

Right Whale Distribution: Historical Perspectives and Recent Shifts

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Over 35 years of dedicated right whale surveys have taught us much about North Atlantic right whale distribution. The boundaries of five critical habitats were described based on sightings from these surveys: the southeastern U.S. (winter), Cape Cod Bay (winter/early spring), Great South Channel (spring/early summer), and the Bay of Fundy and Roseway Basin (both summer and fall). In 2016, the boundaries of two were expanded in response to additional sightings and acoustic data. There has been some variation in distribution in all of these habitats over the years, but the most dramatic shift occurred starting in 2011 when sightings in all but Cape Cod Bay declined; this change has largely persisted since that time. From 2015 to 2017, directed right whale surveys discovered 40 to 100 whales, including mothers with calves, in a previously unsurveyed area in the Gulf of St Lawrence between Miscou and the Madeleine islands; it is unclear whether whales have been in this area in previous years in similar numbers and were simply not detected, or if this represents an influx of whales into the region. Photo-identification data and tracks from satellite tagged whales demonstrate that right whales can change habitat preferences and travel large distances in short periods of time. Passive acoustic monitoring (PAM) data supplement the sightings data, and can provide long-term, broad-scale information. This monitoring technique is affordable, provides continuous data on whale presence over a larger area, and is not light or weather dependent. It cannot, however, distinguish between whale absence and whales that are present but not calling. PAM data collected since 2004 show that right whales can be spread out along the entire eastern seaboard in most months with, for example, detections from the Scotian Shelf down to Florida in the month of January. Collaboration among researchers sharing right whale sightings and acoustic data has been critical in our current understanding of right whale habitat use. These collaborations across geographic areas and countries need to be maintained and expanded to allow us to better understand the dynamic distribution of this population.

Things to consider when reviewing the slides from this talk: 1) Plots of sightings are from the URI sightings database, not the Catalog; 2) Passive acoustics strengths are that the device work year round and don't rely on us being there and good visibility, their weakness is that they don't detect presence of whales if they aren't vocalizing; 3) Tagged entangled whales may behave differently than whales with implanted tags.

Take home messages: 1) Whales are along the entire eastern seaboard during the winter; 2) There is a consistent presence of right whales in the area south of Cape Cod and north of New Jersey; 3) The acoustic data show more whales along the edge of the continental shelf and in the mid-Atlantic than previously thought; 4) The tag data mostly mirror the sightings and acoustic data except for the two excursions in September off the continental shelf along the seamounts; 5) There has been a shift in distribution since 2011 with more whales in Cape Cod Bay and the Gulf of St. Lawrence and fewer whales in Great South Channel, the Southeast U.S., Bay of Fundy, and Roseway Basin; 6) right whales travel surprisingly quickly and cover large areas. We need to employ additional protective measures—drawing boxes around past distributions and protecting those boxes cannot, alone, provide the necessary protection for these animals.

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Sources of Data on Right Whale Distribution

➤ Sightings Database

- all known sightings in North Atlantic 1762 to present
- managed for the Consortium by the University of Rhode Island

Sources of Data on Right Whale Distribution

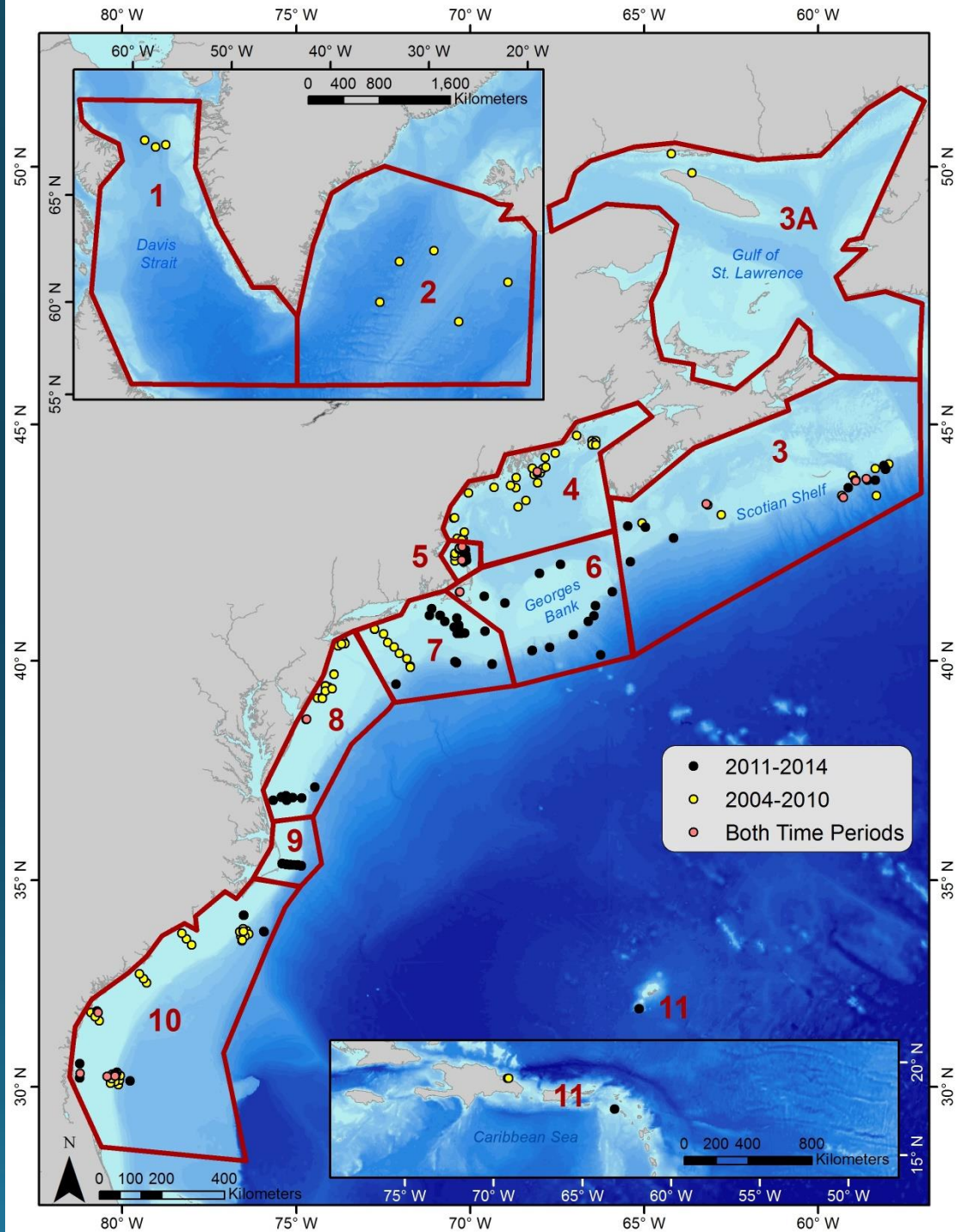
➤ Sightings Database

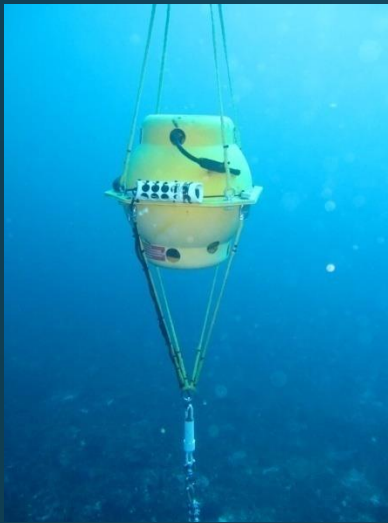
- all known sightings in North Atlantic 1762 to present
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➤ Passive Acoustic Monitoring Collaboration

- all acoustic detections 2004 to present
- curated by PI's, contributed to NEFSC for right whale study (Davis *et al.* 2017)

Davis, G. E., Baumgartner, M. F., Bonnell, J. M., Bell, J., Berchok, C., Bort Thornton, J., Brault, S., Buchanan, G., Charif, R. A., Cholewiak, D., Clark, C. W., Corkeron, P., Delarue, J., Dudzinski, K., Hatch, L., Hildebrand, J., Hodge, L., Klinck, H., Kraus, S., Martin, B., Mellinger, D. K., Moors-Murphy, H., Nieukirk, S., Nowacek, D. P., Parks, S., Read, A. J., Rice, A. N., Risch, D., Širović, A., Soldevilla, M., Stafford, K., Stanistreet, J. E., Summers, E., Todd, S., Warde, A., Van Parijs, S. M. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. Scientific Reports 7: 13460. DOI:10.1038/s41598-017-13359-3





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

Deployed 1 to 12 months



HARU

(Haruphone)

NOAA PMEL &
Oregon State University

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➤ Satellite Tracks from Tagged and Entangled Whales

- from tags that have been implanted or attached to an entangled whale's telemetry buoy 1989 to present
- curated by PI's, single position in both sightings and Catalog databases

