

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

Atlantic Large Whale Assessment:

Passive Acoustic Monitoring in the Northwest Atlantic Ocean (2006– Current)

Genevieve Davis ¹, Mark Baumgartner ², Danielle
Cholewiak ¹, Julianne Gurnee ¹, Sofie Van Parijs ¹



¹ Northeast Fisheries Science Center

² Woods Hole Oceanographic Institute

PAM in the Northwest Atlantic

1. Archival analysis of all existing passive acoustic data
 - Species focus: right, fin, sei, blue, humpback whales



North Atlantic right whale



fin whale



sei whale



blue whale



humpback whale

2. Current data collection efforts

- Consistent effort and data coverage for three years
- Focus on all species: mysticetes & odontocetes

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Passive Acoustic Monitoring for NARW

Changes in movement:

- Prior to 2010: movements fairly predictable
- Post 2010: Where are they going?
- **We need to understand migration routes prior to and post 2010**



Figure: ocean.si.edu

Migration routes & seasonal occurrence

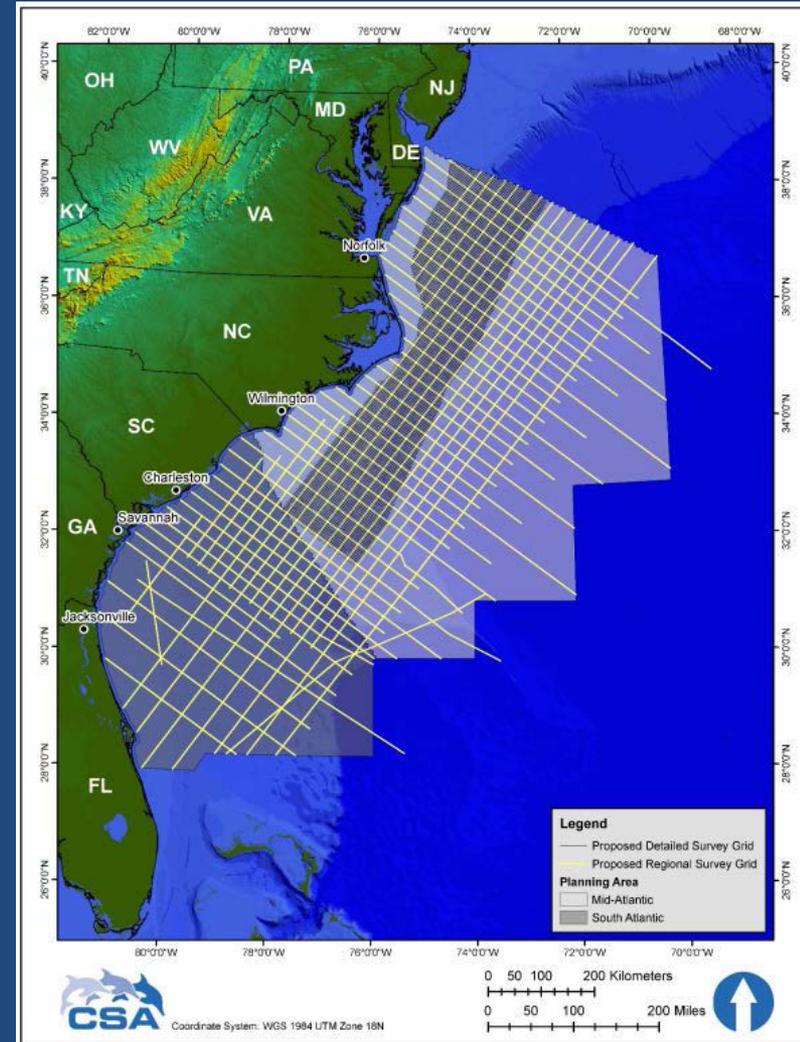
- Timing
- Distance from Shore
- Dispersed or in groups



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Need for information

- Ongoing threats
 - Entanglement and ship strike
 - Renewable energy development
 - Naval operations
- Upcoming threats
 - Seismic exploration (postponed as of today)



Passive Acoustic Monitoring for NARW seasonal occurrence

- Previous studies:
 - Concentration on specific areas
 - Often short-term (1–2 years or less)
- **This project:**
 - Large scale
 - Call for W. Atlantic data
 - Incorporate all available data



