



NOAA
FISHERIES

Passive Acoustic Technologies and Research in the Atlantic Ocean

Sofie Van Parijs



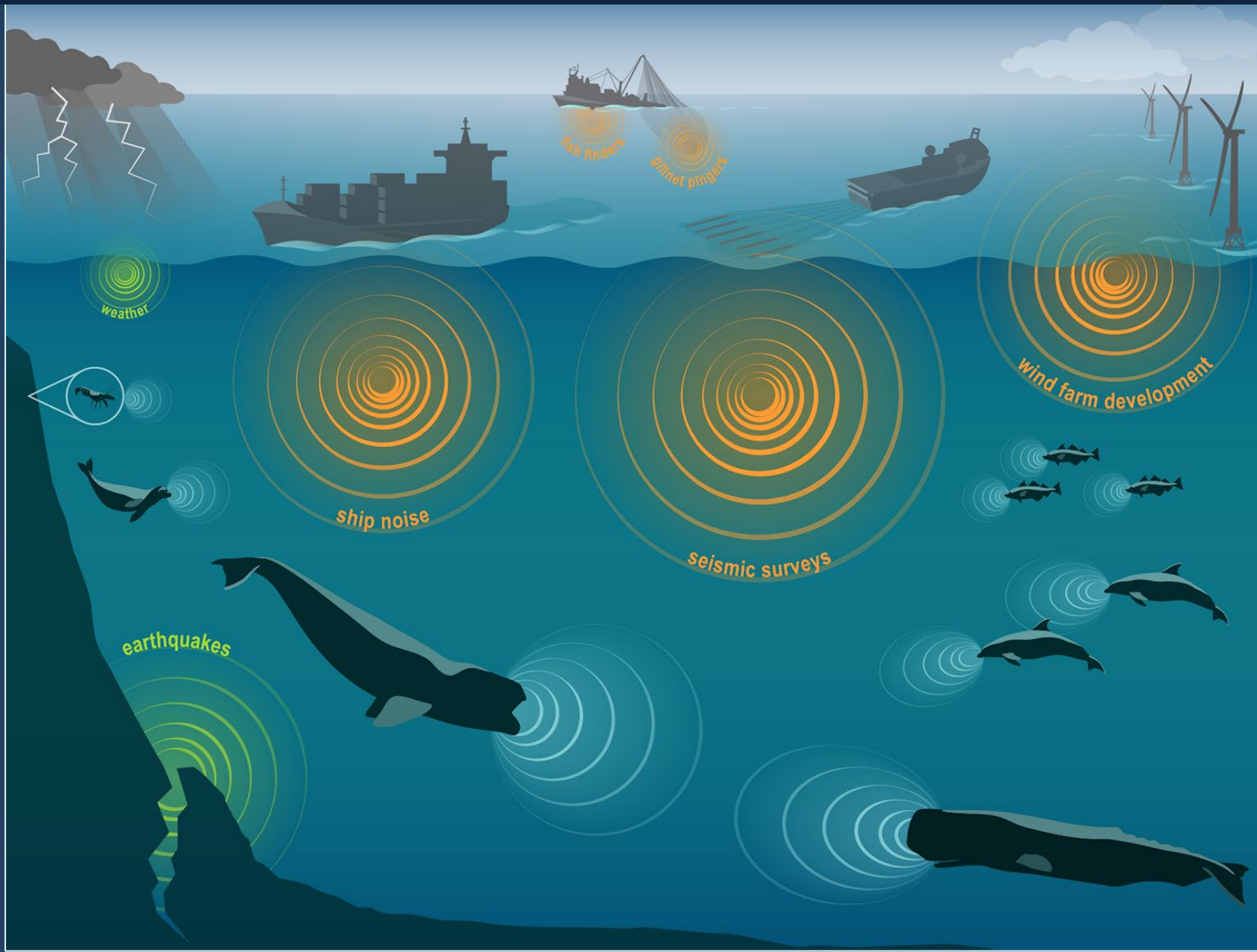
All light is absorbed within 200 m of the ocean's surface



Sound travels 5 times faster in water than in air
(1500m/s) (340m/s)



APPLIED ECOLOGY AND PAM





WHY **P**ASSIVE **A**COUSTIC **M**ONITORING? (**PAM**)

Provides a non-invasive, valuable alternative or addition to traditional survey methods



+ Benefits +

- Can detect animals at night and in bad weather
- Can do long-term monitoring with reduced field effort and cost
- Can cover wide spatial range

- Limitations -

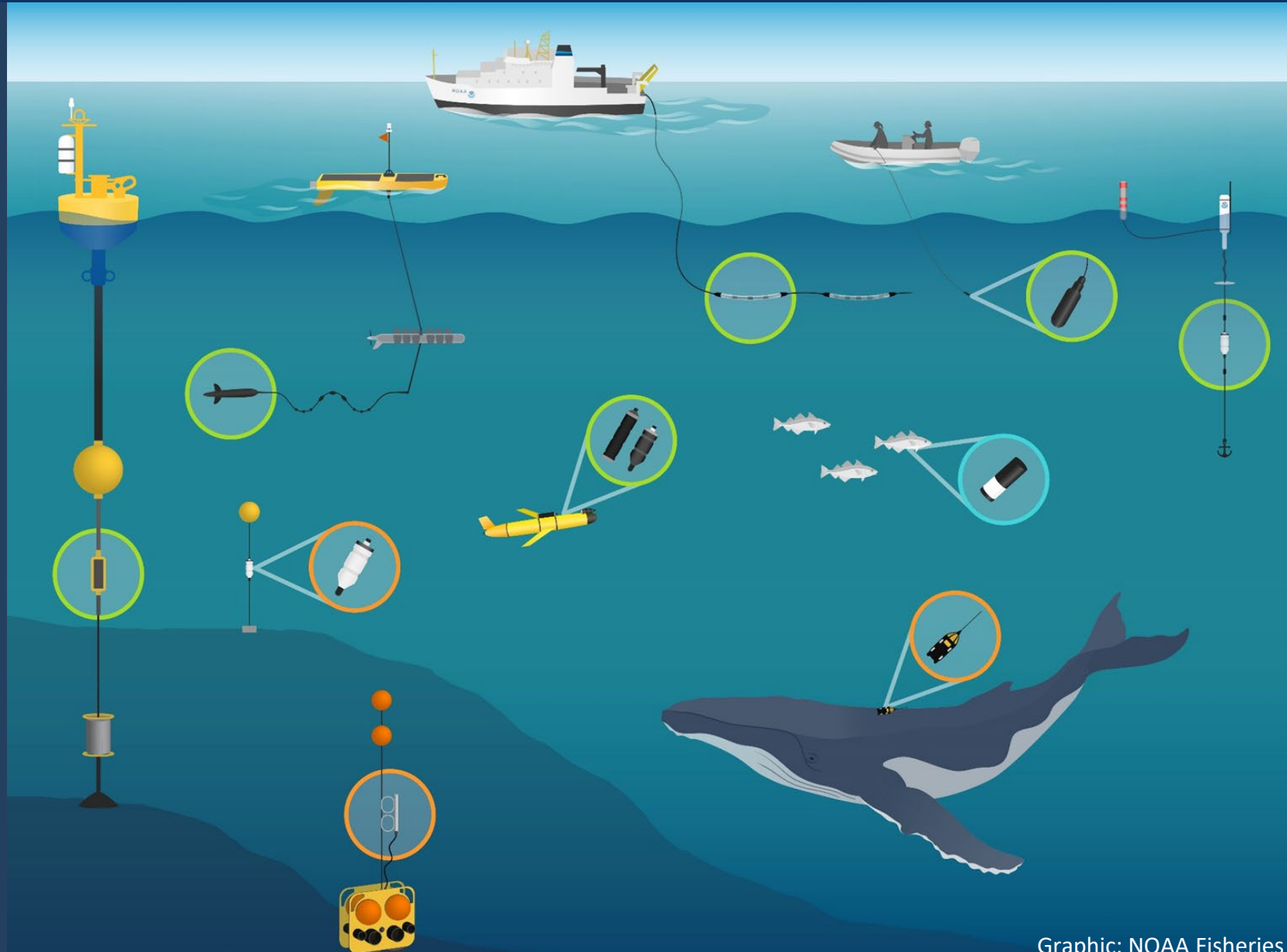
- Presence only: cannot tell when animals are NOT around
- For most species, difficult to determine number of individuals present
- Many sounds are still unknown



WHAT DO WE COLLECT PAM DATA?

ARCHIVAL

- Bottom-mounted recorders
- Acoustic tags
- Telemetry tags (active)

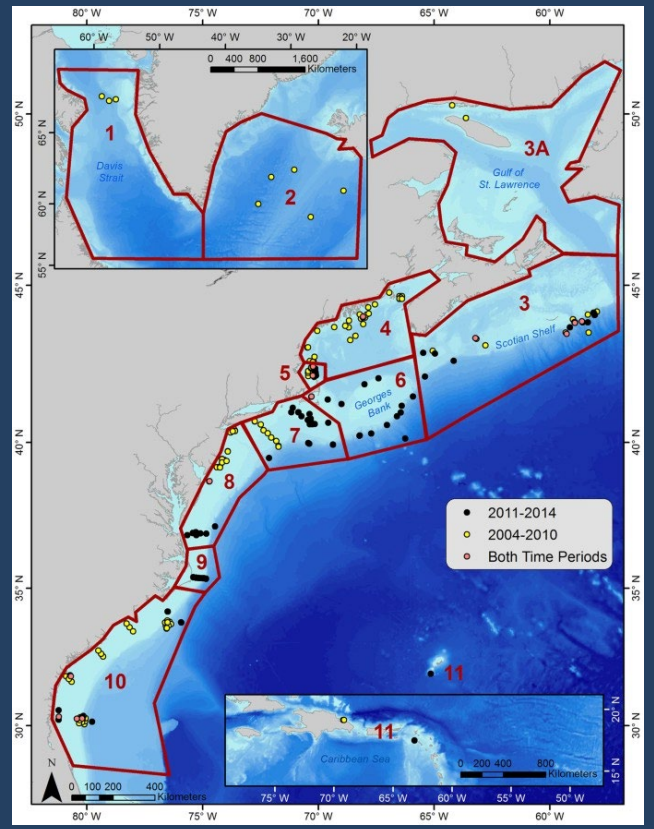


REAL TIME

- Moored buoys
- Gliders
- Towed Arrays
- Drop hydrophones
- Drifting buoys

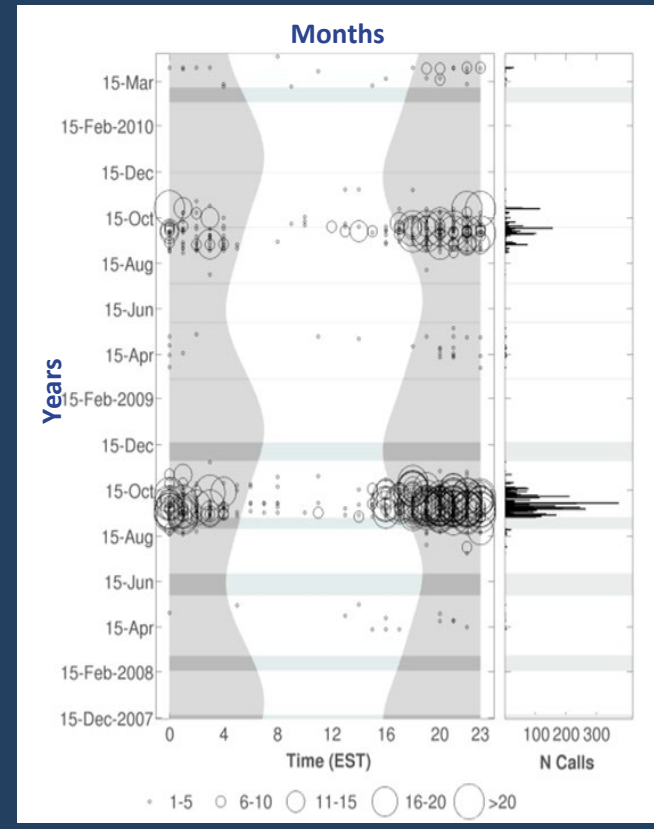
WHAT CAN IT TELL US?

