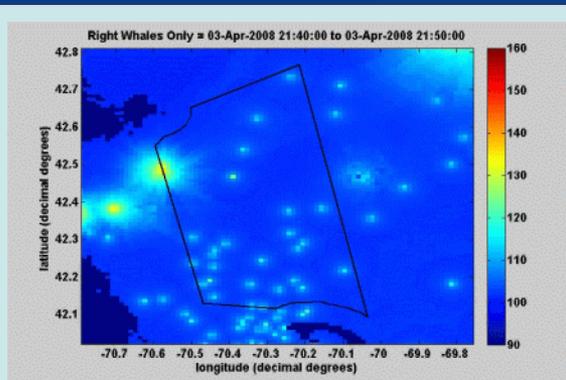
Vessels



Applying NPS
terrestrial
approaches to
ocean
soundscapes

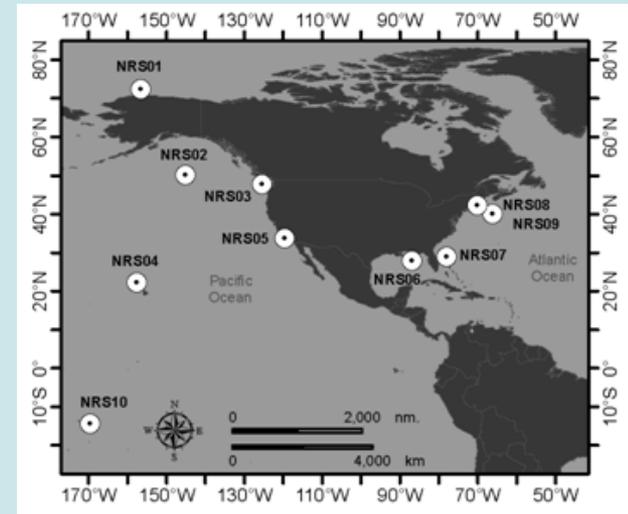


Loss of
communication
space



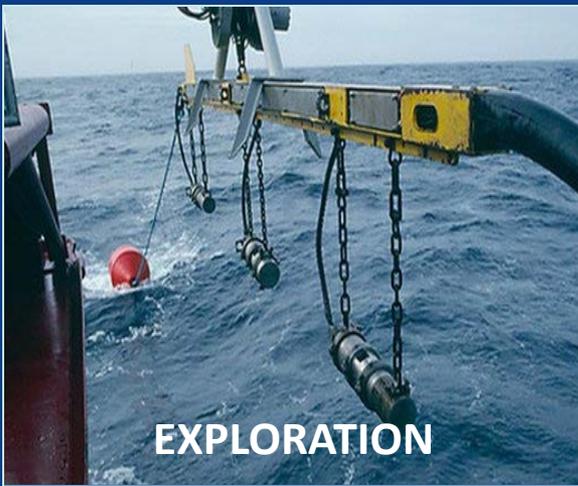
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION The Cornell Lab of Ornithology