Figure: ocean.si.edu

Data Contributors / Collaborators

- Ana Sirovic, John Hildebrand; Scripps Institution of Oceanography
- Andy Read, Joy Stanistreet, Lynne Hodge; Duke University
- Catherine Berchok; NOAA National Marine Mammal Laboratory
- Chris Clark, Russ Charif, Holger Klinck, Aaron Rice; Cornell University
- Dave Mellinger, Sharon Nieuwkerk; Oregon State University
- Erin Summers; Maine Department of Marine Resources
- Gary Buchanan; New Jersey Department of Environmental Protection
- Kathleen Dudzinski; Dolphin Communication Project
- Helen Bailey; University of Maryland
- Hilary Moors–Murphy; Department of Fisheries and Oceans Canada
- Joel Bell, Jaqueline Bort, Anu Kumar; NAVFAC Naval Facilities Engineering Command
- Julien Delarue, Bruce Martin; JASCO Applied Sciences
- Kate Stafford; University of Washington
- Scott Kraus; New England Aquarium
- Sean Todd; College of the Atlantic
- Susan Parks; Syracuse University
- Lance Garrison, Melissa Soldevilla; NOAA Southeast Fisheries Science Center
- Mike Thompson, David Wiley, Leila Hatch; NOS Stellwagen Bank National Marine Sanctuary
- Denise Risch, Scottish Association for Marine Science



Thank You!



MARU

(Marine Autonomous
Recording Unit)

Cornell University



HARP

(High-frequency Acoustic
Recording Package)

Scripps Institution of Oceanography



AMAR

(Autonomous Multichannel
Acoustic Recorder)

Jasco Applied Sciences

Recorder Types



HARU

(Haruphone)

NOAA PMEL &
Oregon State University

Available Passive Acoustic Data

Recordings from:

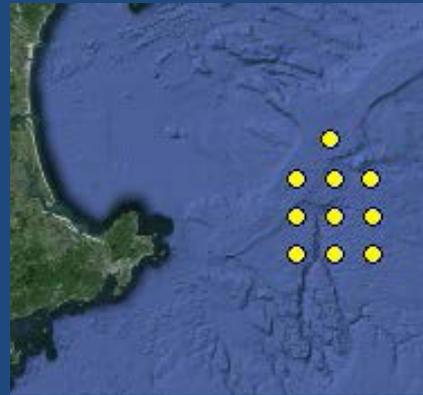
- 2004 to 2014
- 2 weeks to 2 years of continuous data
- Deployments in the form of:

Single Units



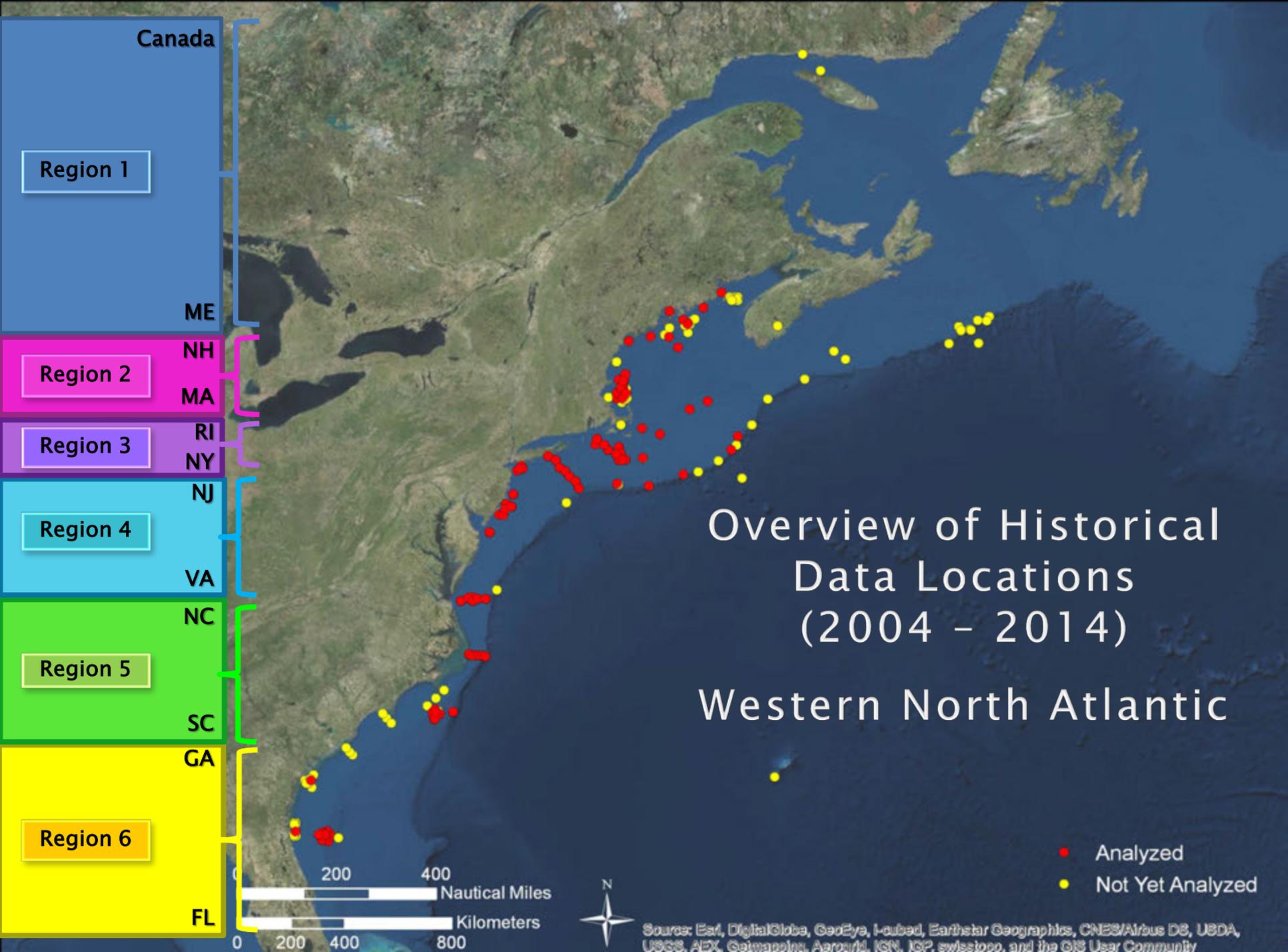
Arrays

Clusters



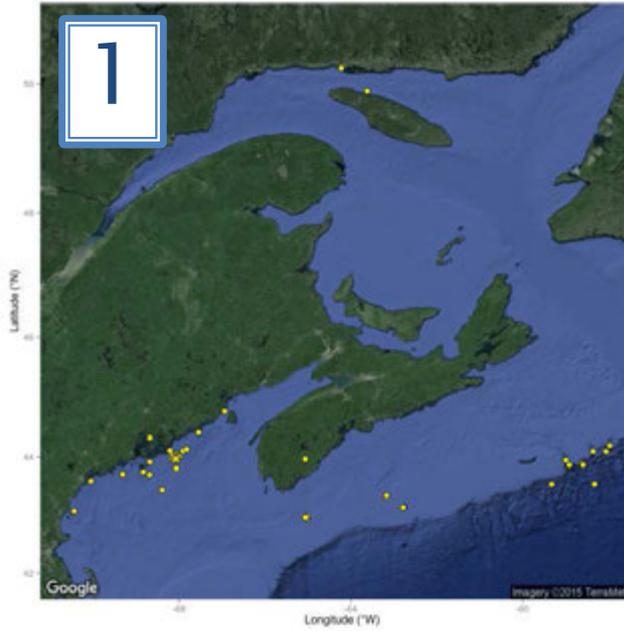
Lines



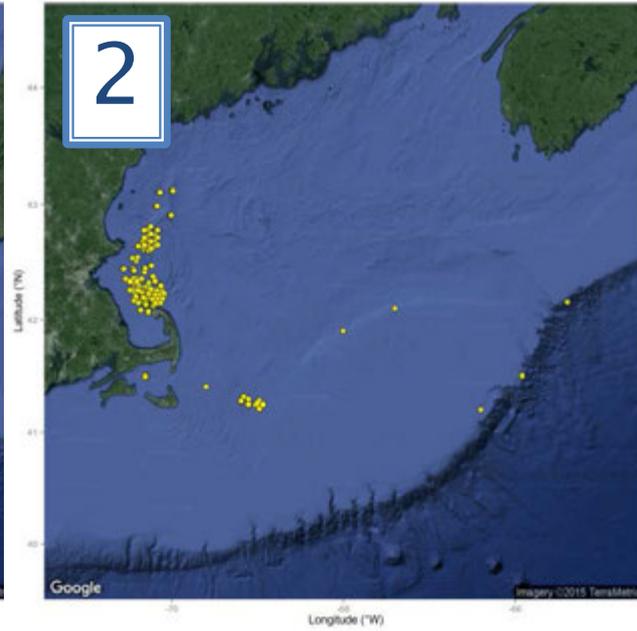


Data by region

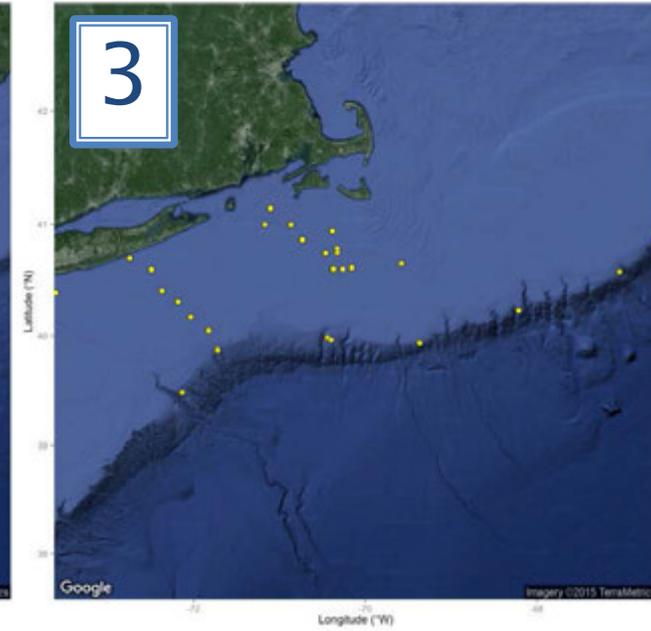
1



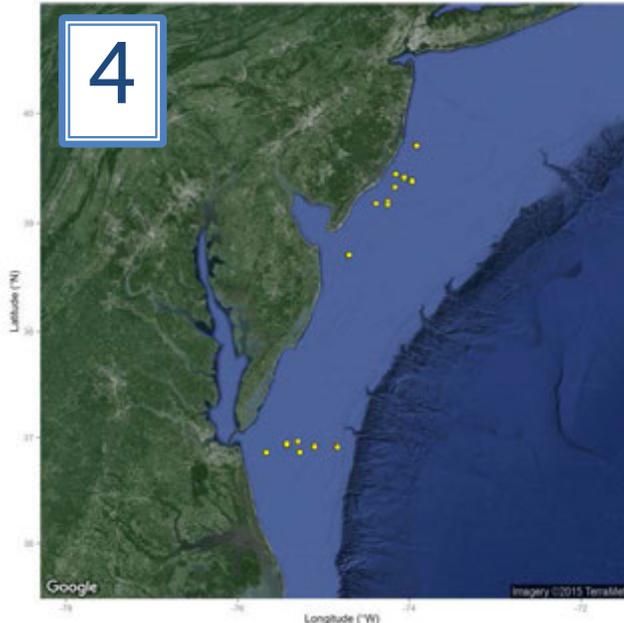
2



3



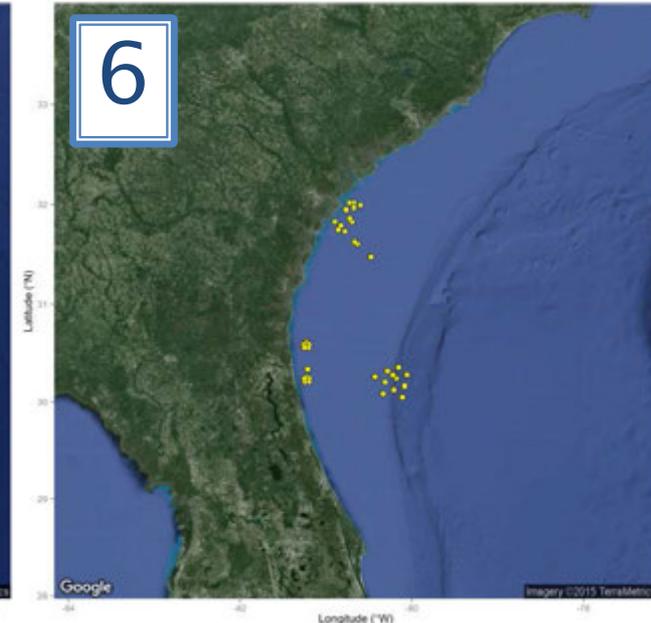
4



5



6



Combined Available Data for Migratory Corridor Analysis

Region 1