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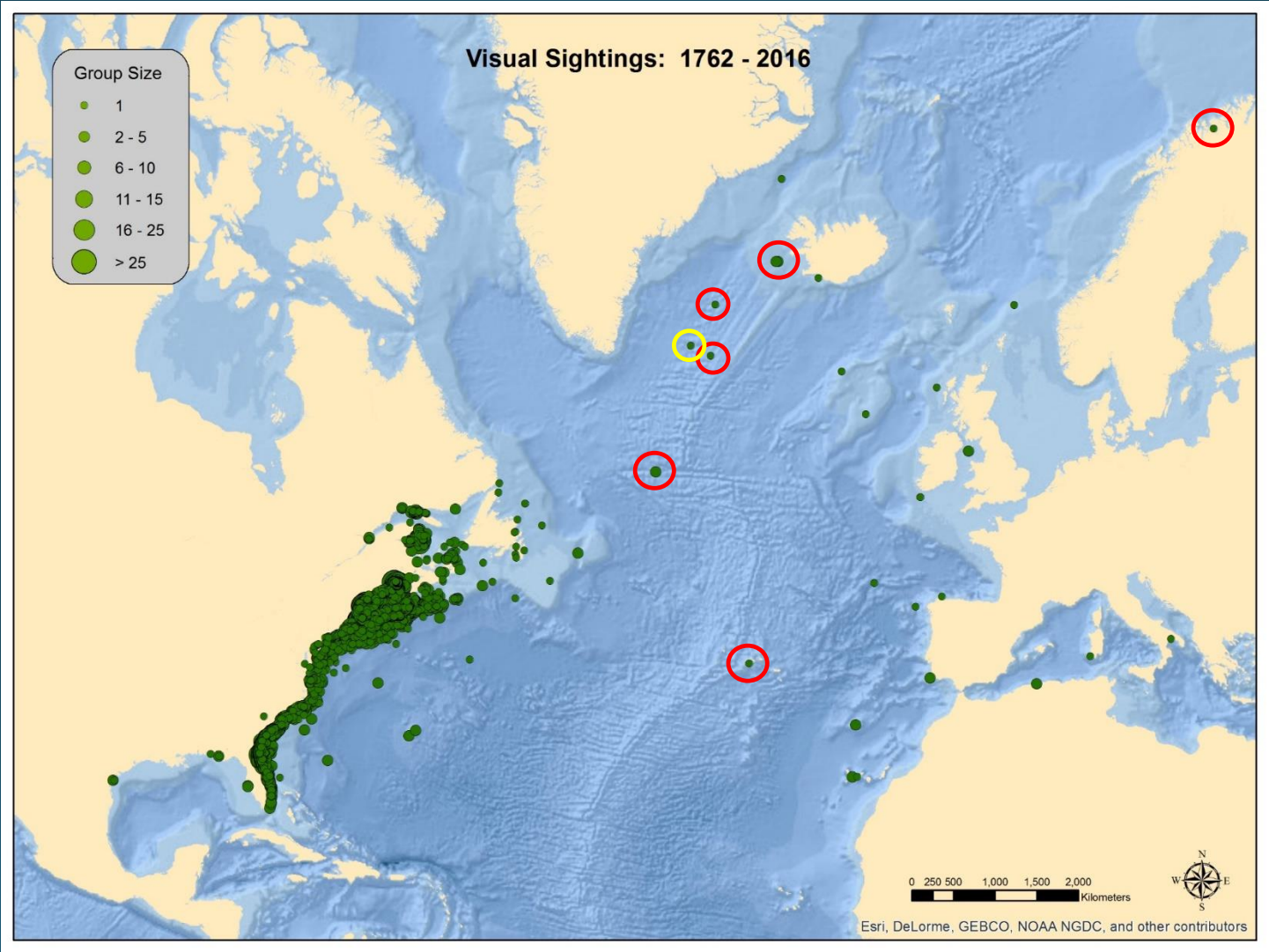
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➤ Photo-Identification Database (a.k.a. the Catalog)

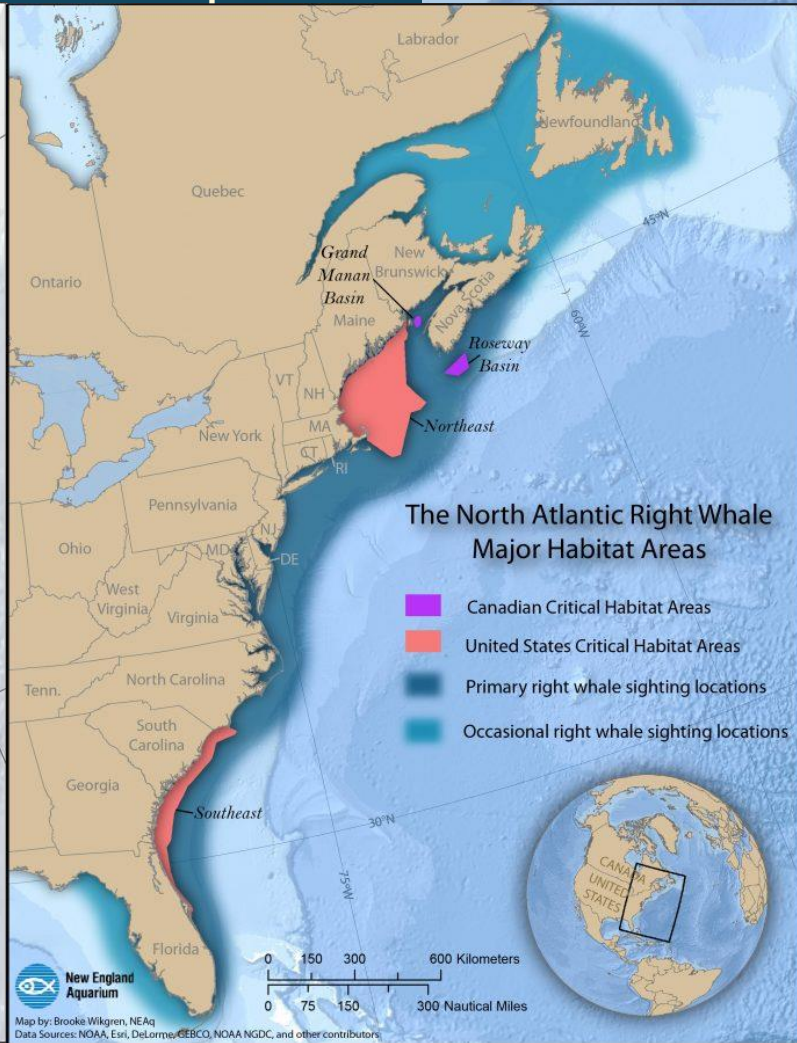
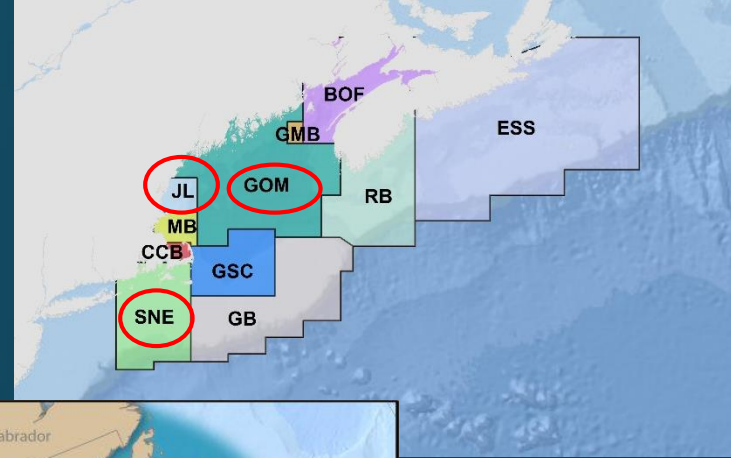
- all photographed whales from 1935 to present plus some tag locations of identified individuals
- curated by the Anderson Cabot Center/New England Aquarium for the Consortium



Critical Habitats

1994 to 2016

2016 to present



Other Habitats

Need Further Study

Other Areas of Interest/ On Our RADAR

Jeffreys Ledge (JL)

Fall and spring habitat, different whales than CCB, inconsistent effort over the years, no shipboard effort since 2011

Gulf of Maine (GoM)

Mating ground discovered in middle of GoM, whales there November through January

Gulf of St Lawrence (GSL)

Only a few directed surveys prior to 2015, most of pre-2015 data from whale watches and private boaters

Mid-Atlantic (MIDA)

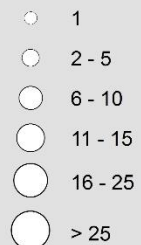
Area from South Carolina to southern Cape Cod, big area, poorly understood, acoustics suggest year round presence, recent surveys south of Cape Cod finding many whales February to April