Differences
across
regions



Map: Mike Thompson, NOAA/SBNMS

NOISE IMPACTS



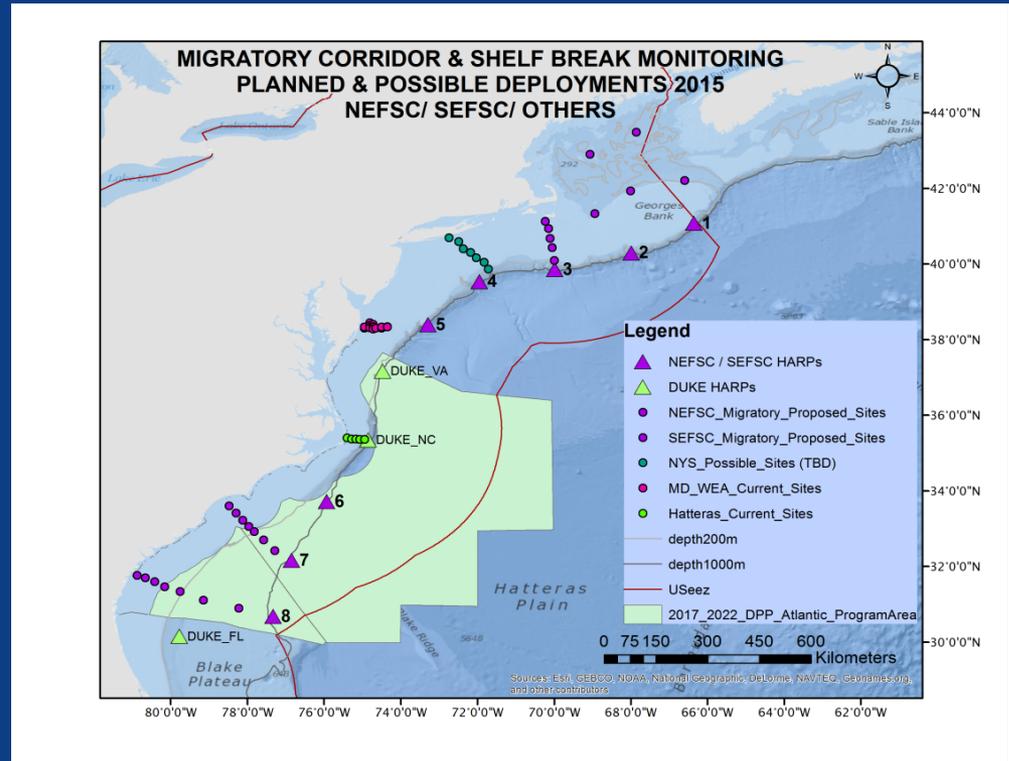
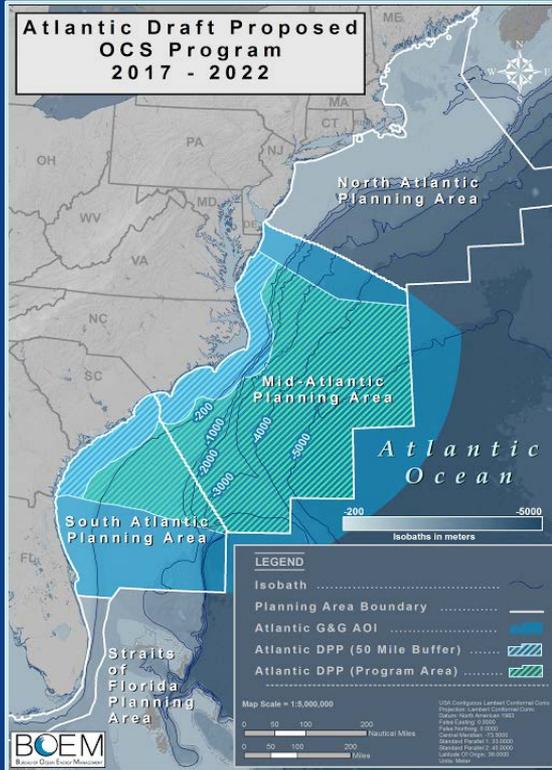
EXPLORATION