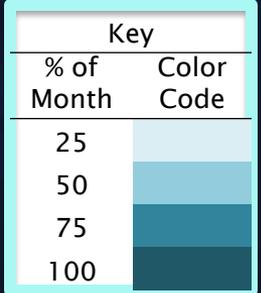
Region 2

Region 3

Region 4

Region 5

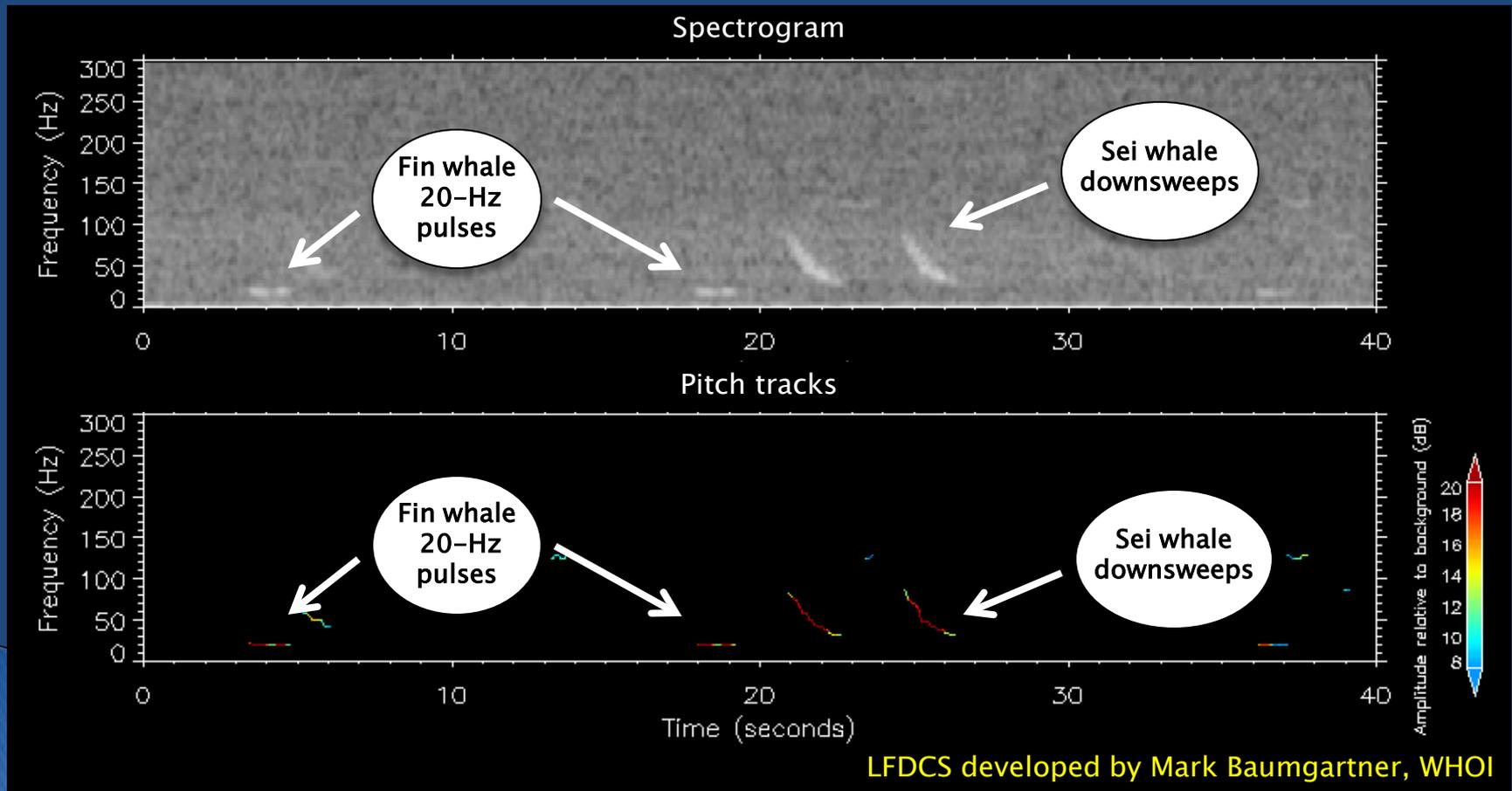
Region 6



Year	2004				2005				2006				2007				2008				2009				2010				2011				2012				2013				2014											
Season	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F
Region																																																				
1	[Heatmap data for Region 1]																																																			
2	[Heatmap data for Region 2]																																																			
3	[Heatmap data for Region 3]																																																			
4	[Heatmap data for Region 4]																																																			
5	[Heatmap data for Region 5]																																																			
6	[Heatmap data for Region 6]																																																			