December through March

December - March

Visual Sightings:
1980 - 2016

Group Size

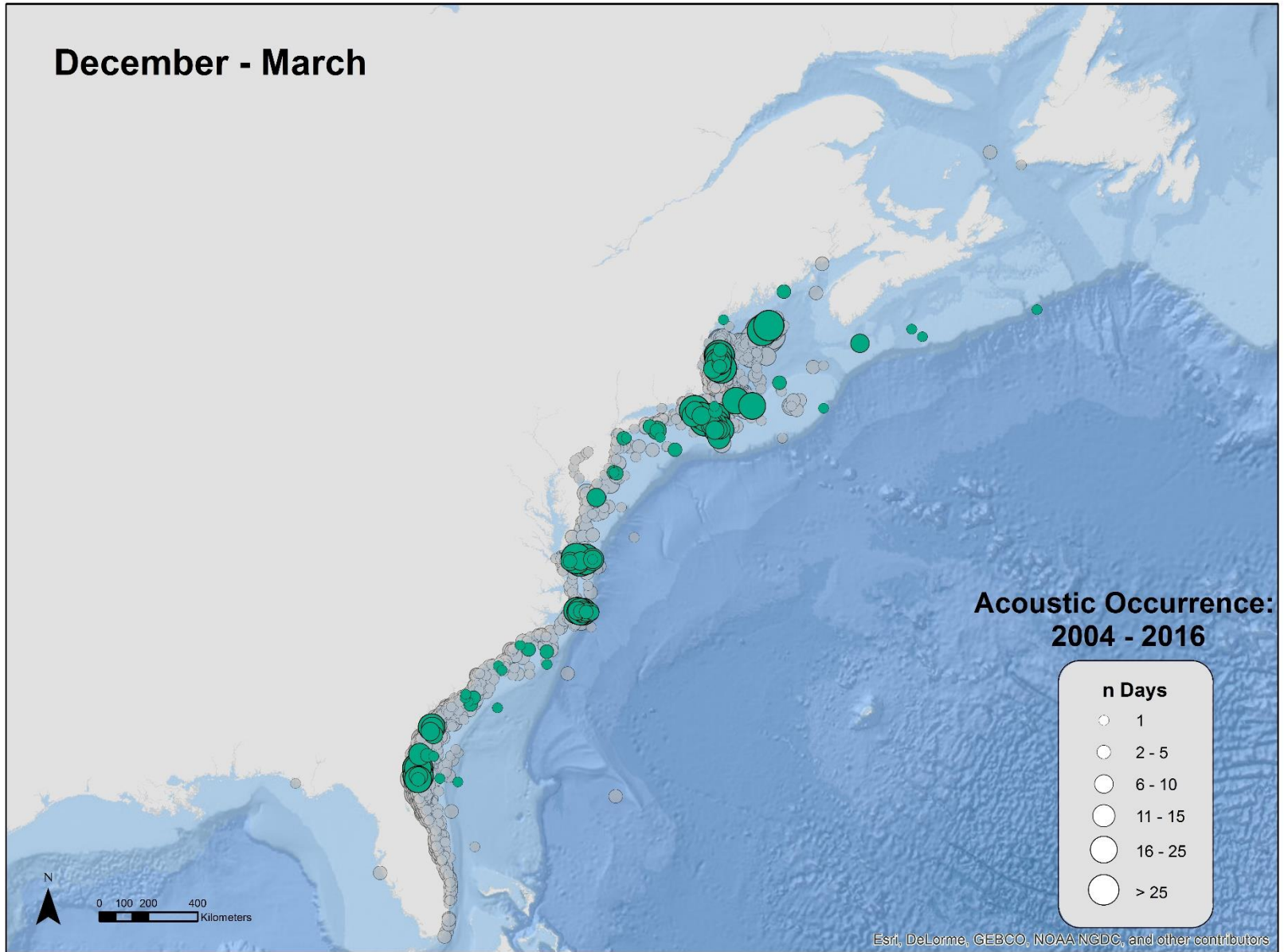


N

0 100 200 400
Kilometers

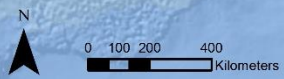
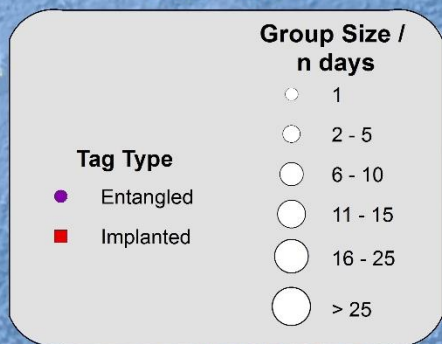
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

December - March



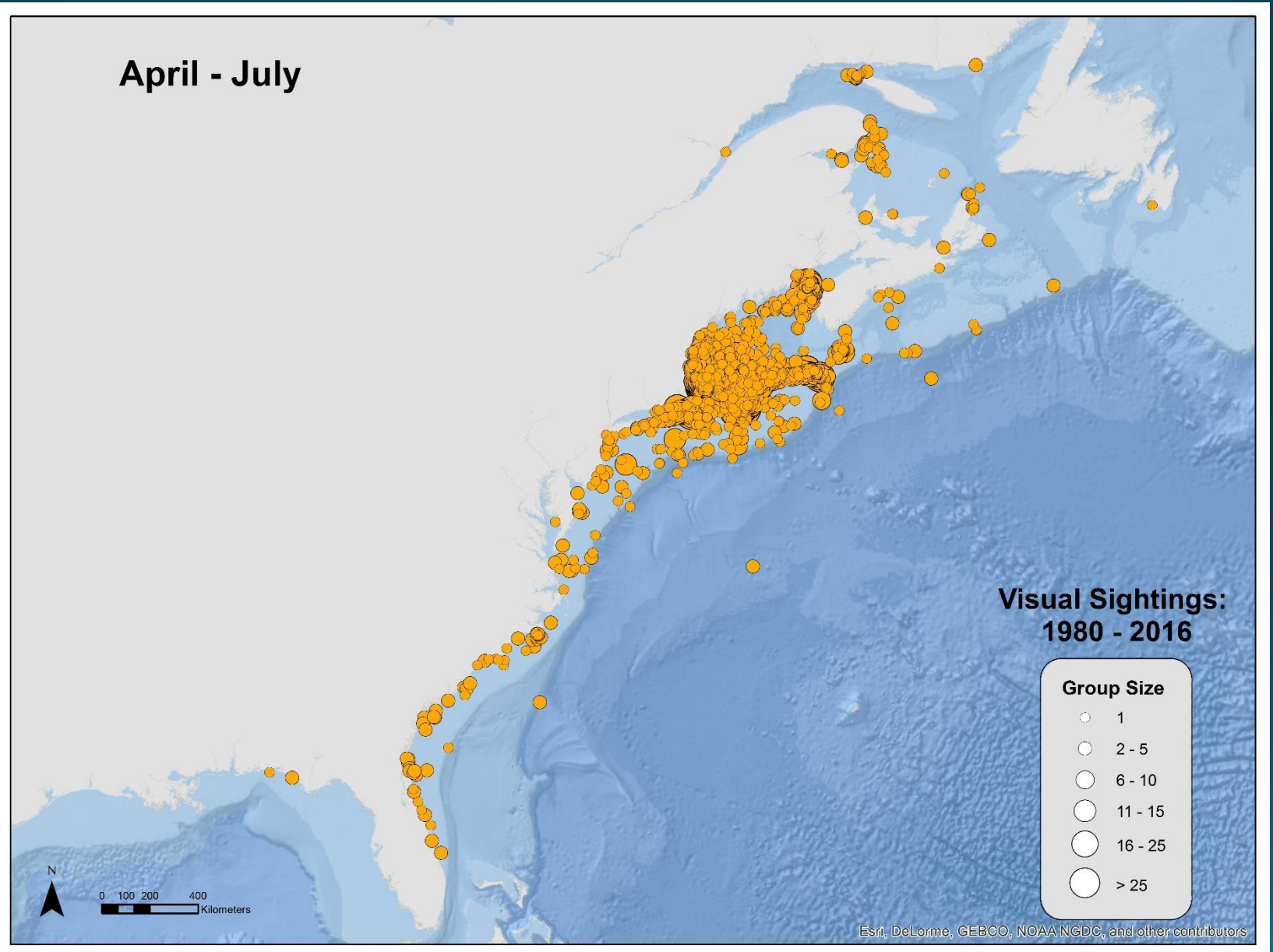
December - March

Satellite Tag Locations:
1989 - 2011

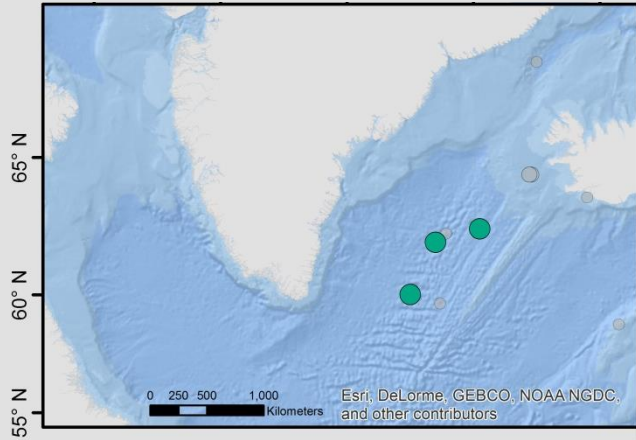


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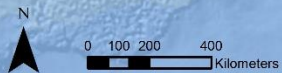
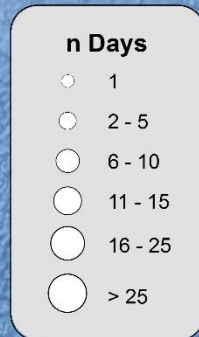
April through July