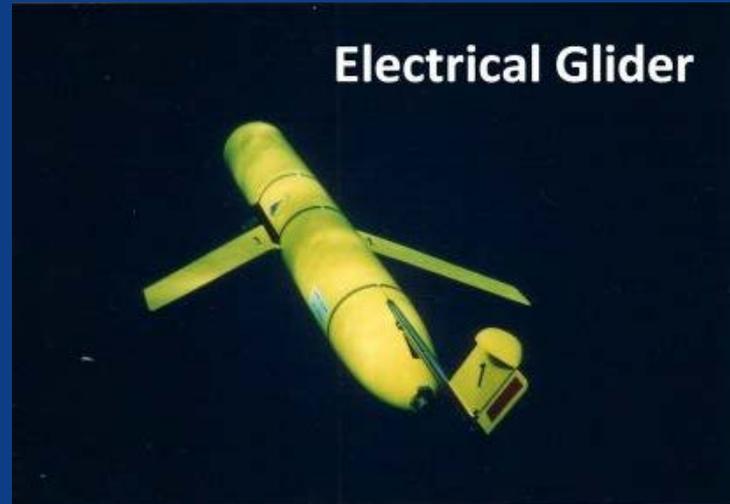
WIND

Photo: Global Nevadacorp

Proposed BACI design



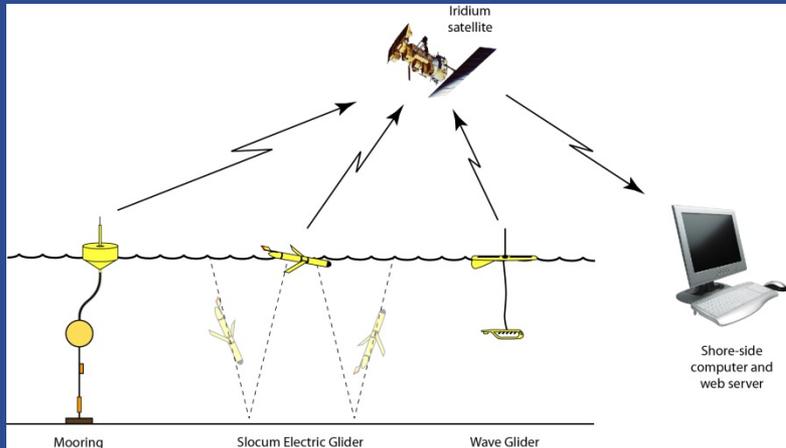
REAL-TIME ACOUSTICS



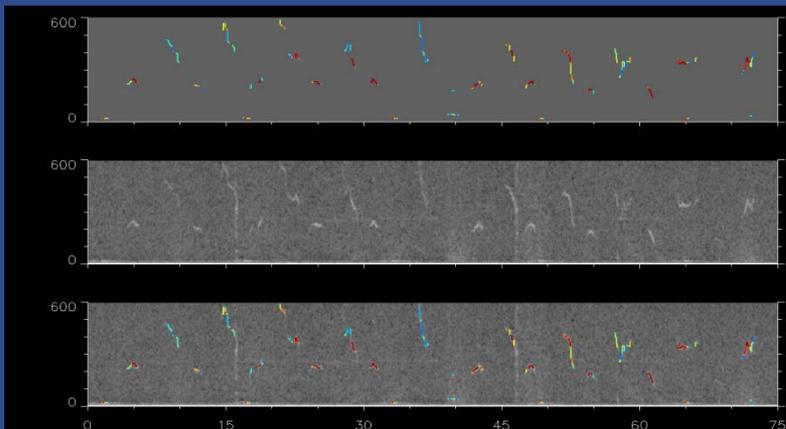
REAL-TIME ACOUSTICS