Spatial Coverage



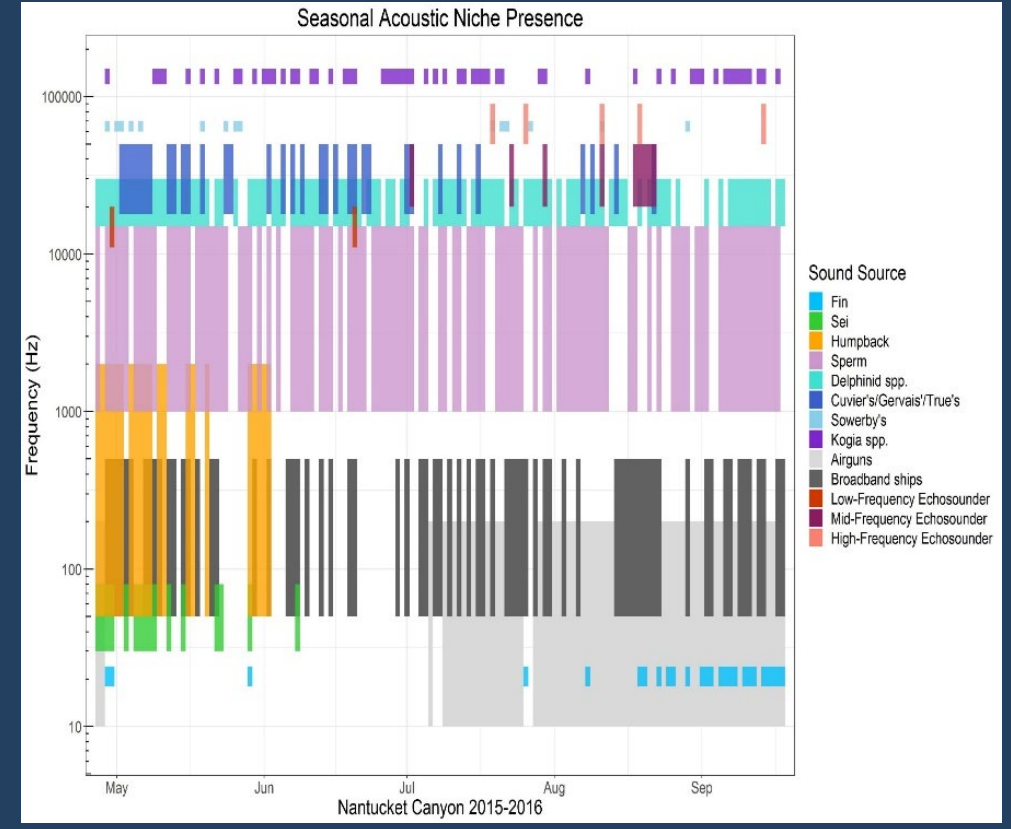
Davis et al. 2017

Long Time Periods



Risch et al. 2014

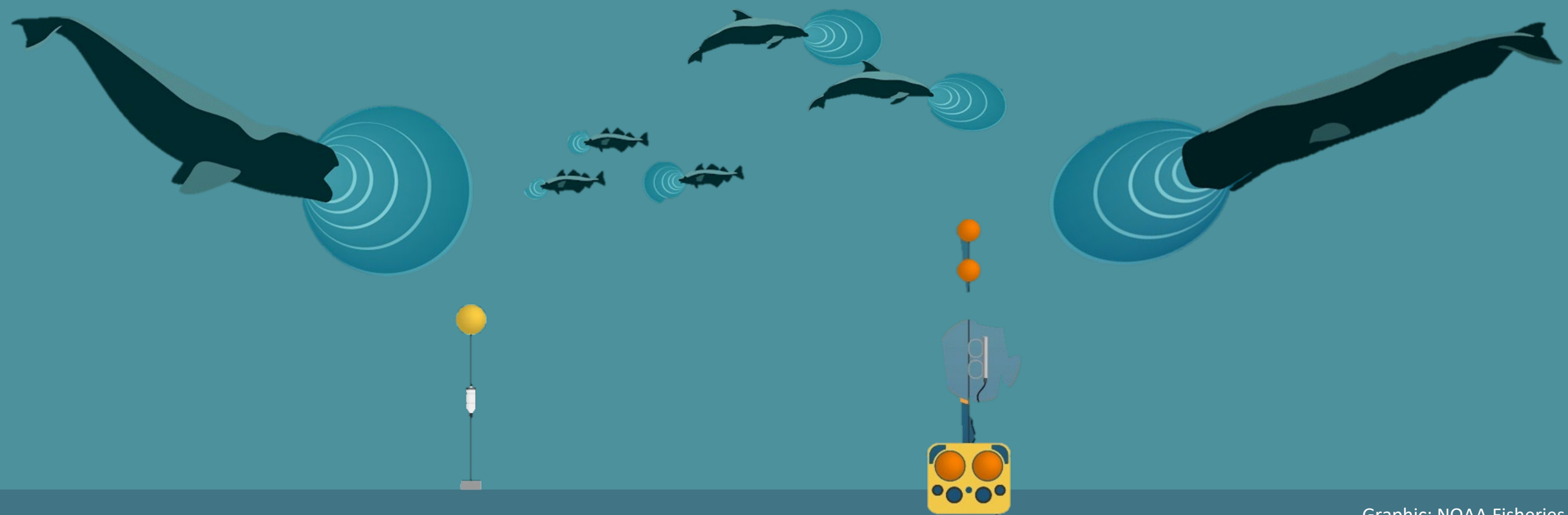
Species Ecology/Soundscape



Weiss et al. 2021



ARCHIVAL PASSIVE ACOUSTICS





WHERE HAVE WE HAD PAM INSTRUMENTS?

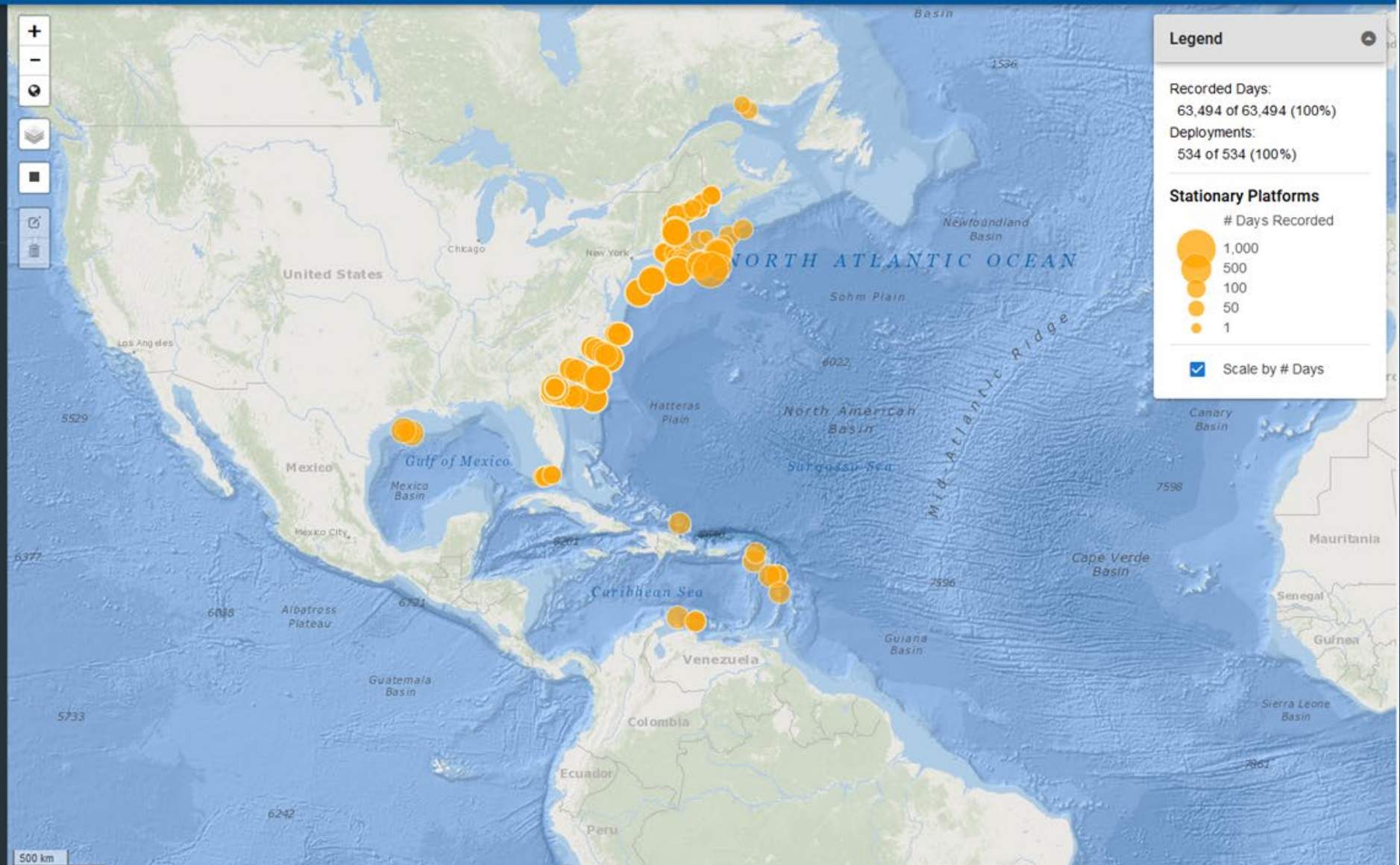
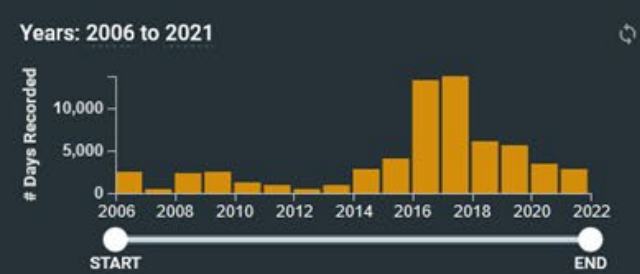
Select a Species/Group

NEFSC Deployments

Select Platform Type(s)