April - July

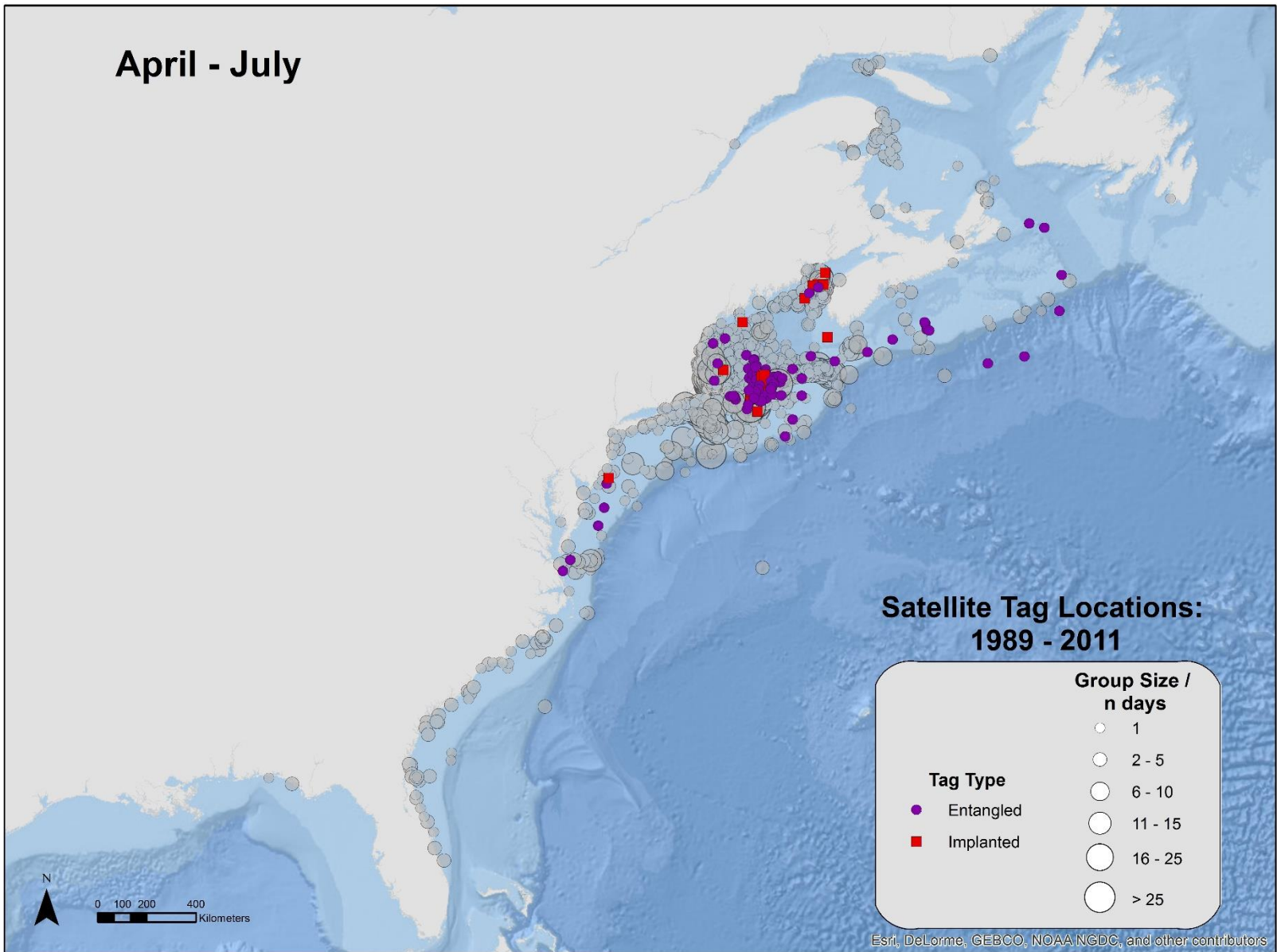


Acoustic Occurrence: 2004 - 2016



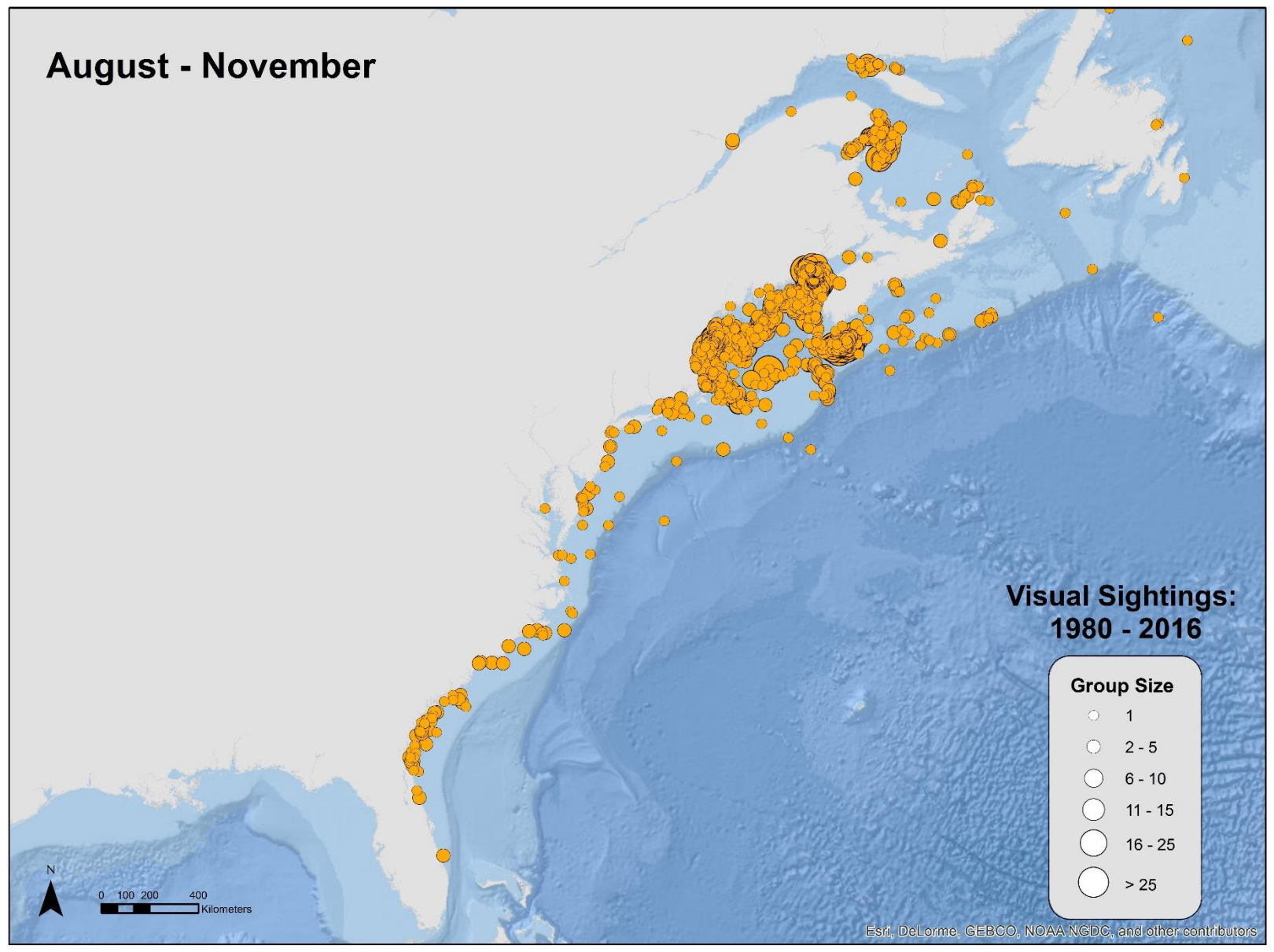
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