Using real time information to improve monitoring and mitigation

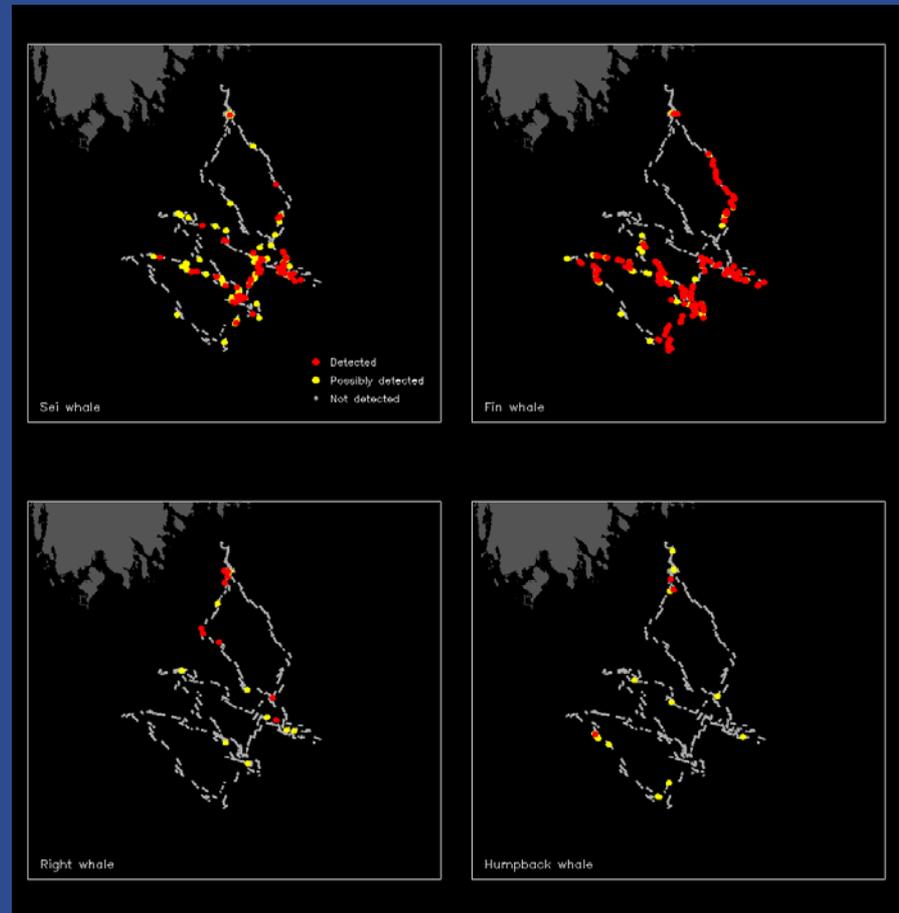
Technology



Sounds

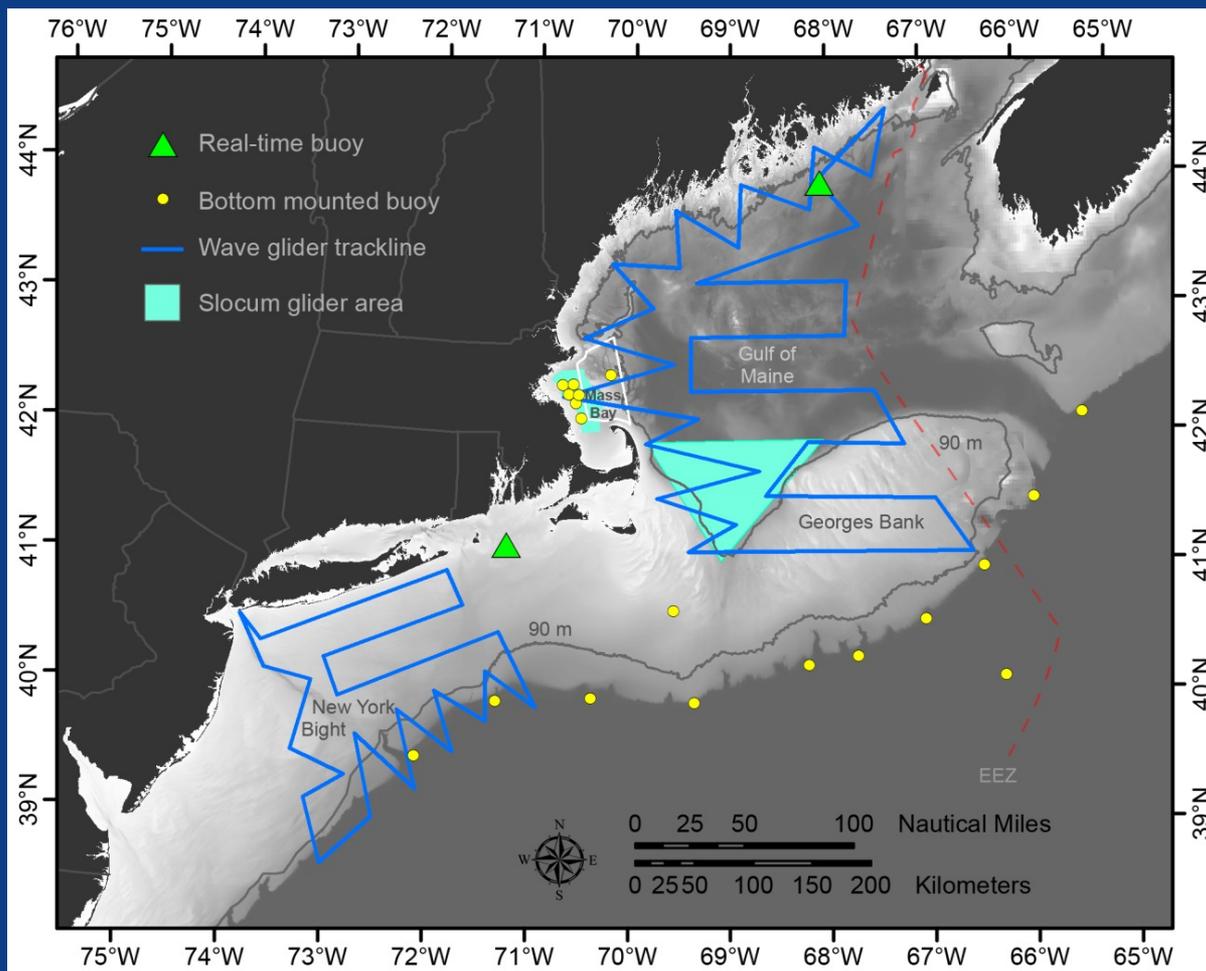


Presence



BROAD SENSING NETWORK

Establishment of a monitoring and mitigation network