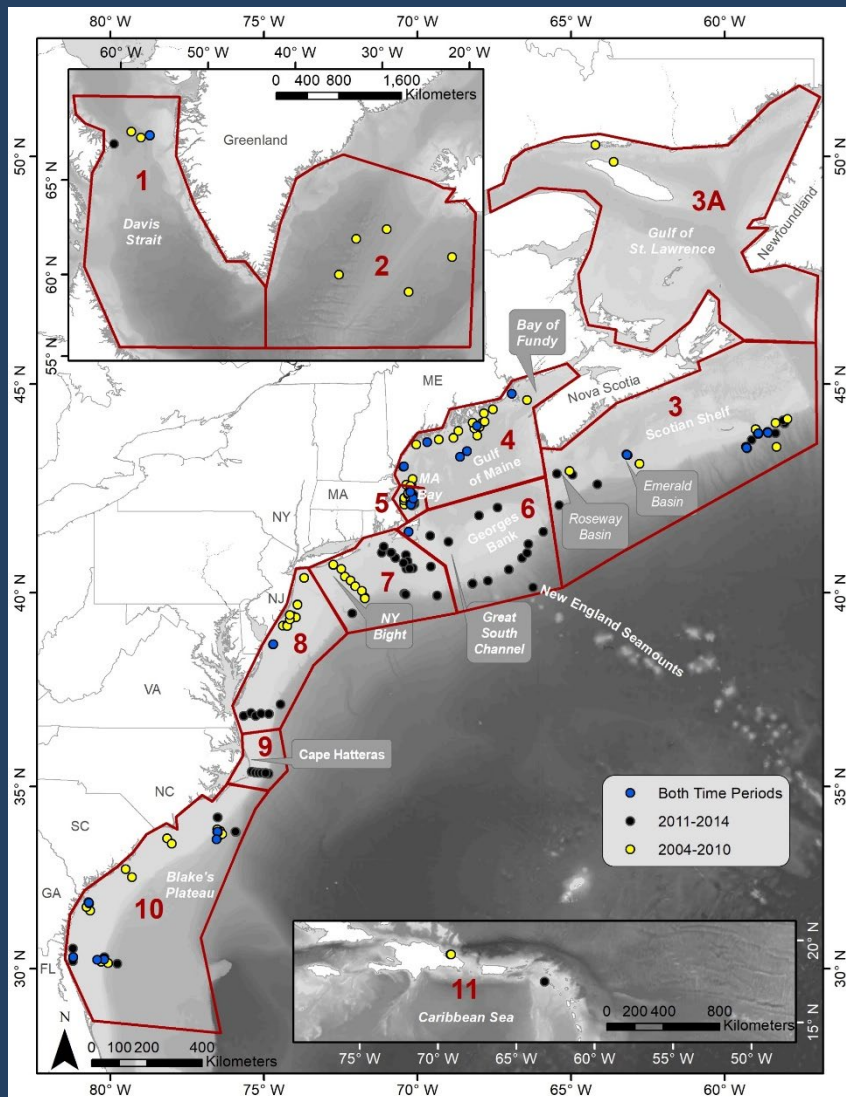
Bottom-Mounted Mooring

ADVANCED FILTERS...



DECADAL CHANGES IN WHALE DISTRIBUTION OF WHALES

2004 – 2014

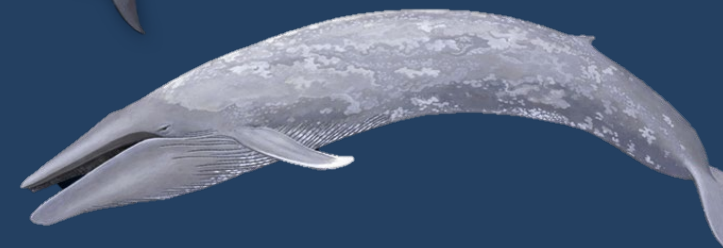


North Atlantic right whales



fin whales

blue whales



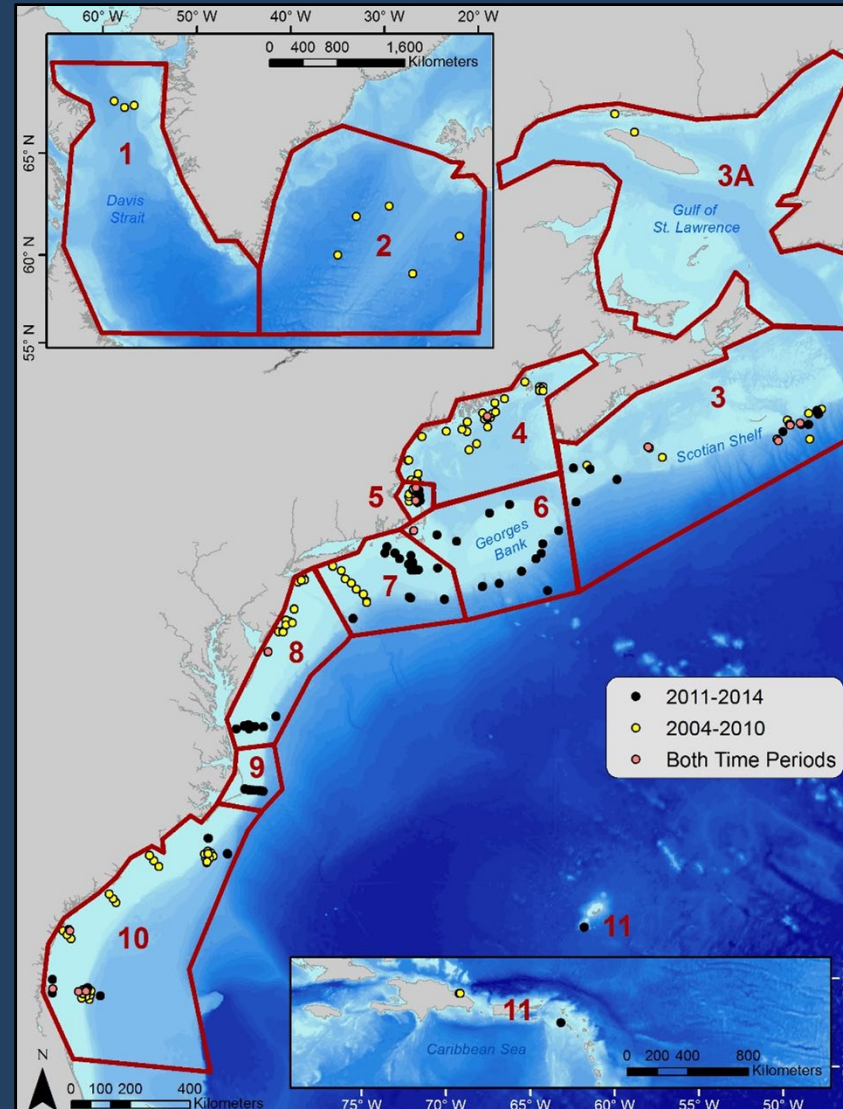
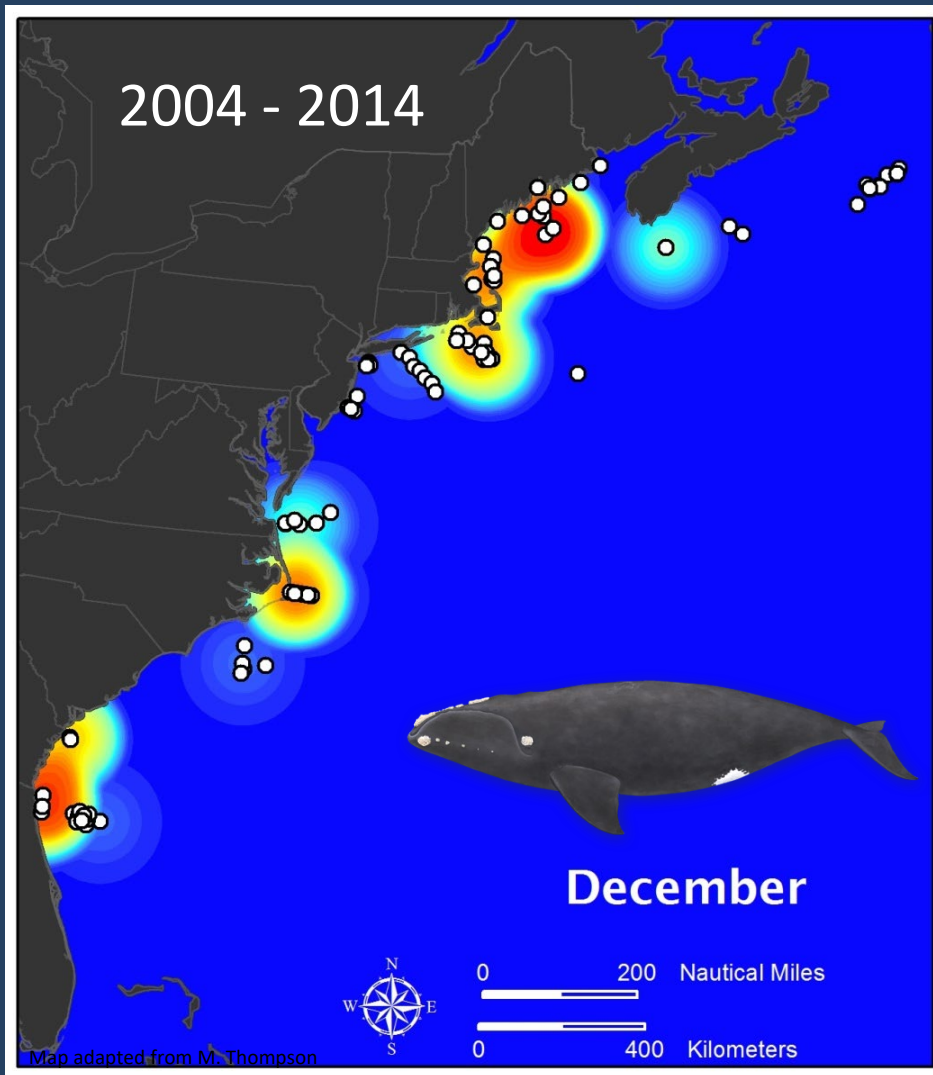
humpback whales

sei whales



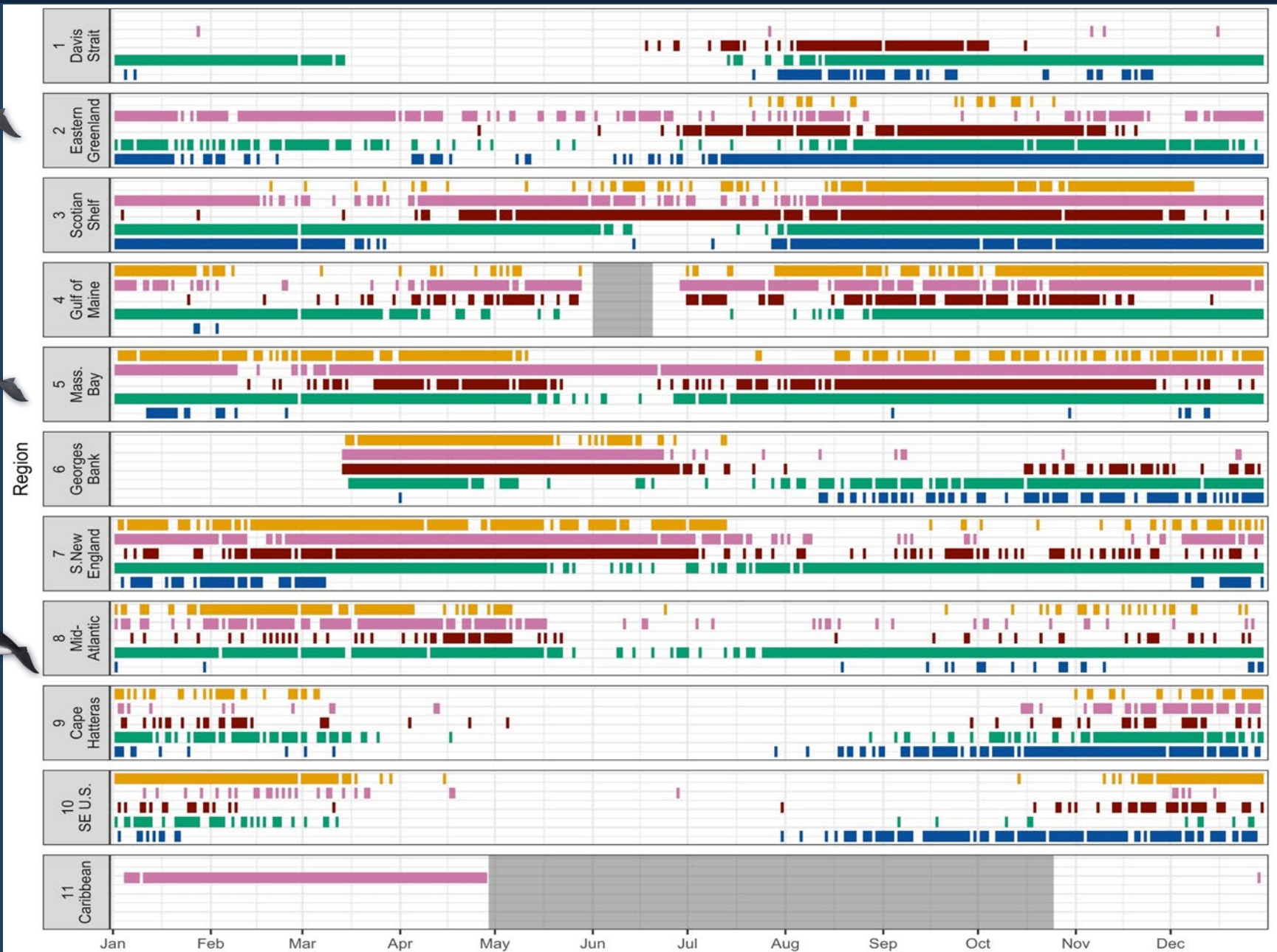
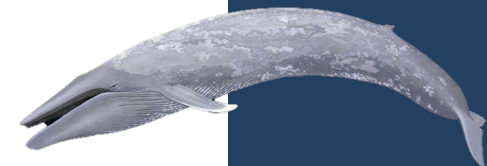