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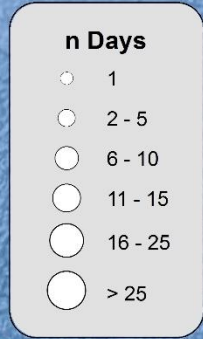
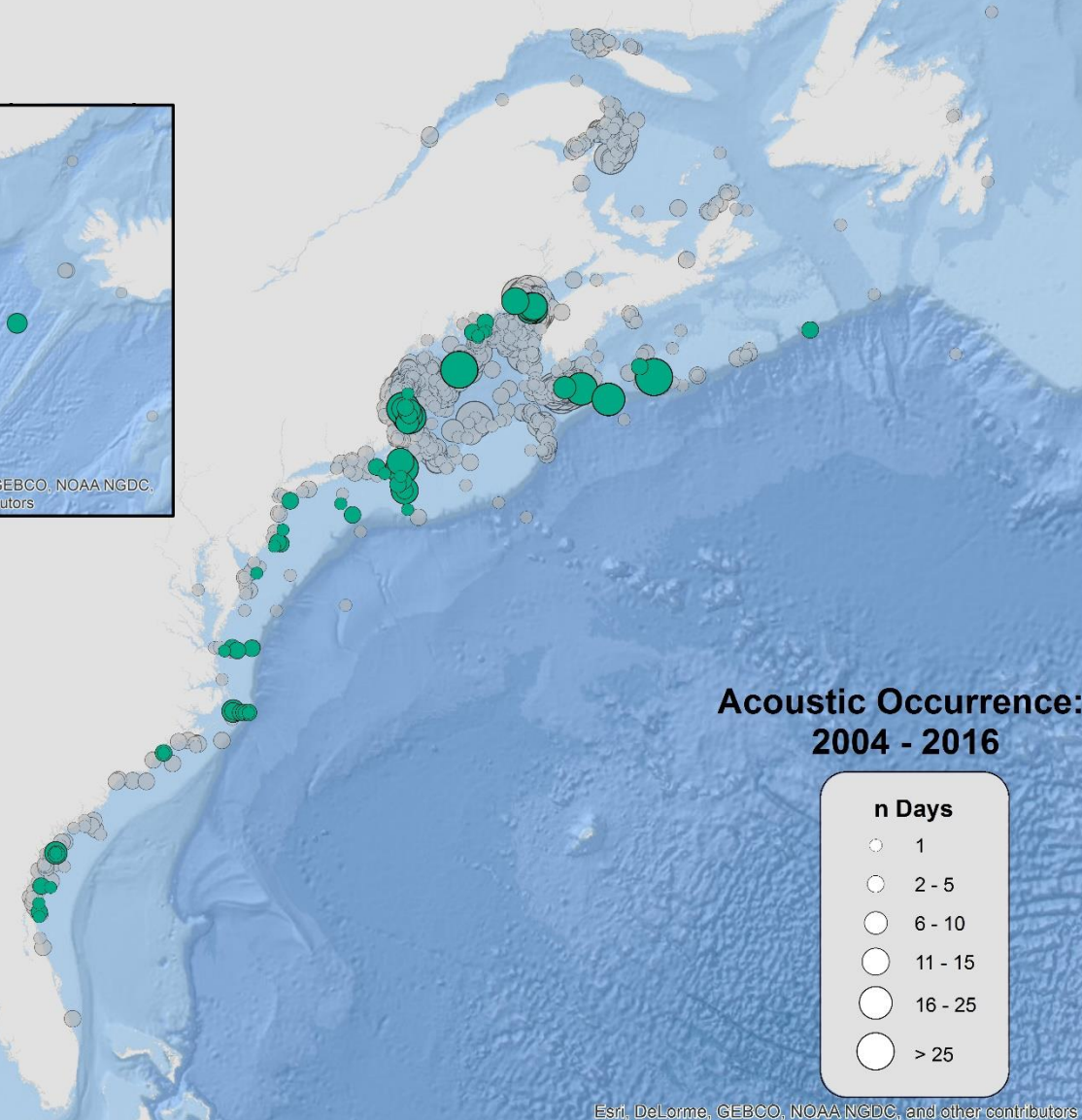
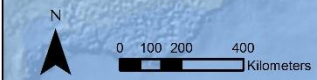
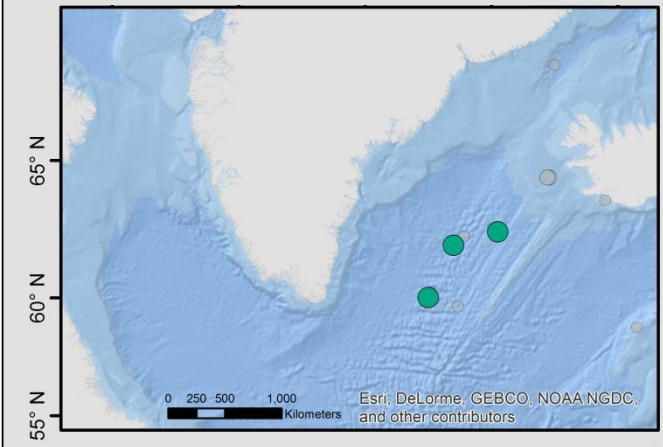