Map: Mike Thompson, NOAA/SBNMS



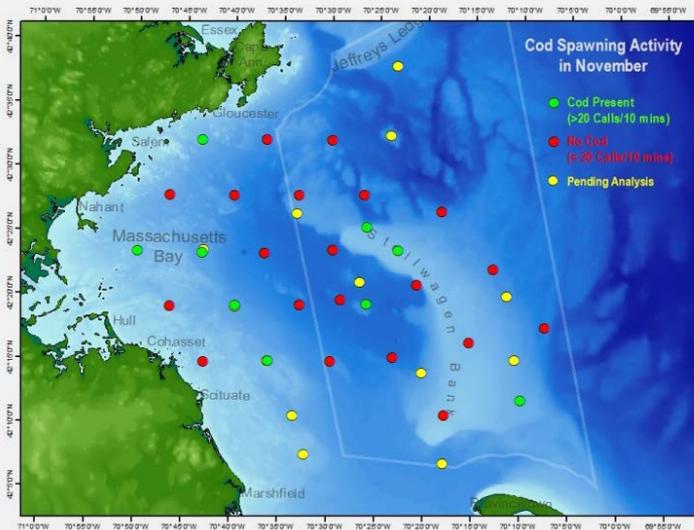
FISH ACOUSTICS

PASSIVE RECORDINGS AND TELEMETRY

ACOUSTICS FOR FISH

Using passive acoustics to identify and protect cod spawning areas

Historical activity (2007 – 2012)