NARW LONG TERM CHANGES: SPATIAL

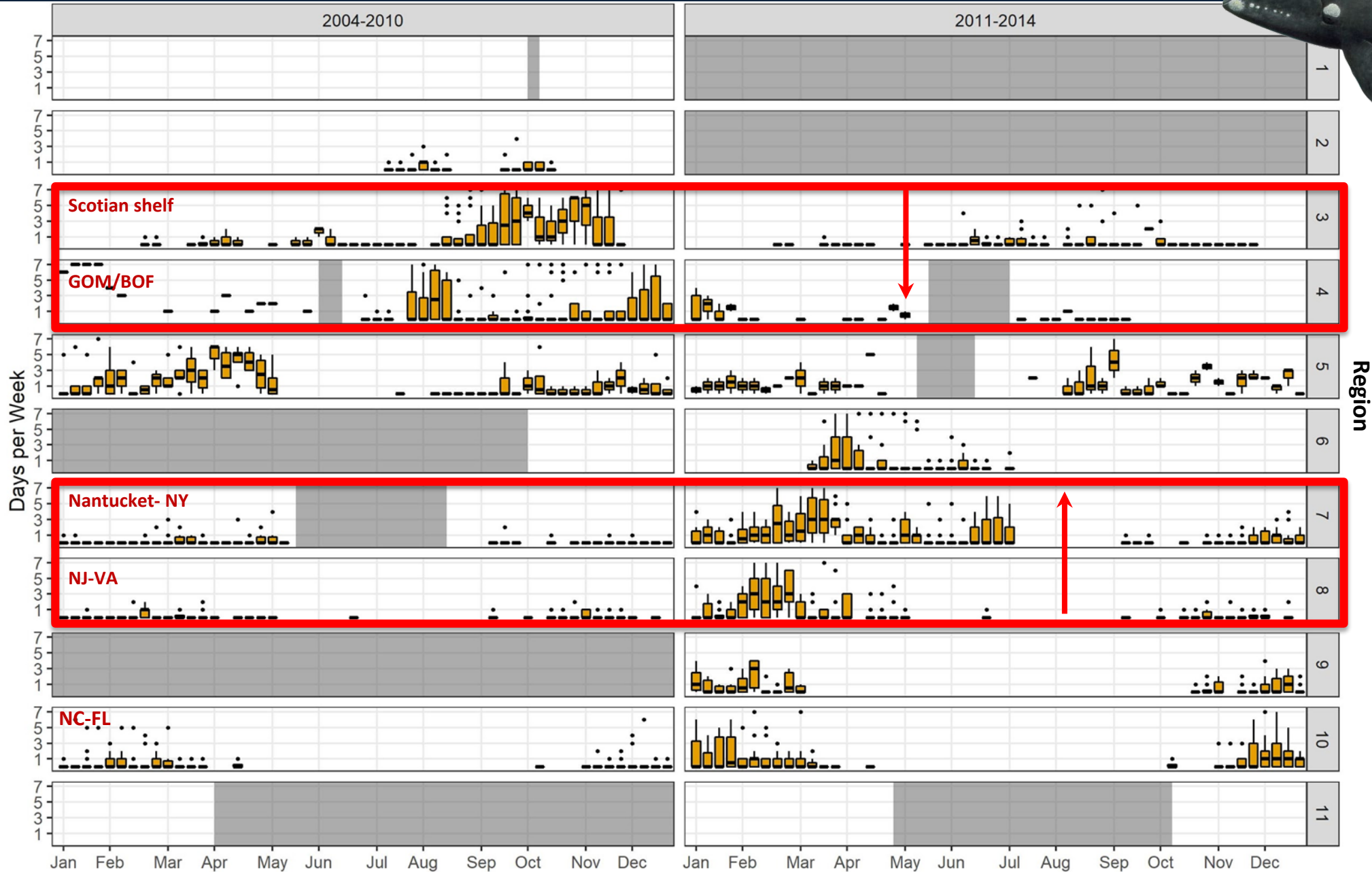


Davis et al. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales. Scientific Reports 7: 13460.

BALEEN WHALES: TEMPORAL

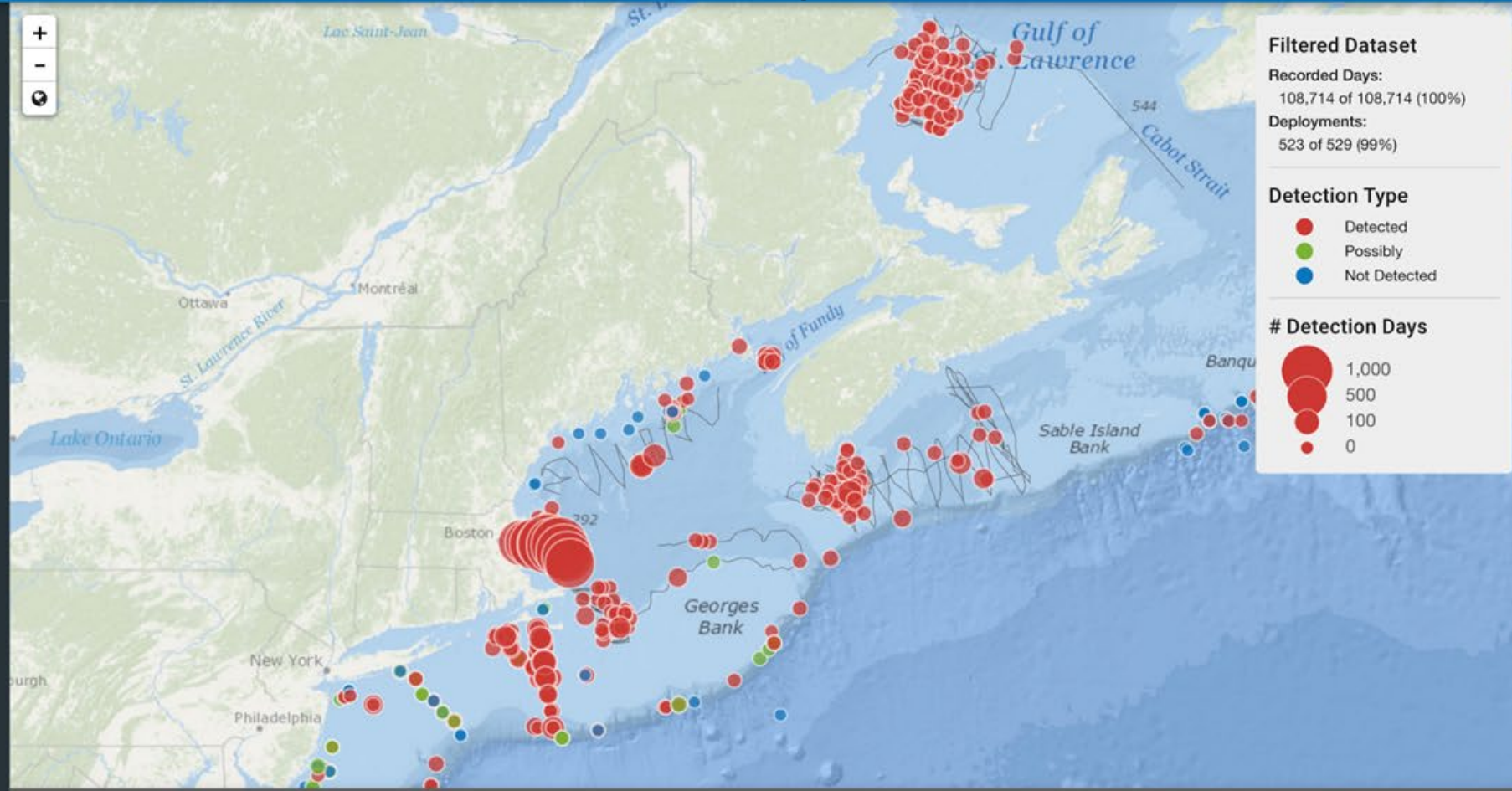
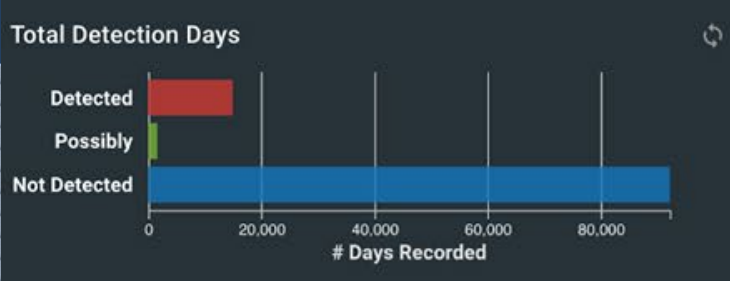
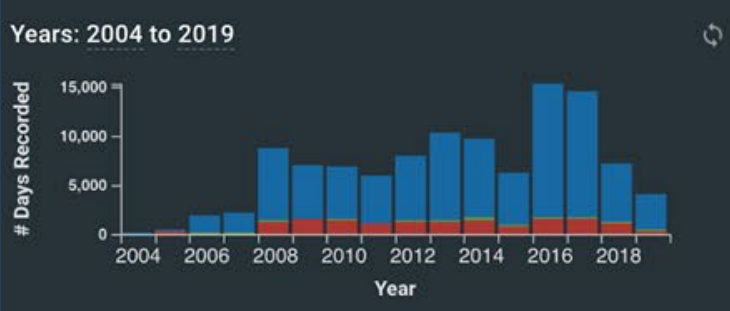
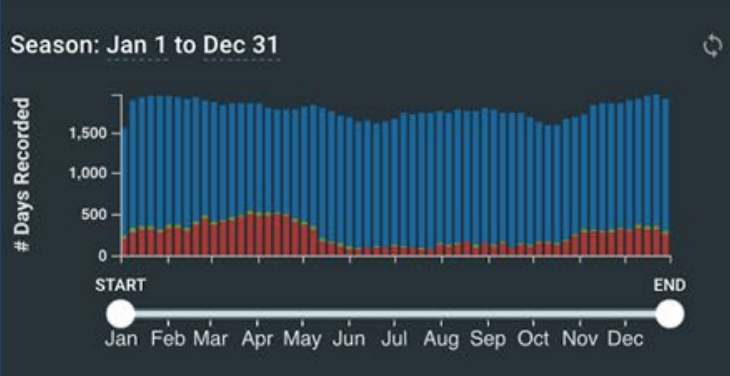