August through November

August - November

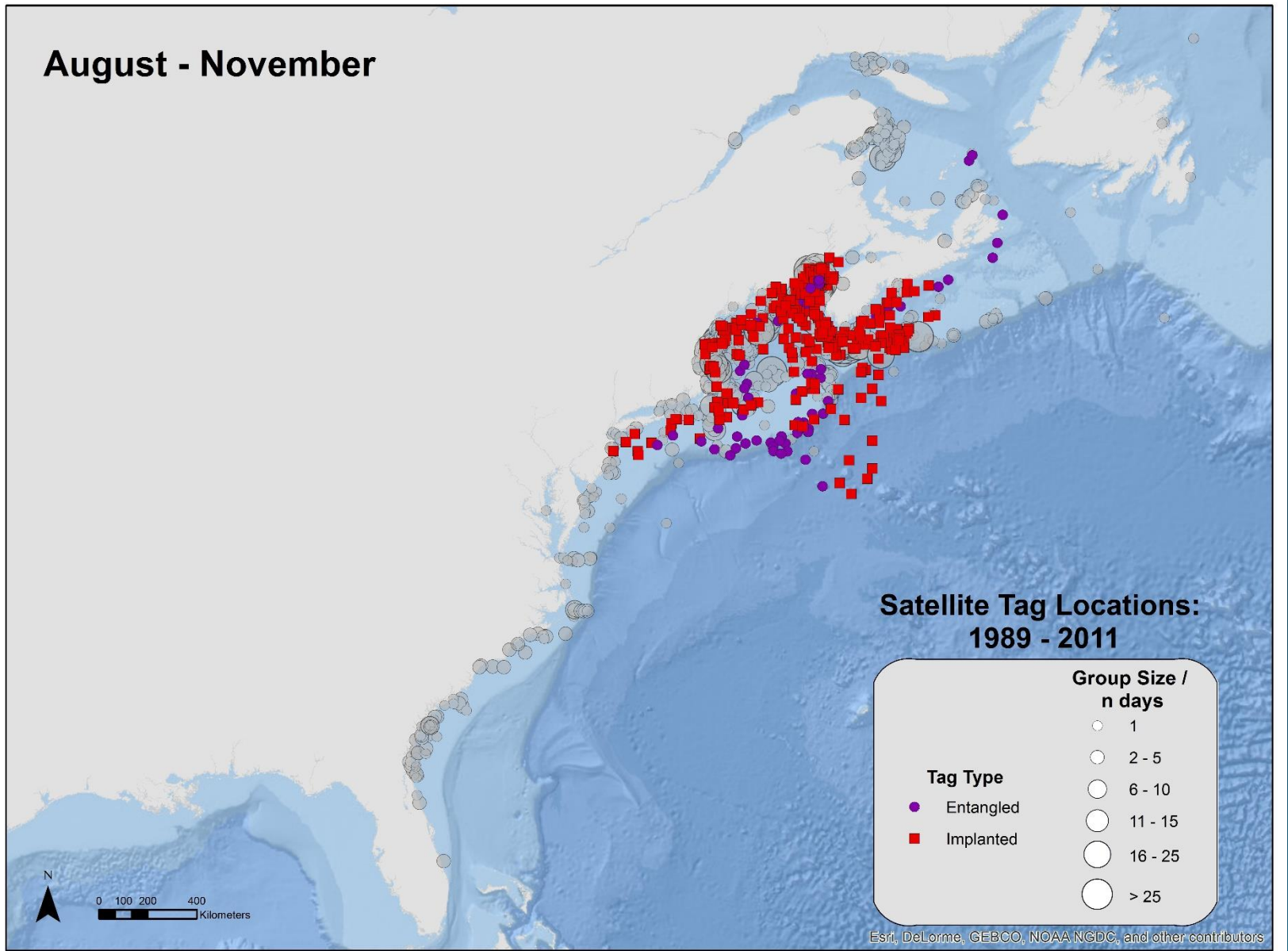


August - November

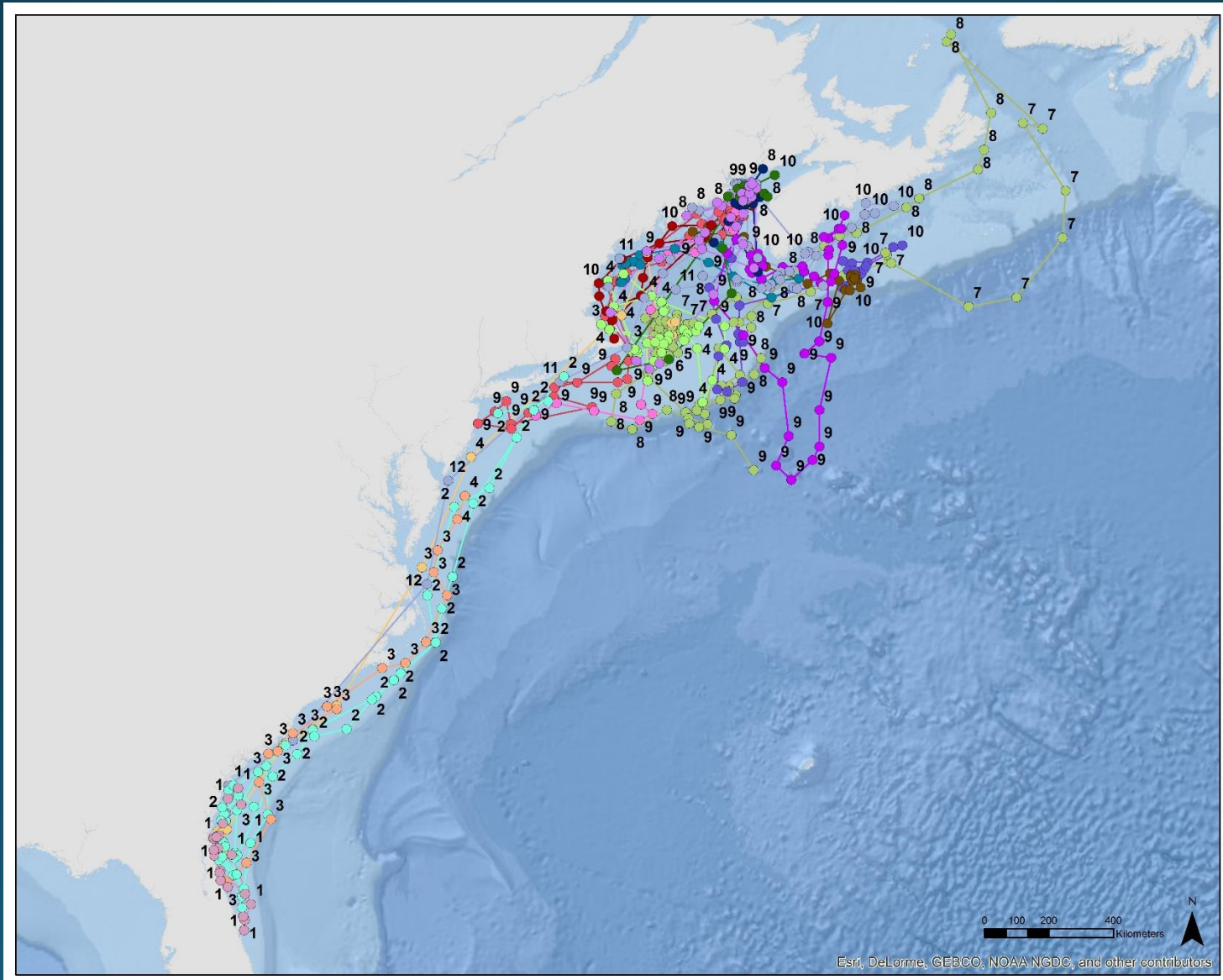


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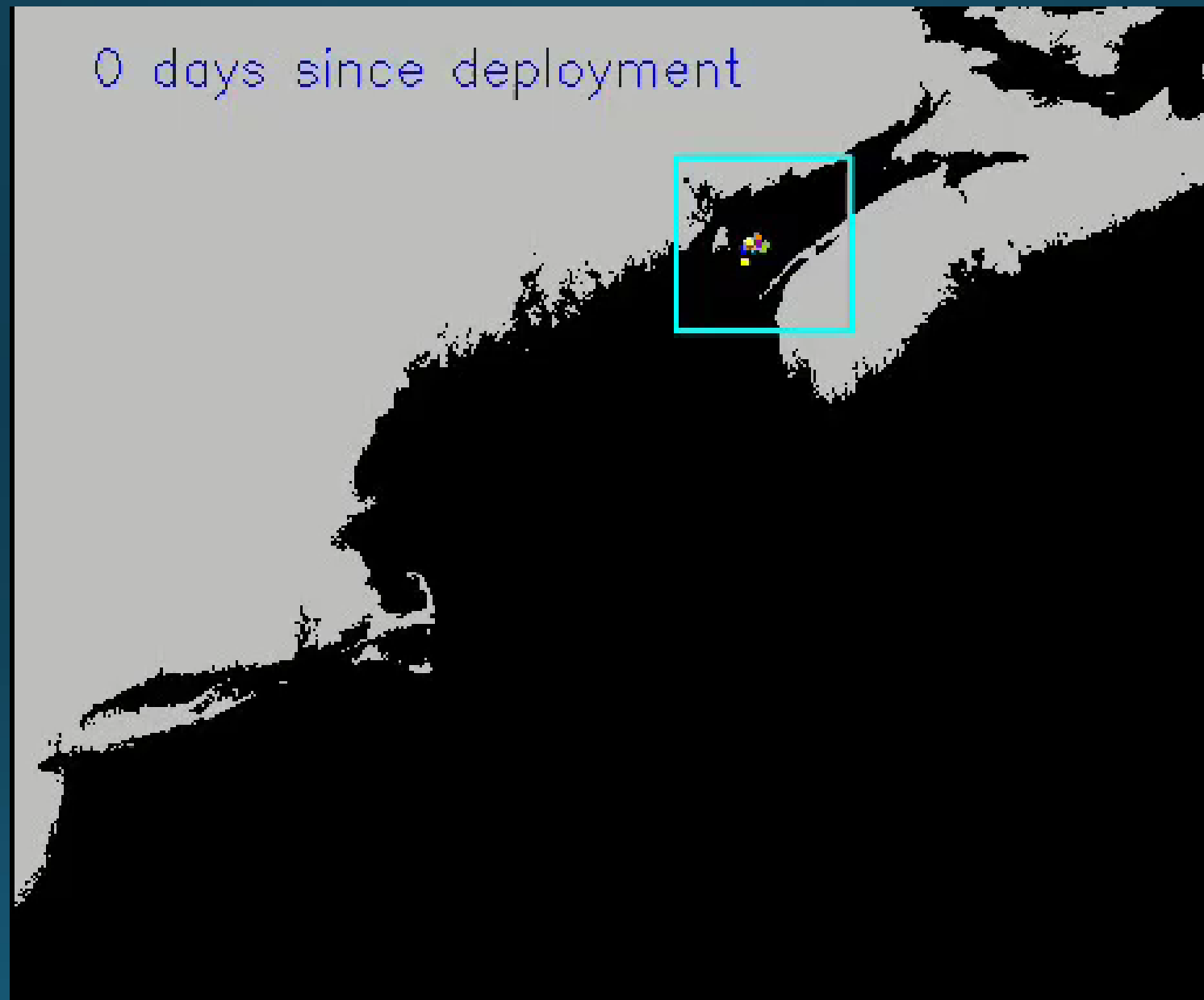
August - November