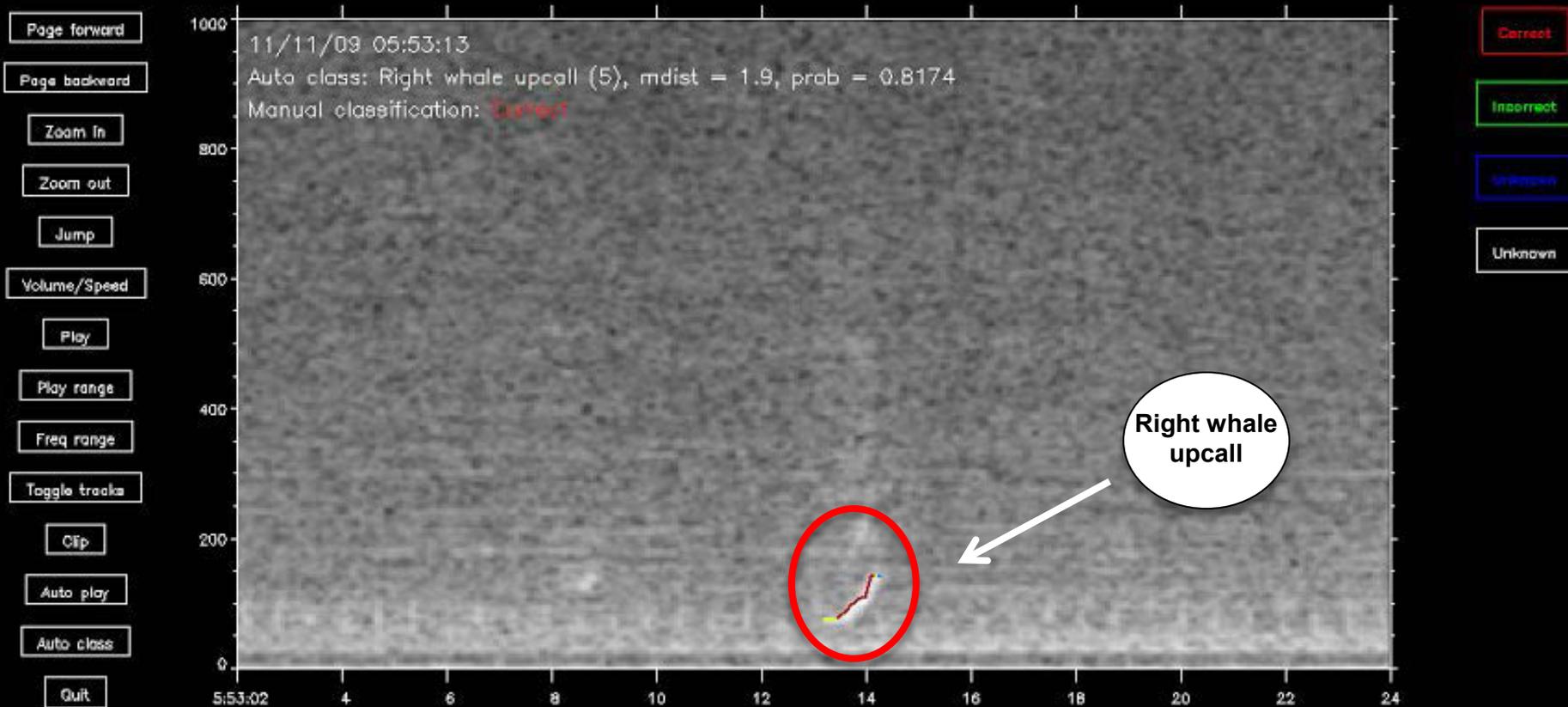
LFDCS: Low-frequency detection and classification system

- Creates a spectrogram
- Detects sounds and pitch tracks
- Classifies pitch tracks based on call library

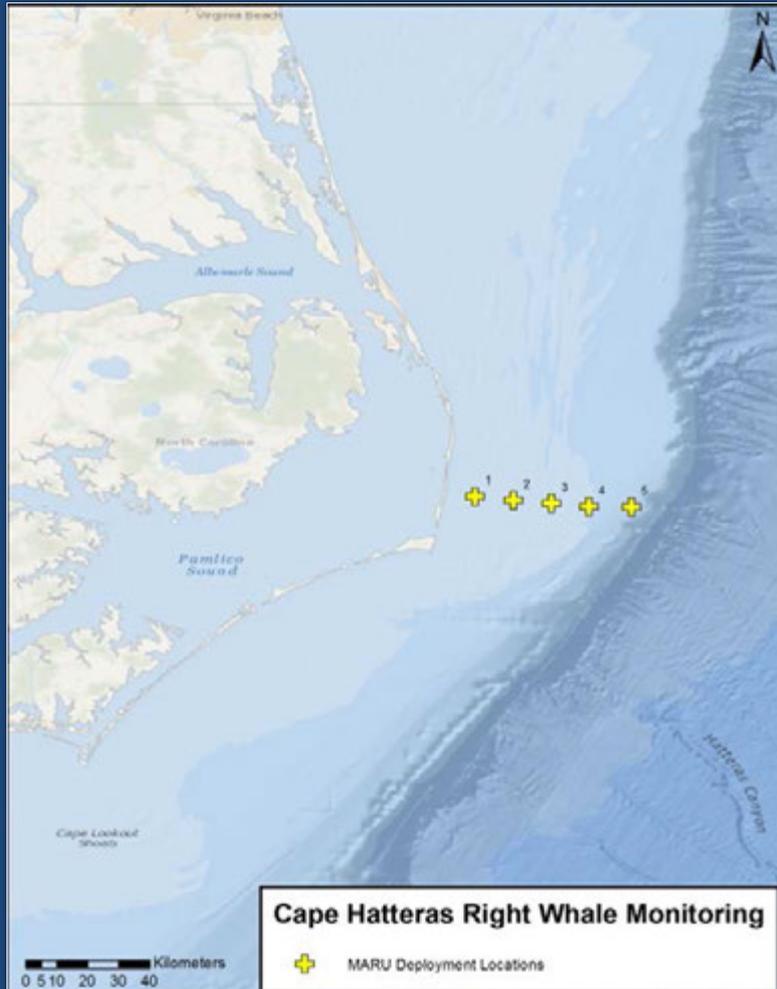


Project Methods:

- Run LFDCS through all data
- Browse data for true detections
 - Daily presence = 3 true detections



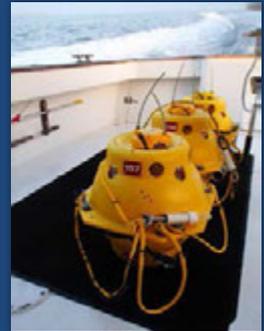
Passive acoustic monitoring for North Atlantic right whales off Cape Hatteras, North Carolina: 2013 – 2015



MARU Deployments:

October 2013 – June 2014

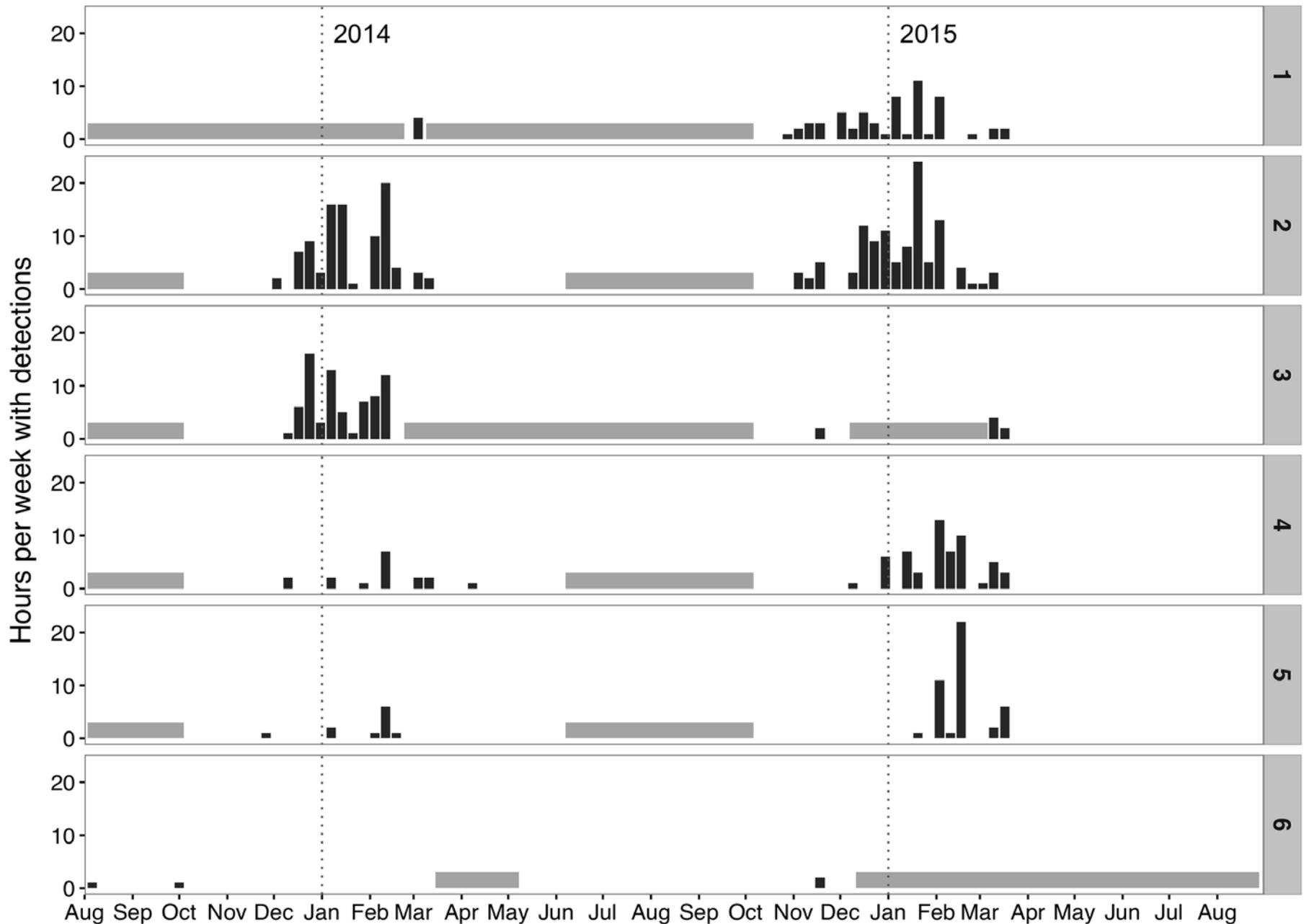
October 2014 – August 2015



Continuous recordings, 2 kHz sampling rate

560 days of monitoring, >55,000 total recording hours across all sites

Stanistreet, J. E., Daly, M., Broadhead, T., Davis, G., Bell, J., Nowacek, D. P., Read, A. J., & Van Parijs, S.M. *Seasonal occurrence of North Atlantic right whales off Cape Hatteras, North Carolina.* (in prep)