NARW SHIFTS ACROSS TIME



Select a species
 North Atlantic Right Whale

Select platform type(s)
 Bottom Mooring X Glider X Surface Buoy X
 Towed Array X



Filtered Dataset
 Recorded Days: 108,714 of 108,714 (100%)
 Deployments: 523 of 529 (99%)

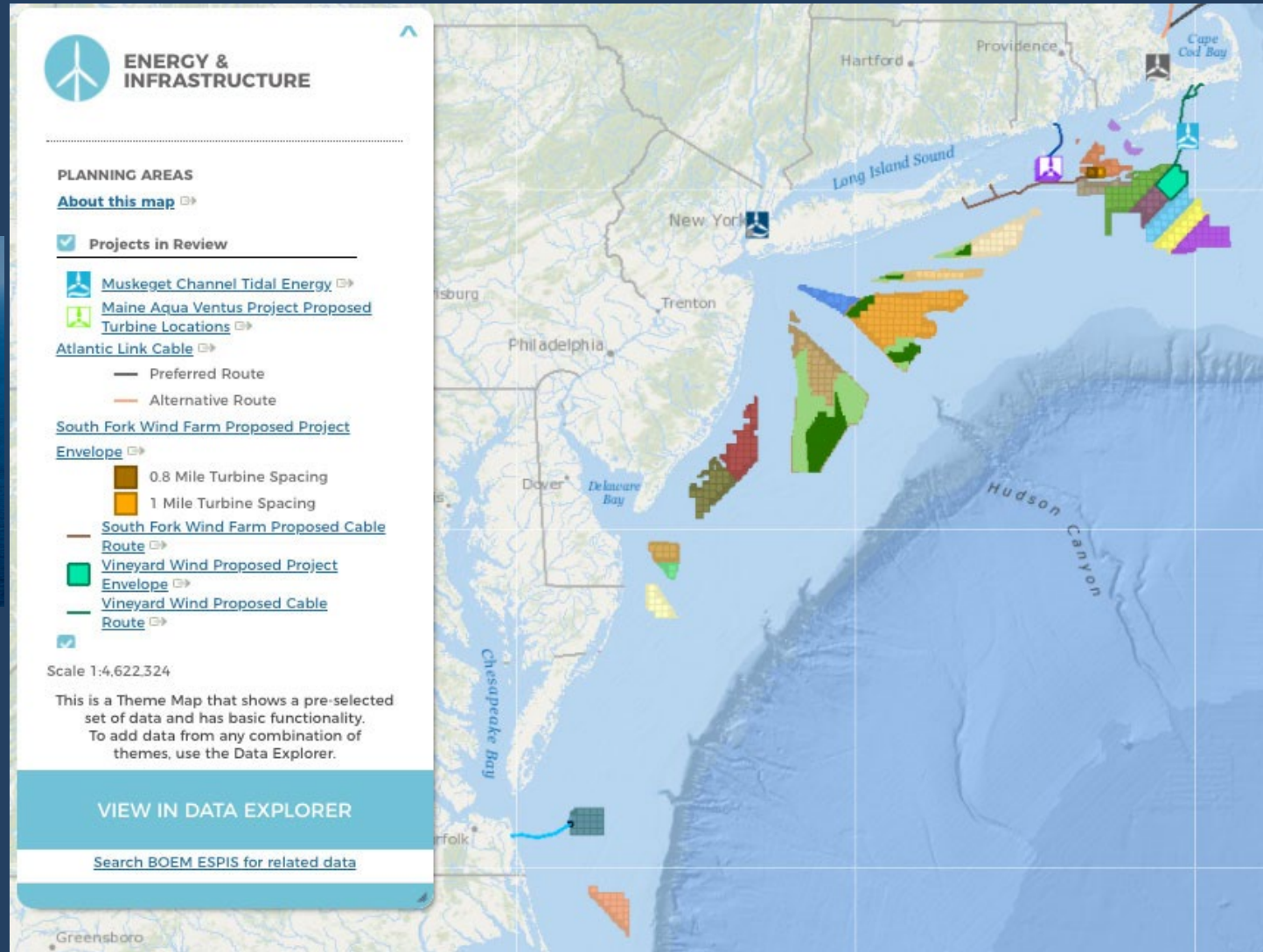
Detection Type
 ● Detected
 ● Possibly
 ● Not Detected

Detection Days
 ● 1,000
 ● 500
 ● 100
 ● 0

Site: N4
 Platform: Bottom Mooring
 Unit: MARU
 Position: 40.6112, -70.2600
 Deployed: Dec 20, 2018 to Jun 27, 2019
 Duration: 190 days