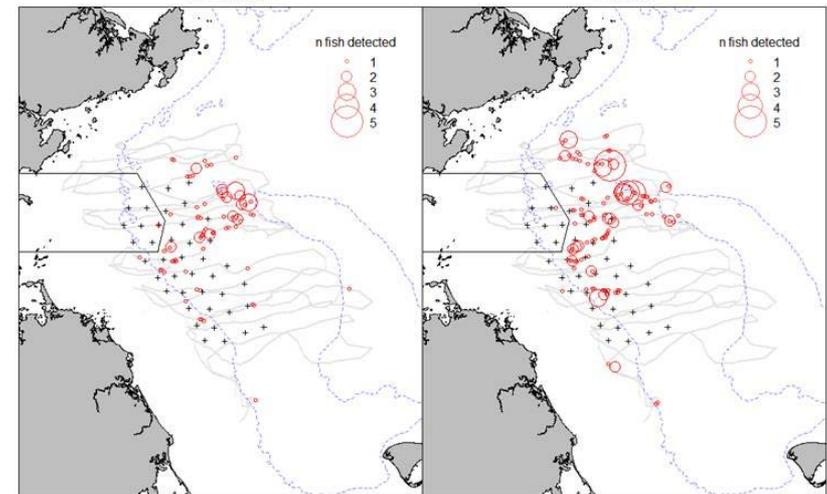


Combined with
MASS DMF
telemetry project

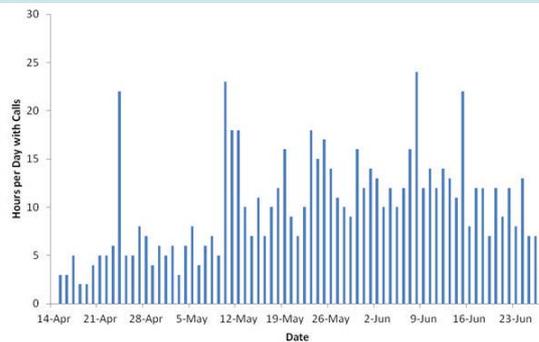


FEMALE

MALE



Seasonality



GOM telemetry network next...

DATA

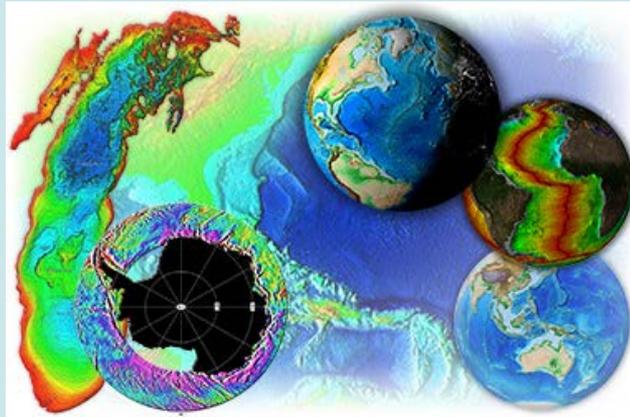
Organizing, storing and distributing petabytes of sound data

Managing Acoustic Records



Tethys metadata program –
UCSC/Scripps/NMFS SCs

Archiving



NGDC pilot project

Dissemination



Countless
collaborative data
sharing projects

Ask and you shall
receive

OUTREACH

Teaching the next generation about protected species



Aquarium sound exhibit:

Materials used in Smithsonian, New Bedford whaling museum and more



NOEPS: Growing program bringing hands on lessons to all local schools and classrooms, science fairs, educational events

STRENGTHS

Created an internationally recognized center of Excellence in passive acoustics research

Leading & contributing to wide array of national and international efforts to advance PAM

Developing, testing and standardizing PAM tools

Leading efforts for NOAA & NEFSC data archiving and management

Excellent partnerships with academics and other NMFS acousticians

Highly successful in attracting external funding

Highly skilled cadre of acoustic contract analysts

CHALLENGES



Transitioning research tools from development to operational stage

Massive data management and sharing needs

Data processing needs in addition to the continued development and improvement of automated detectors

Maintenance of NOAA wide, national and international collaborations requires time and FTE support

Extensive reliance on external support and contract analysts

Capacity to keep collecting PAM data long term

This whole operation can not rest on one persons shoulders

RECOMMENDATIONS

Enhance internal NOAA support of passive acoustics work

Continue to focus Center efforts on passive acoustics, maintain national leadership role

Maintain and expand partnerships with funding agencies and with research institutions

Continue to pursue real-time monitoring efforts, implementation of broad sensing networks, studies of ocean noise impacts, and integration of acoustics and visual survey data

Reduce excessive reliance on temporary and external funding for all parts of this program - support, support, support