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sperm whale



beaked whales



common dolphin



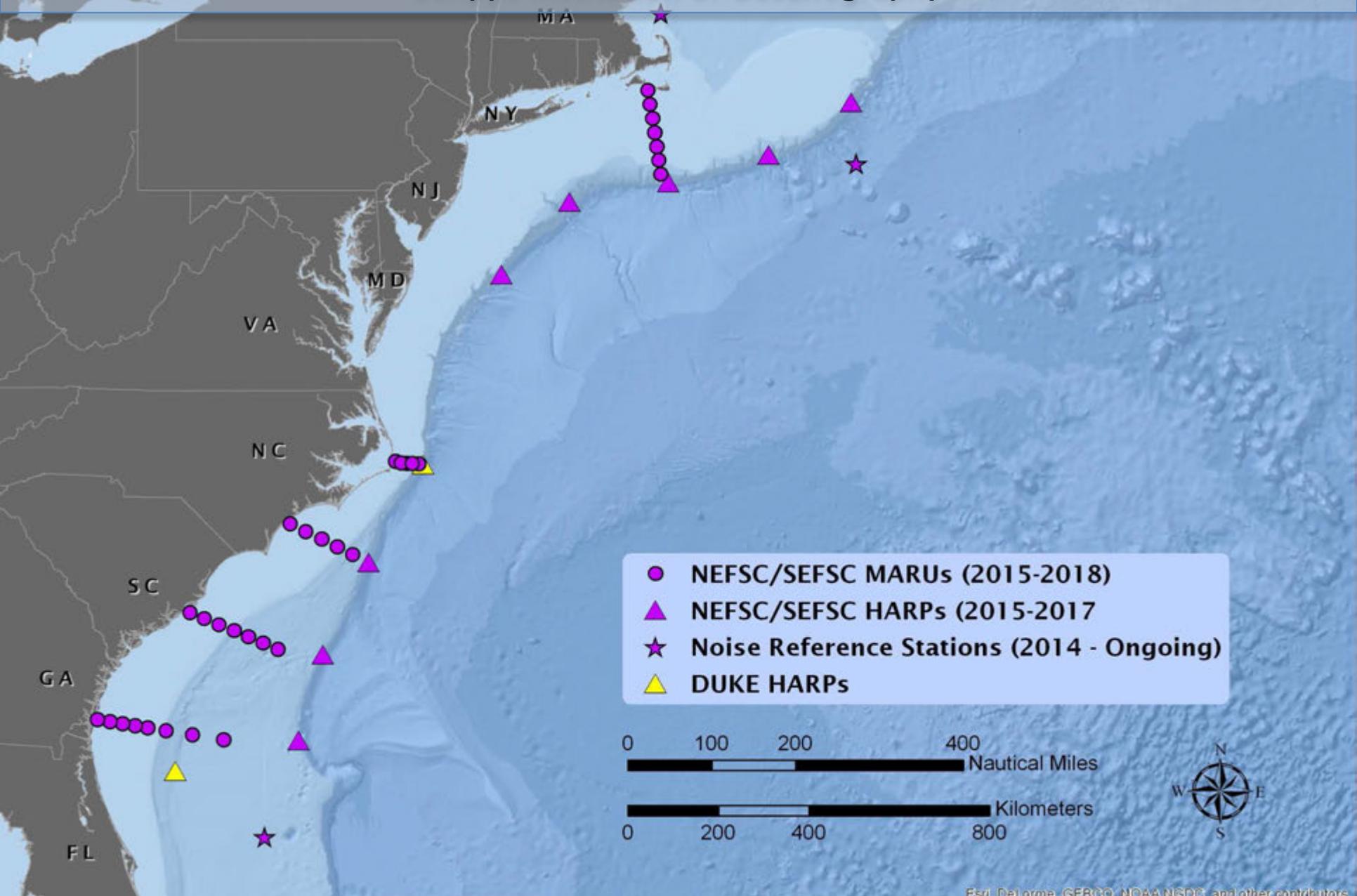
harbor porpoise



Risso's dolphin

Migratory Corridor Acoustic Deployments: 2015 - 2018

NOAA Northeast & Southeast Fisheries Science Centers, Duke & Cornell University, Scripps Institution of Oceanography



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- Dana Gerlach, Annamaria Izzi, Eric Matzen, Jenni Stanley, Chris Tremblay – NOAA/NEFSC
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Fisheries and Oceans Canada

Thank you!