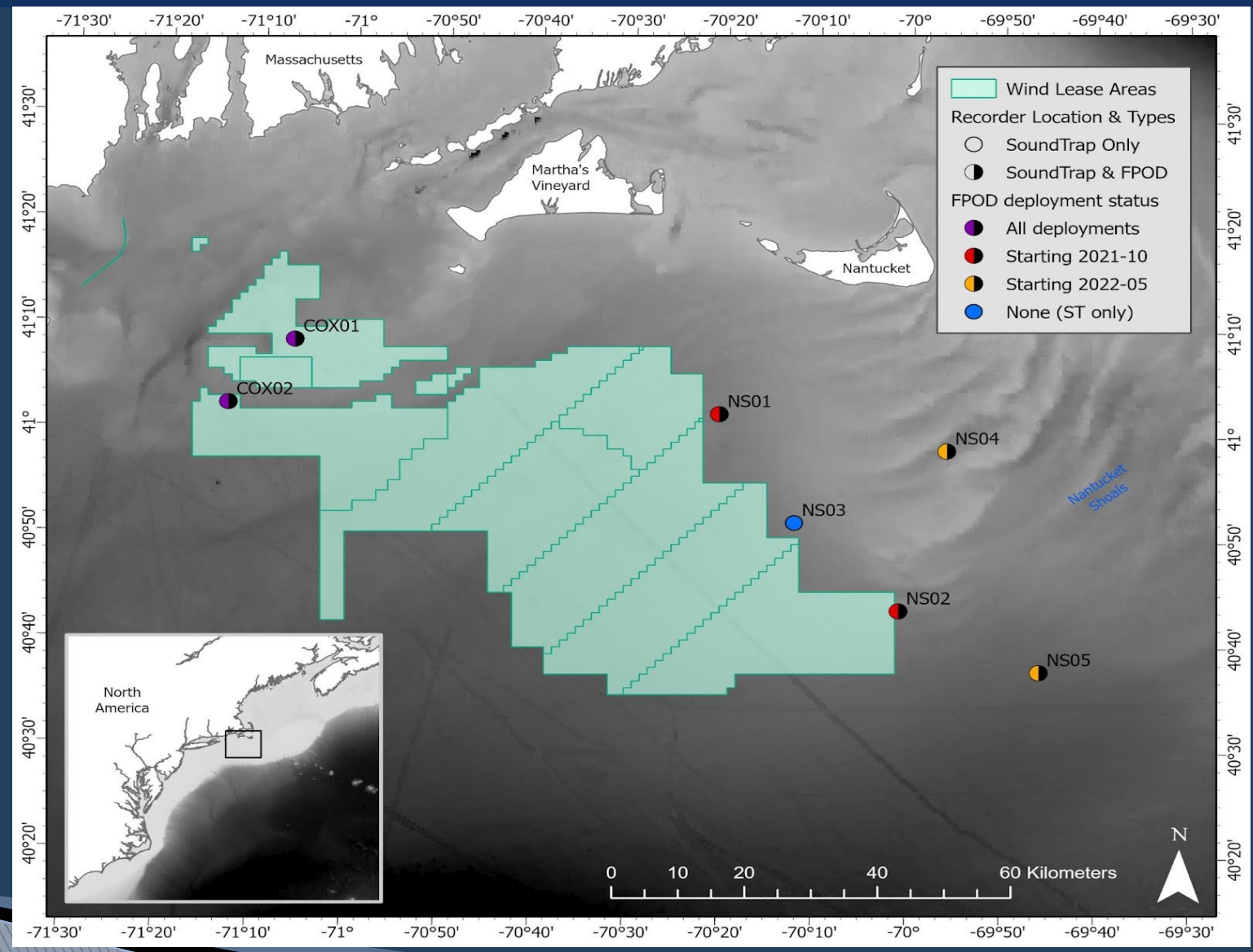


WIND ENERGY DEVELOPMENT





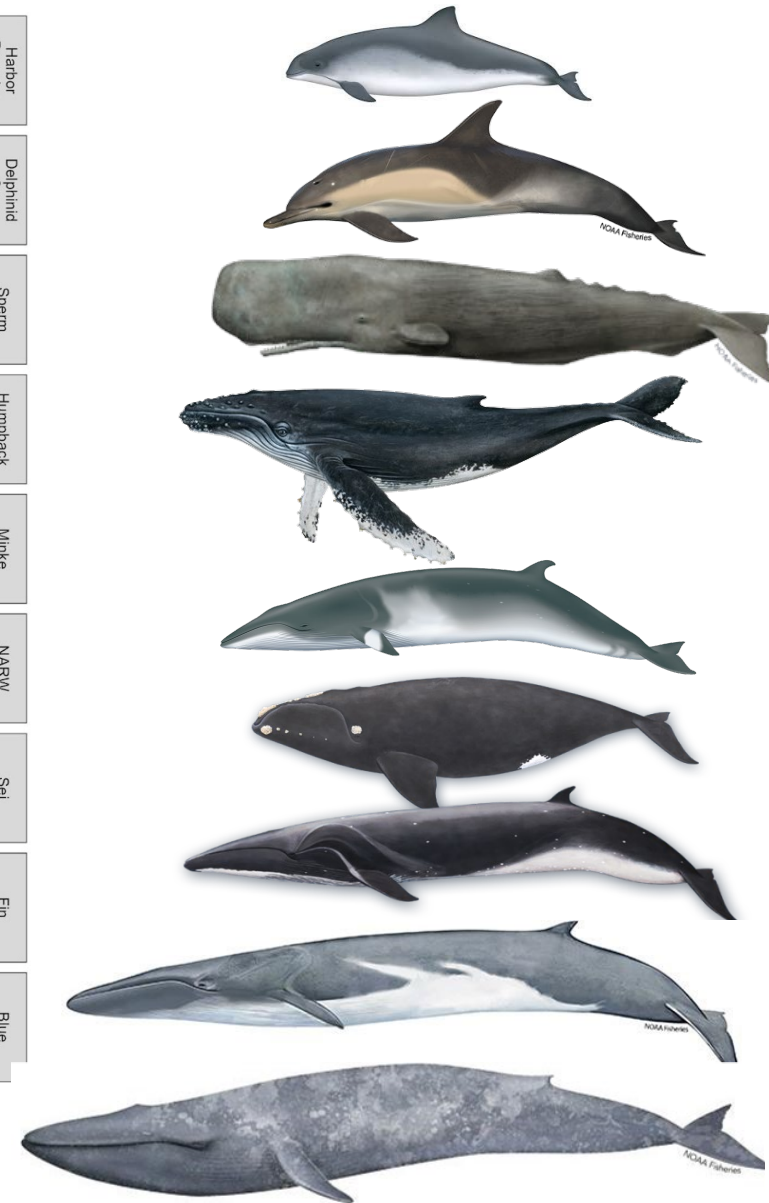
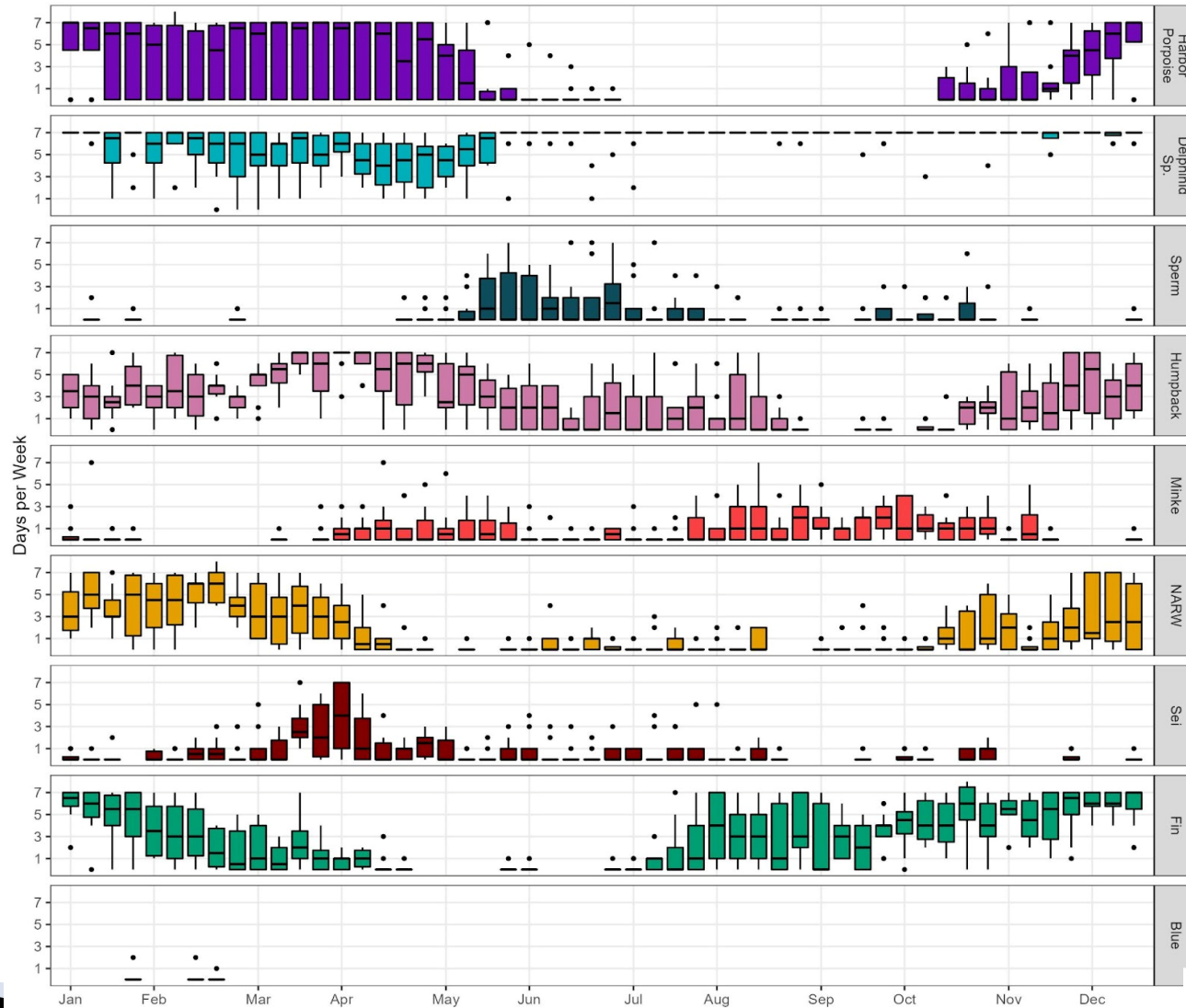
WIND ENERGY DEVELOPMENT





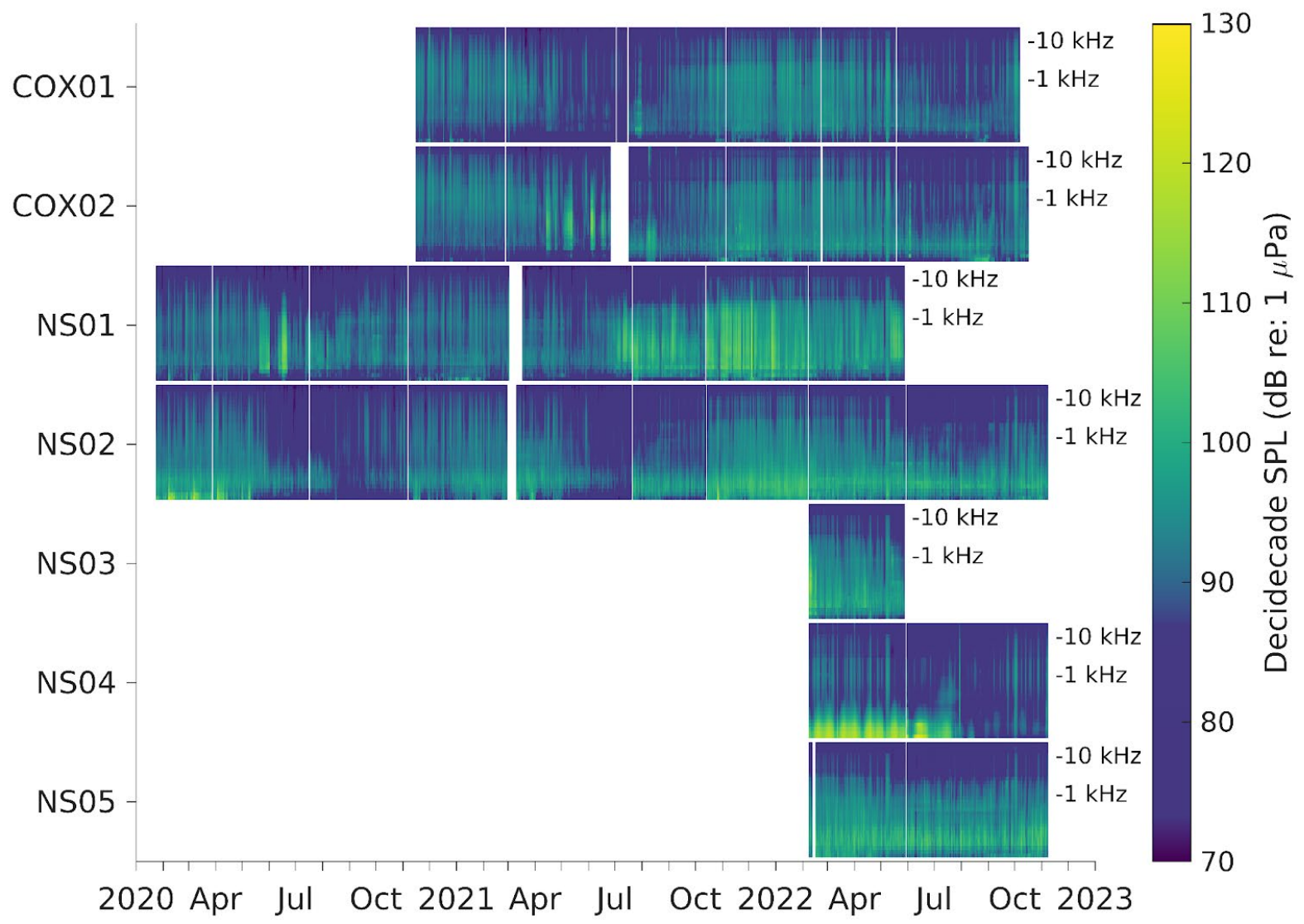
WHO USES THIS AREA?