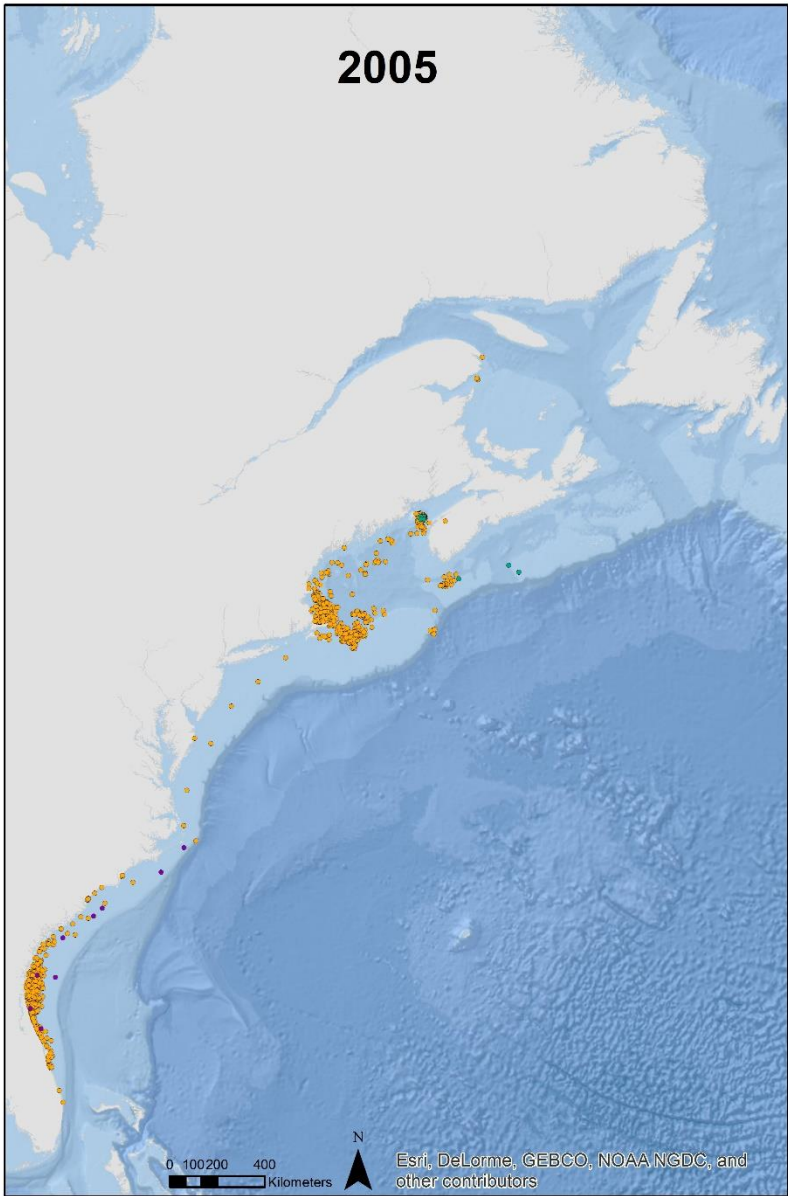
Movement of 15 Right Whales from Tag Data



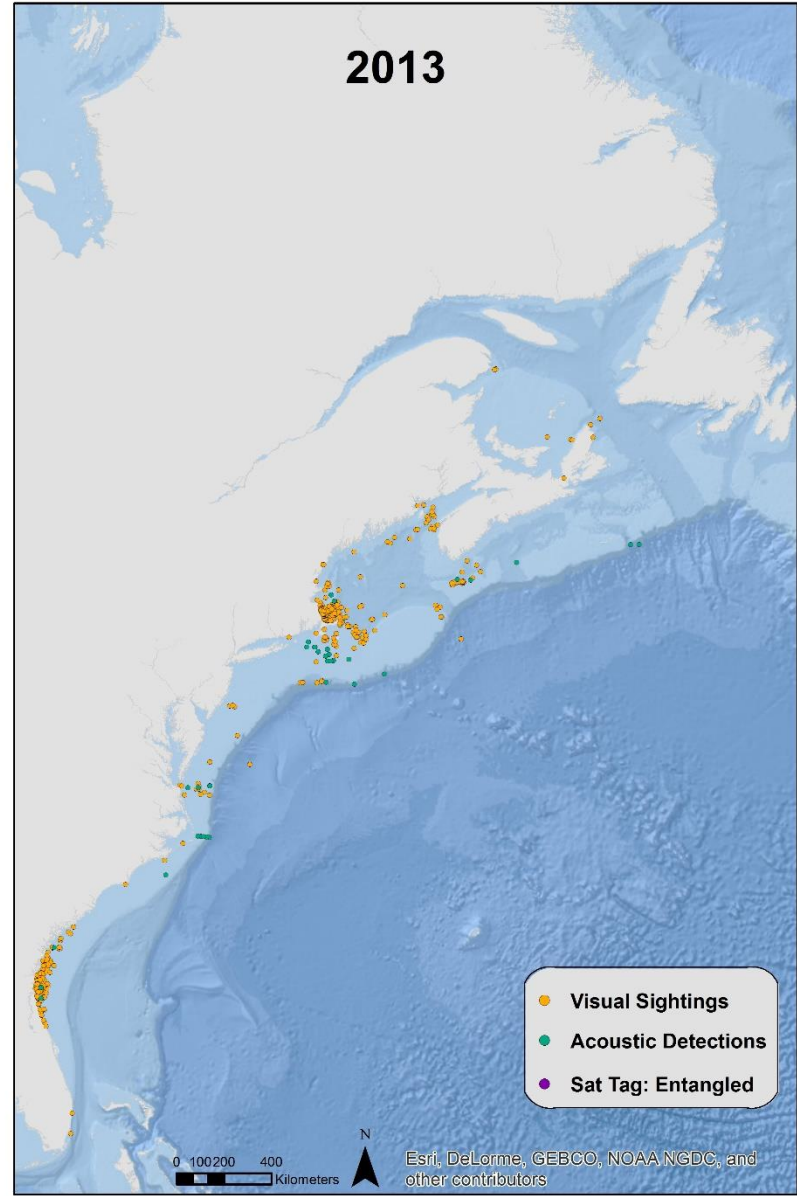
0 days since deployment



2005

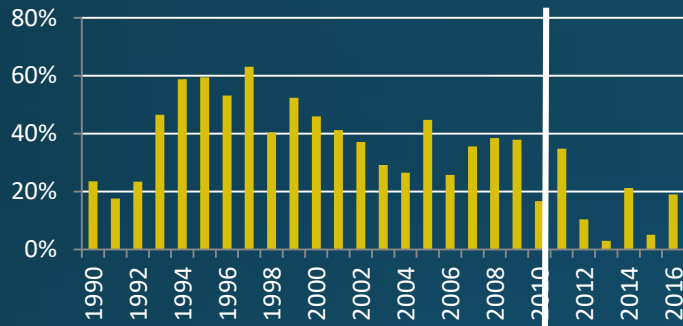


2013

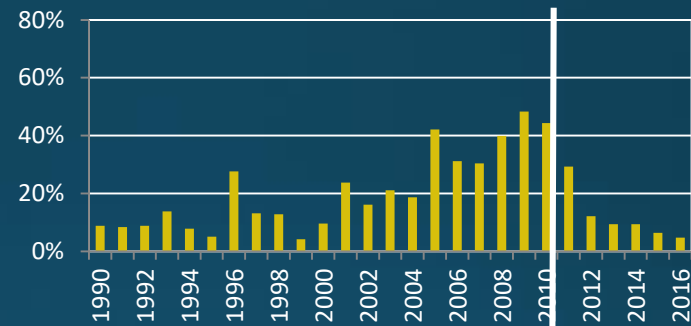


Percent of the Living Population Identified by Region

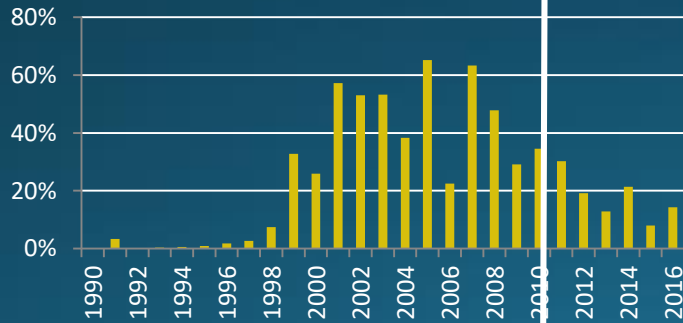
BoF



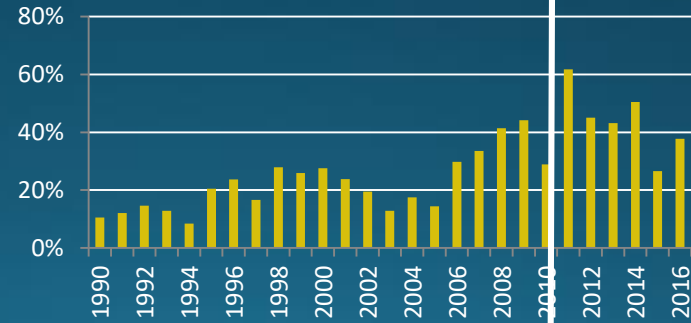
SEUS



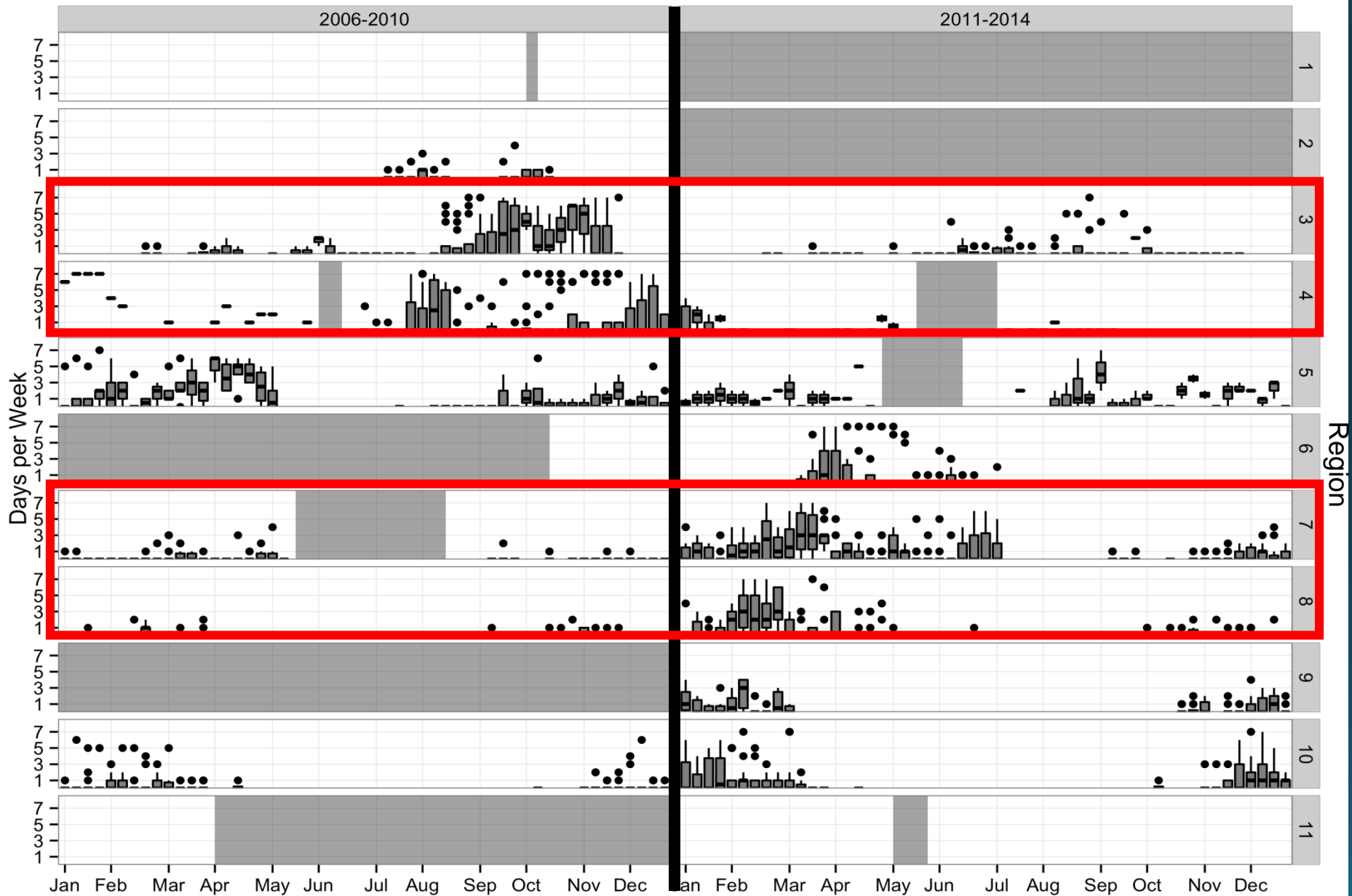
GSC



CCB & MB



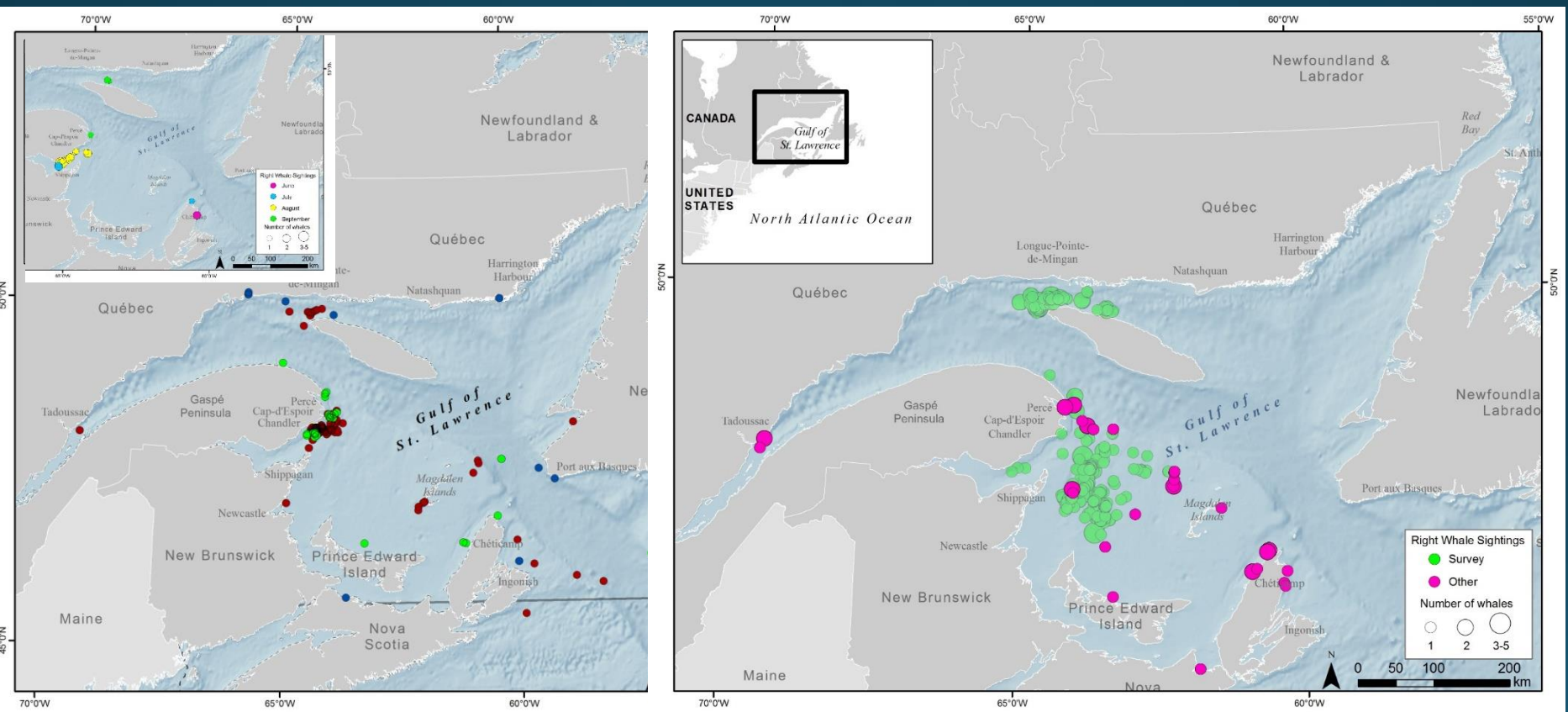
Daily Presence: comparison over time



Right Whales In the Gulf of St Lawrence

1954 to 2013
(inset 2014)

2015-2017



Conclusions



- They travel far and can do so surprisingly quickly
- They change their distribution patterns
- Recent shift includes GSL, but other summer/fall aggregations still unknown

A C K N O W L E D G E M E N T S

- **Hundreds of observers, technicians, data analysts**
- **North Atlantic Right Whale Consortium**
- **Bob Kenney- University of Rhode Island for sightings data**
- **Maps by Genevieve Davis**
- **Acoustic Data Contributors**
 - Sean Todd; College of the Atlantic
 - Chris Clark, Russ Charif, Holger Klinck, Aaron Rice; Cornell University
 - Hilary Moors-Murphy; Department of Fisheries and Oceans Canada
 - Andy Read, Joy Stanistreet, Lynne Hodge, Doug Nowacek; Duke University
 - Kathleen Dudzinski; Dolphin Communication Project
 - Julien Delarue, Bruce Martin; JASCO Applied Sciences
 - Erin Summers; Maine Department of Marine Resources
 - Joel Bell, Jaqueline Bort, Anu Kumar; NAVFAC Naval Facilities Engineering Command
 - Scott Kraus; New England Aquarium
 - Gary Buchanan; New Jersey Department of Environmental Protection
 - Catherine Berchok; NOAA National Marine Mammal Laboratory
 - Melissa Soldevilla, Lance Garrison; NOAA Southeast Fisheries Science Center
 - Leila Hatch, David Wiley, Mike Thompson; NOS Stellwagen Bank National Marine Sanctuary
 - Dave Mellinger, Sharon Nieukirk; Oregon State University
 - Kate Stafford; University of Washington
 - Denise Risch, Scottish Association for Marine Science
 - Ana Sirovic, John Hildebrand; Scripps Institution of Oceanography
 - Susan Parks; Syracuse University

Thank You!

Questions?



Photo: Center for Coastal Studies