8 species and 1 family of cetaceans





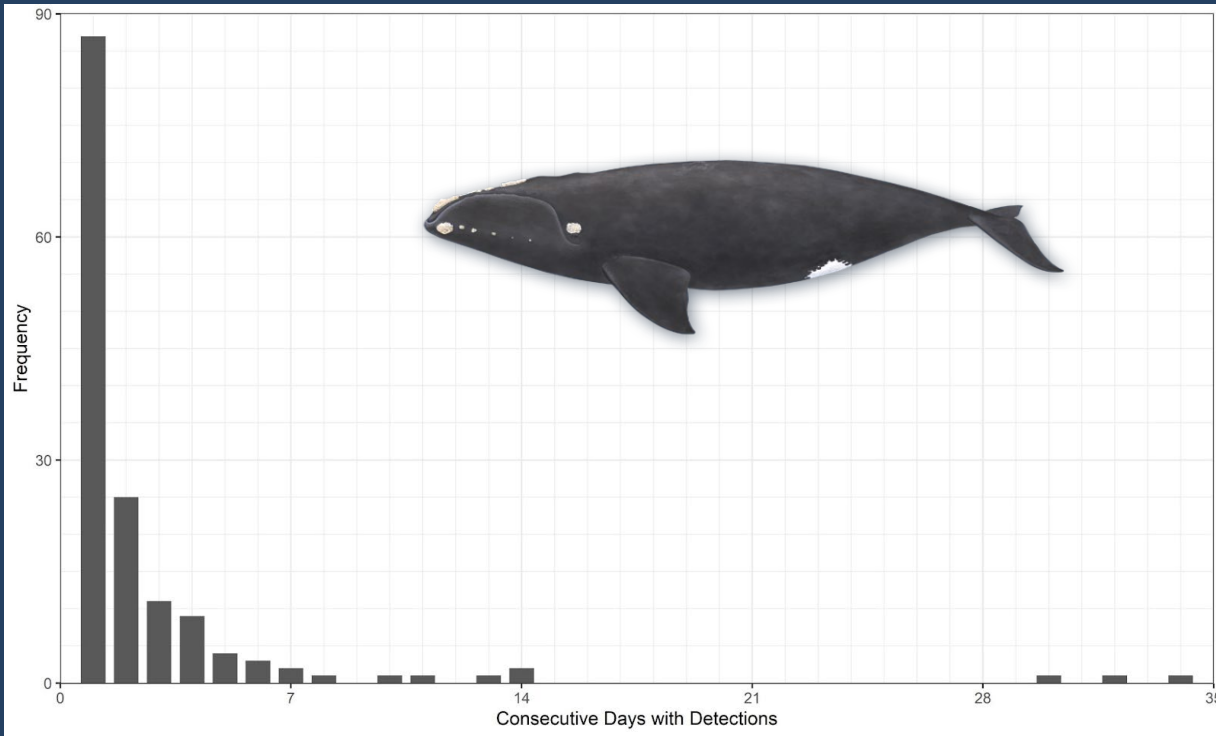
AMBIENT SOUNDS



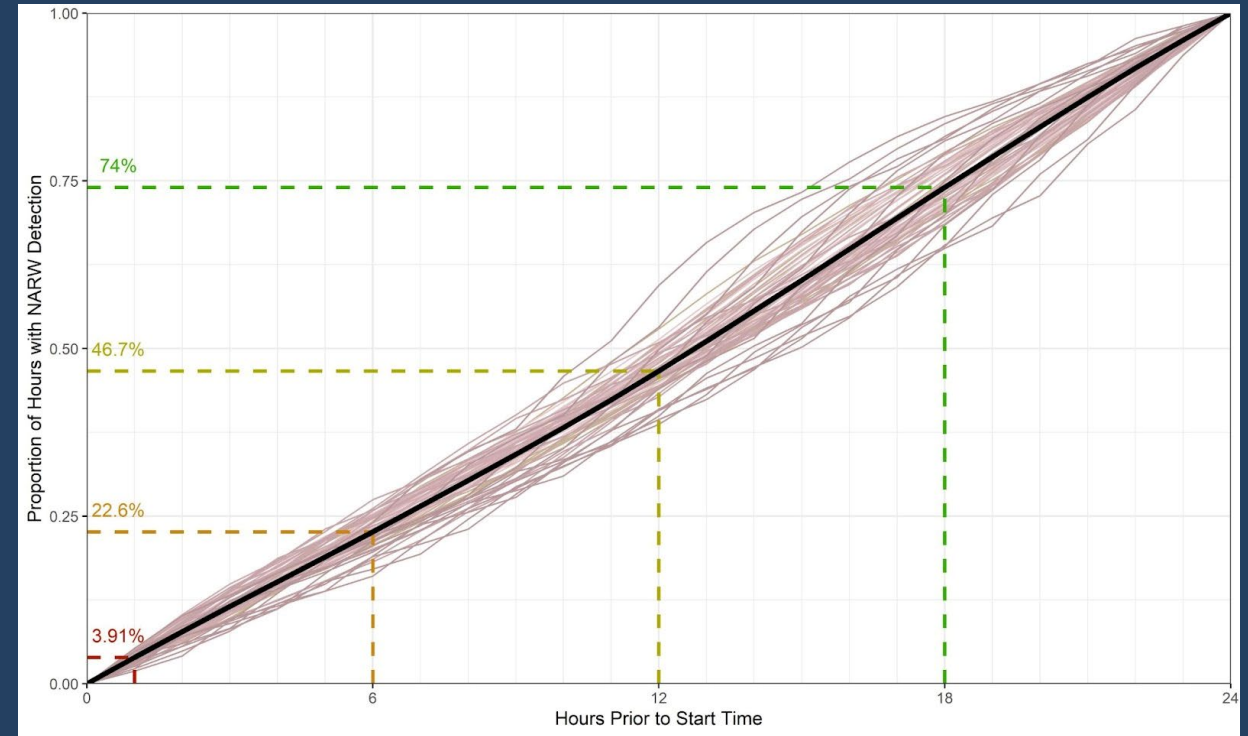


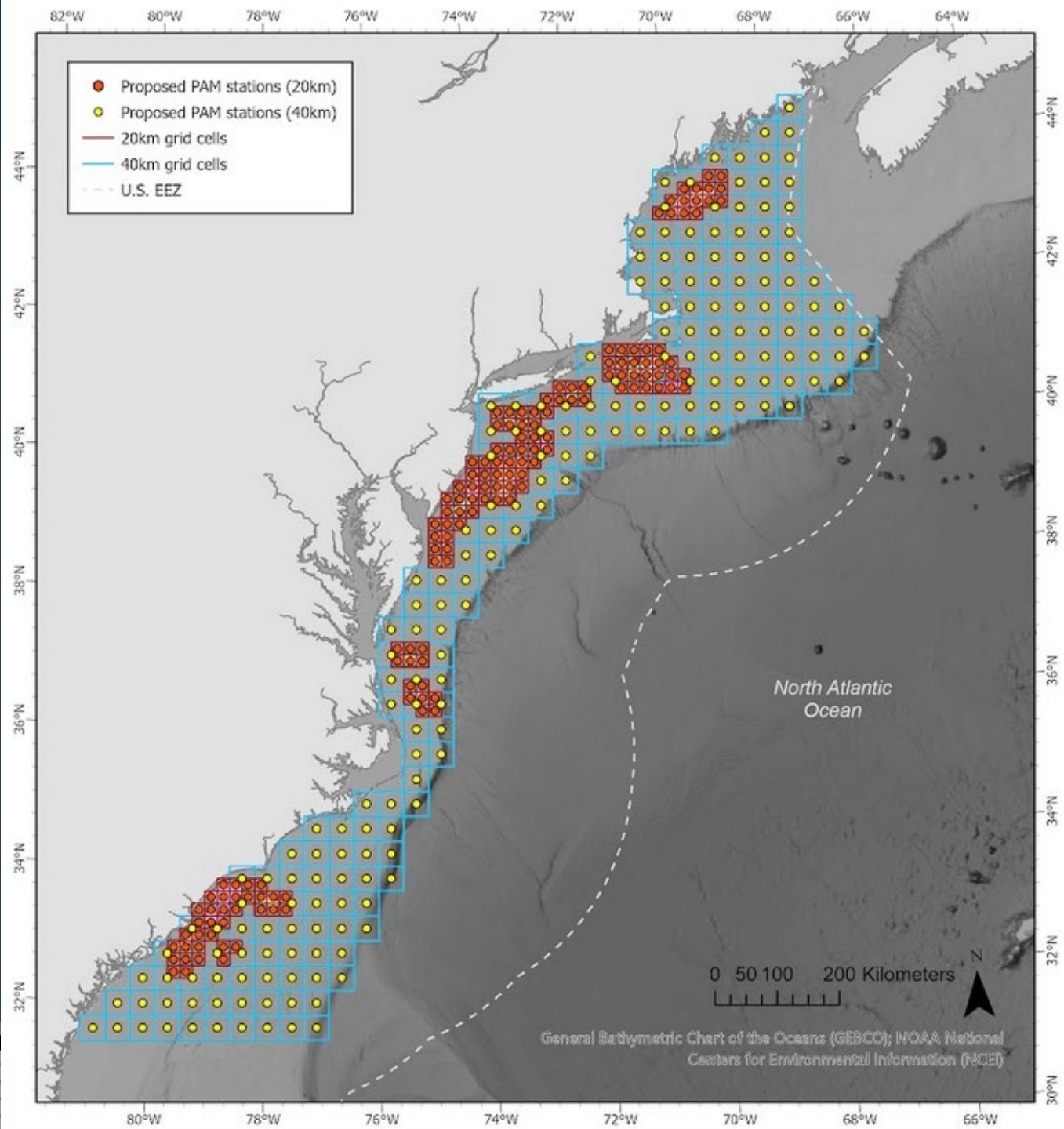
ADVISING MANAGERS

Persistence – how often do NARWs call?



How long to monitor for before pile driving?

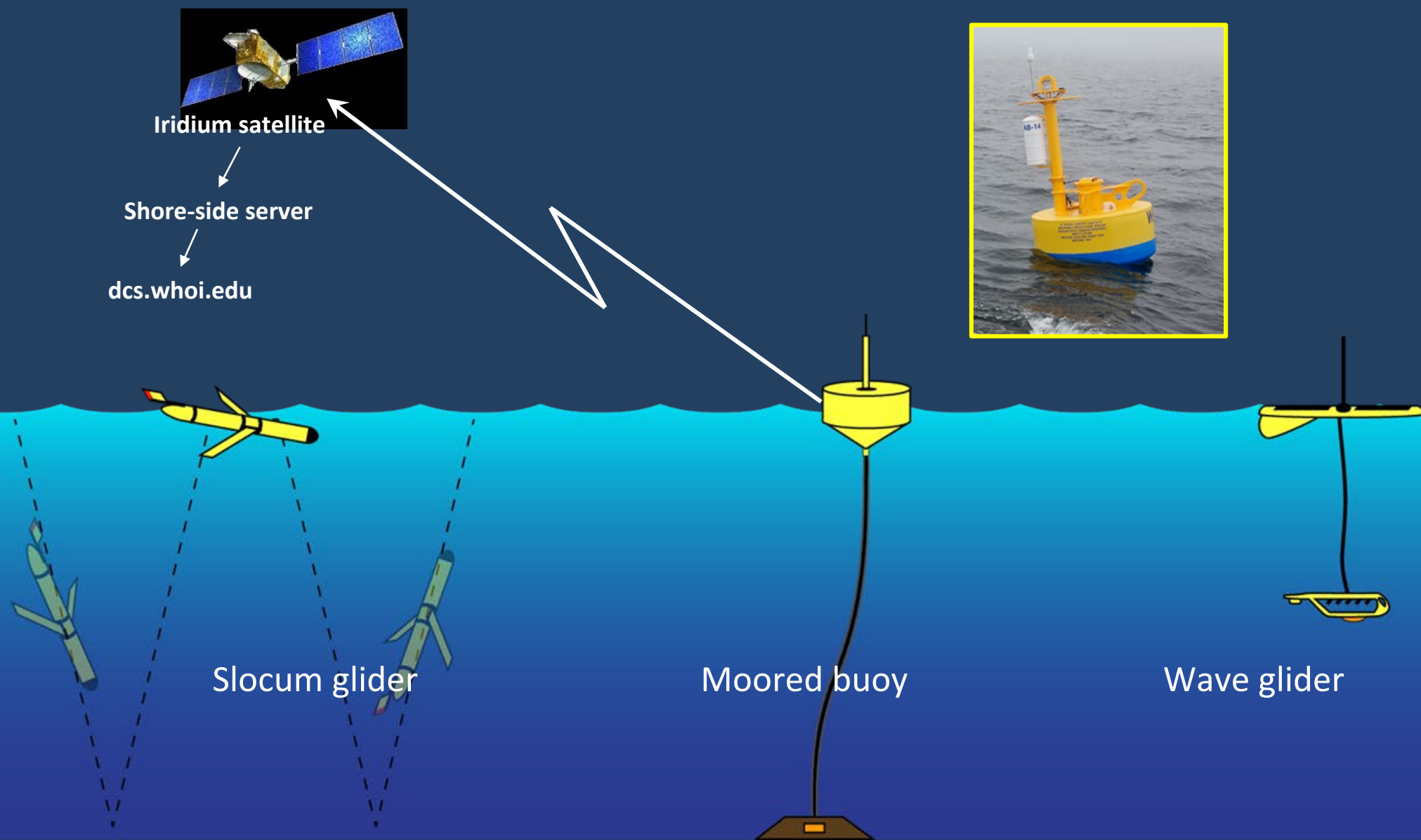




PAM Regional Monitoring Framework

Van Parijs et al. 2021

REAL-TIME MONITORING & MITIGATION





REAL-TIME ACOUSTICS

Live now at: robots4whales.who.edu

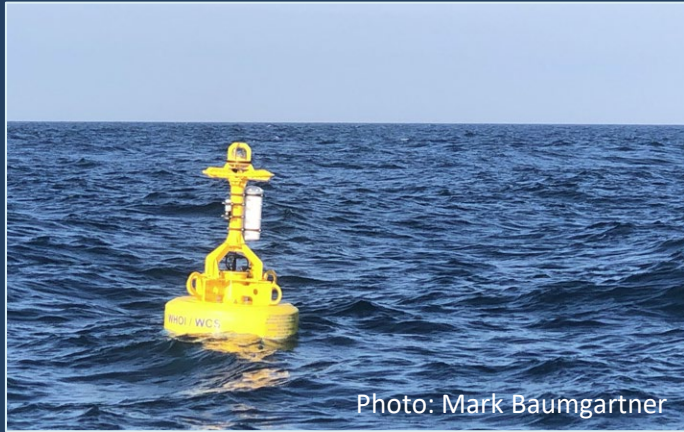


Photo: Mark Baumgartner

Monitoring:

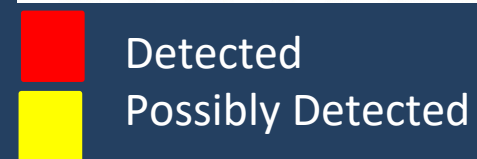
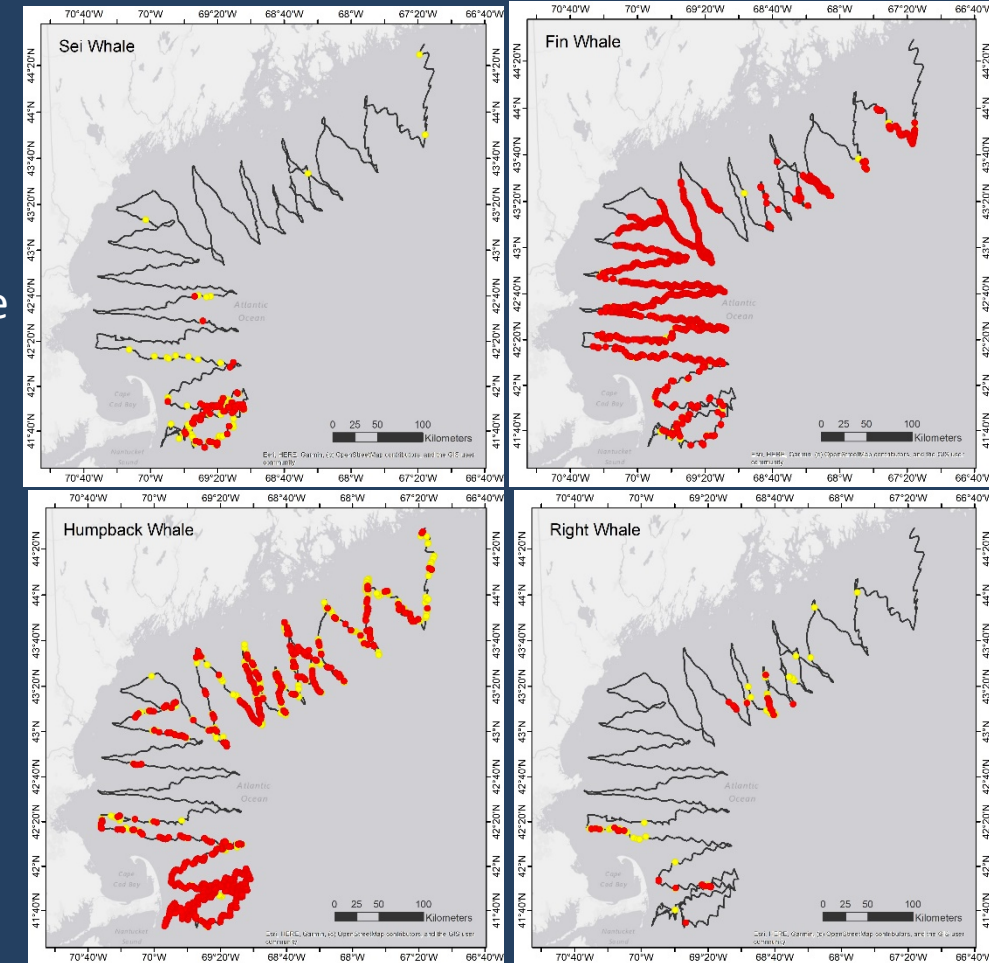
- When and where are they?
- Reduce aerial/vessel survey time spent looking for whales



Photo: Mark Baumgartner

Mitigation:

- Reduce ship strike risk
- Creation of NMFS 'Slow Zones'
- Inform operations e.g. wind



REAL-TIME MONITORING & MITIGATION

Distribution of Information

Web Platforms

robots4whales.who.edu

Daily analyst review:

Date	Sei whale	Fin whale	Right whale	Humpback whale
09/04/2015				
09/03/2015				
09/02/2015				
09/01/2015				
08/31/2015				
08/30/2015				
08/29/2015				
08/28/2015				

WHALEMAP(DFO/Dalhousie)

WHALEMAP: LATEST RIGHT WHALE OBSERVATIONS

Last 14 days of sightings, effort, and acoustic detections

SUMMARY MAP

MAP KEY

ABOUT

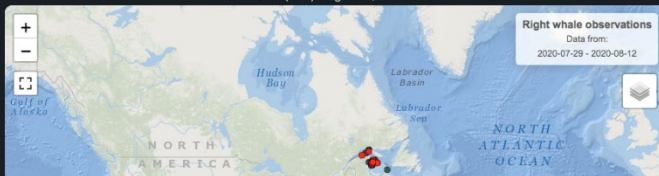
INTERACTIVE MAP

FISHERIES NOTICES

REPORT SIGHTING

REPORT DEAD/DISTRESSED WHALE

Current time (UTC): August 12, 2020 21:36:02



Notifications

Email message

Mark Baumgartner

To: undisclosed-recipients;

Fin whales detected on the Nomans Land buoy

Time now: 12/13/16 12:00 EST

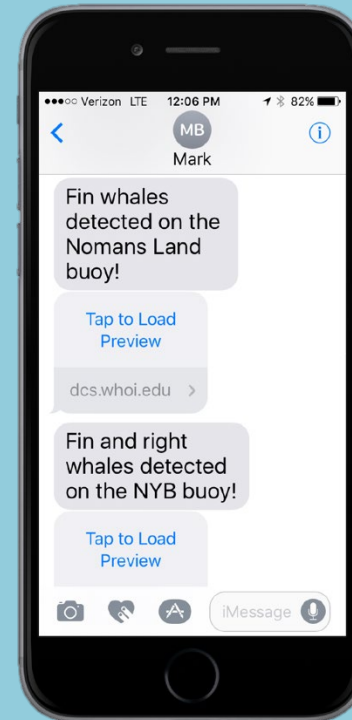
Fin whales detected on the Nomans Land buoy! Latest detections: 2.8 hours ago.

Fin whale detections:

- 12/12/16 18:09 EST (17.8 hr ago)
- 12/12/16 19:09 EST (16.8 hr ago)
- 12/12/16 20:09 EST (15.8 hr ago)
- 12/12/16 21:09 EST (14.8 hr ago)
- 12/12/16 23:09 EST (12.8 hr ago)
- 12/13/16 00:09 EST (11.8 hr ago)
- 12/13/16 01:09 EST (10.8 hr ago)
- 12/13/16 02:09 EST (9.8 hr ago)
- 12/13/16 02:24 EST (9.6 hr ago)
- 12/13/16 03:09 EST (8.8 hr ago)
- 12/13/16 05:09 EST (6.8 hr ago)
- 12/13/16 06:09 EST (5.8 hr ago)
- 12/13/16 07:09 EST (4.8 hr ago)
- 12/13/16 08:09 EST (3.8 hr ago)
- 12/13/16 09:09 EST (2.8 hr ago)

See <http://dcs.who.edu/nomans0916/nomans0916.shtml> for more information

Text message

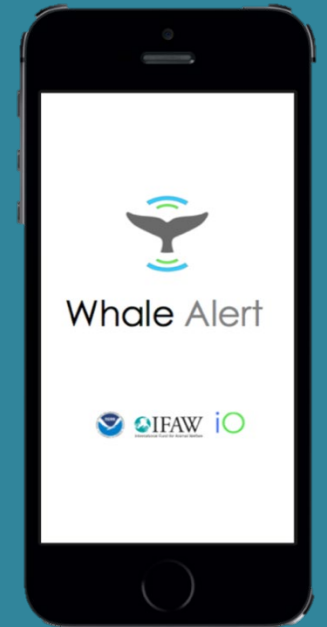


Applications

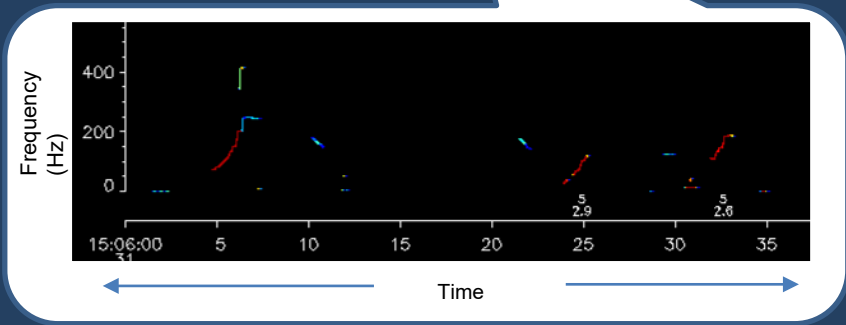
CG1Vie

W

Whale Alert app



RIGHT WHALE SLOW ZONES



Date	Right whale
04/01/2015	Detected

robots4whales.whoi.edu

**ATTENTION ALL BOATERS:
SLOW DOWN TO 10 KNOTS
OR LESS FOR RIGHT WHALES**

Great South Channel 3/31-7/30

Nantucket 2/21-3/6

Long Island 7/12-7/26

Annual seasonal slow down zones. **REQUIRED** for boats 65 feet and bigger. Recommended for smaller boats.

Areas where right whales have been sighted (Dynamic Management Area ^{*}) or heard. Recommended slow down zones for **ALL** vessels.



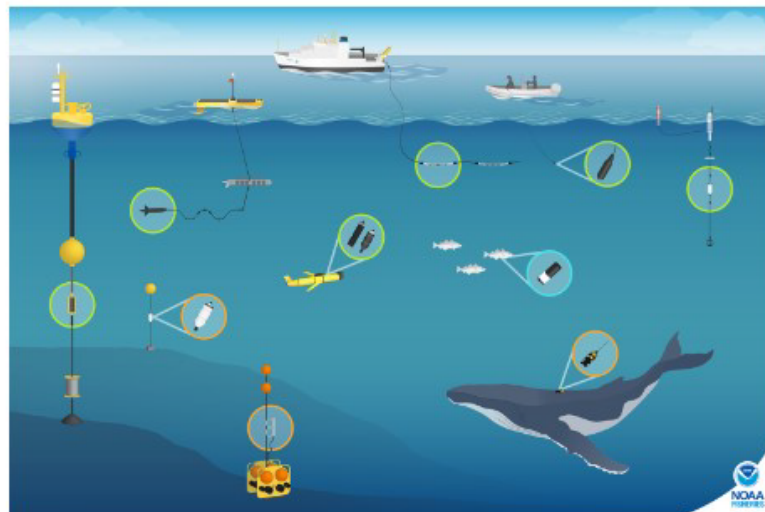


ENDANGERED SPECIES CONSERVATION

Passive Acoustic Research in the Atlantic Ocean

We use innovative passive acoustic technologies to study the behavior, movements and distribution of marine animals and their contribution to soundscape ecology. We also evaluate how man-made sounds affect marine animals.

New England/Mid-Atlantic



NOAA Fisheries studies marine animals by using a variety of technologies to record underwater sounds, including archival passive acoustic recordings (orange), real-time acoustic data collection (green), and active acoustics (blue).

Marine mammals and many fish produce and receive sound in the ocean. In an environment where vision is limited, hearing is one of the most important senses. These animals rely on sound for navigating, socializing, establishing dominance, attracting mates, avoiding predators, and finding food.

Using passive acoustic technologies, we study long-term changes in the behavior, [movements, and distribution](#) of marine animals. To do this we:

- Explore how sound-producing species and anthropogenic sounds make up soundscapes in different areas.
- Monitor and evaluate the impacts of sounds made by human activities such as vessels using protected and sensitive areas as well as shipping lanes, and offshore wind energy development.
- Use our sound recordings and research results for a range of outreach and education.

Since 2006, we have been [deploying acoustic recorders](#) on the ocean bottom to study underwater sounds. These recorders collect and store acoustic data for several weeks to years. Our work is primarily focused on the Atlantic Ocean but we also work elsewhere, especially in the Caribbean and

More Information

- > [Passive Acoustic Cetacean Map](#)
- > [Sounds in the Ocean](#)
- > [Passive Acoustic Research Staff](#)
- > [Past Members of the Passive Acoustics Group](#)
- > [Passive Acoustic Staff Publications](#)
- > [Passive Acoustic Group News & Media](#)
- > [Protected Species Research in the Northeast](#)
- > [Passive Acoustics Research Group Outreach](#)

Recent News

FEATURE STORY

[Women's History Month: Talking with Catherine Foley](#)
New England/Mid-Atlantic



FEATURE STORY

[NOAA Fisheries, Atlantic Coast Partners Release Plan to Improve Atlantic Recreational Fisheries Data](#)
New England/Mid-Atlantic, Southeast



FEATURE STORY

[Seal and Sea Lion Week](#)
Alaska, New England/Mid-Atlantic, Pacific Islands, Southeast, West Coast, National



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