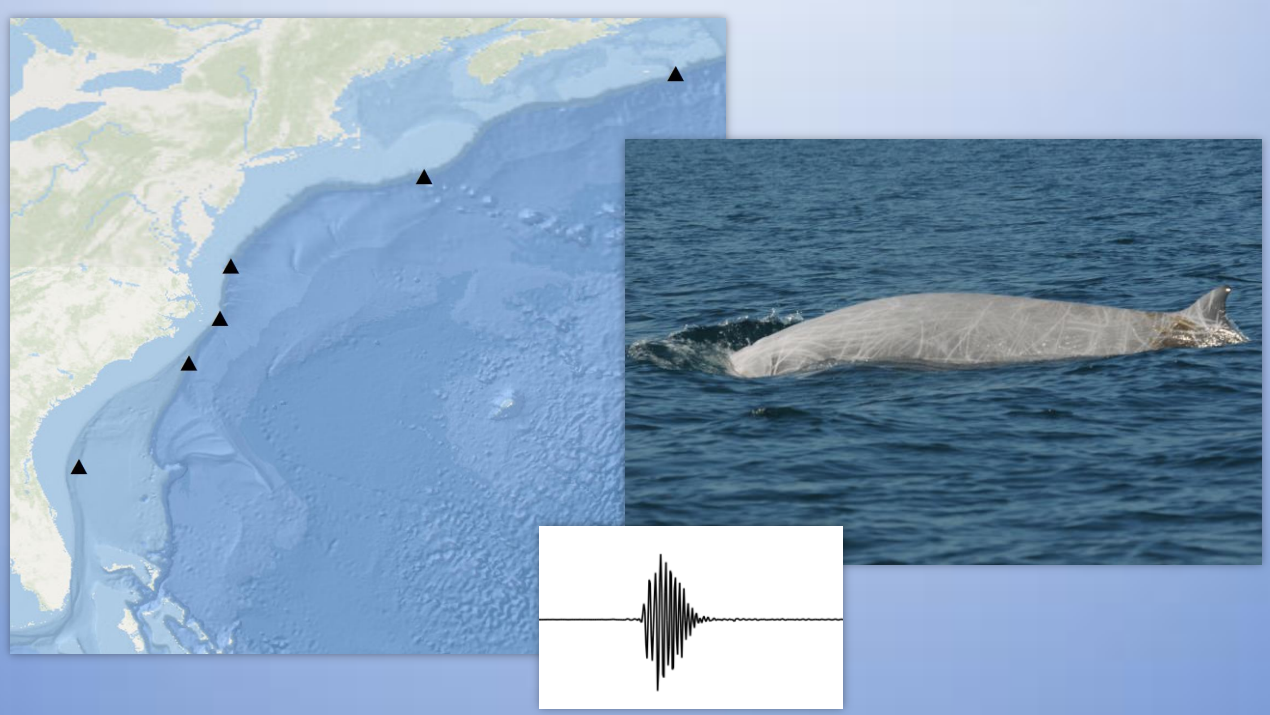
Distribution and seasonal occurrence of beaked and sperm whales in the western North Atlantic Ocean:

New insights from broad-scale passive acoustic monitoring



Joy Stanistreet, Douglas Nowacek, Simone Baumann-Pickering, Joel Bell, Danielle Cholewiak, John Hildebrand, Lynne Hodge, Hilary Moors-Murphy, Sofie Van Parijs, & Andrew Read

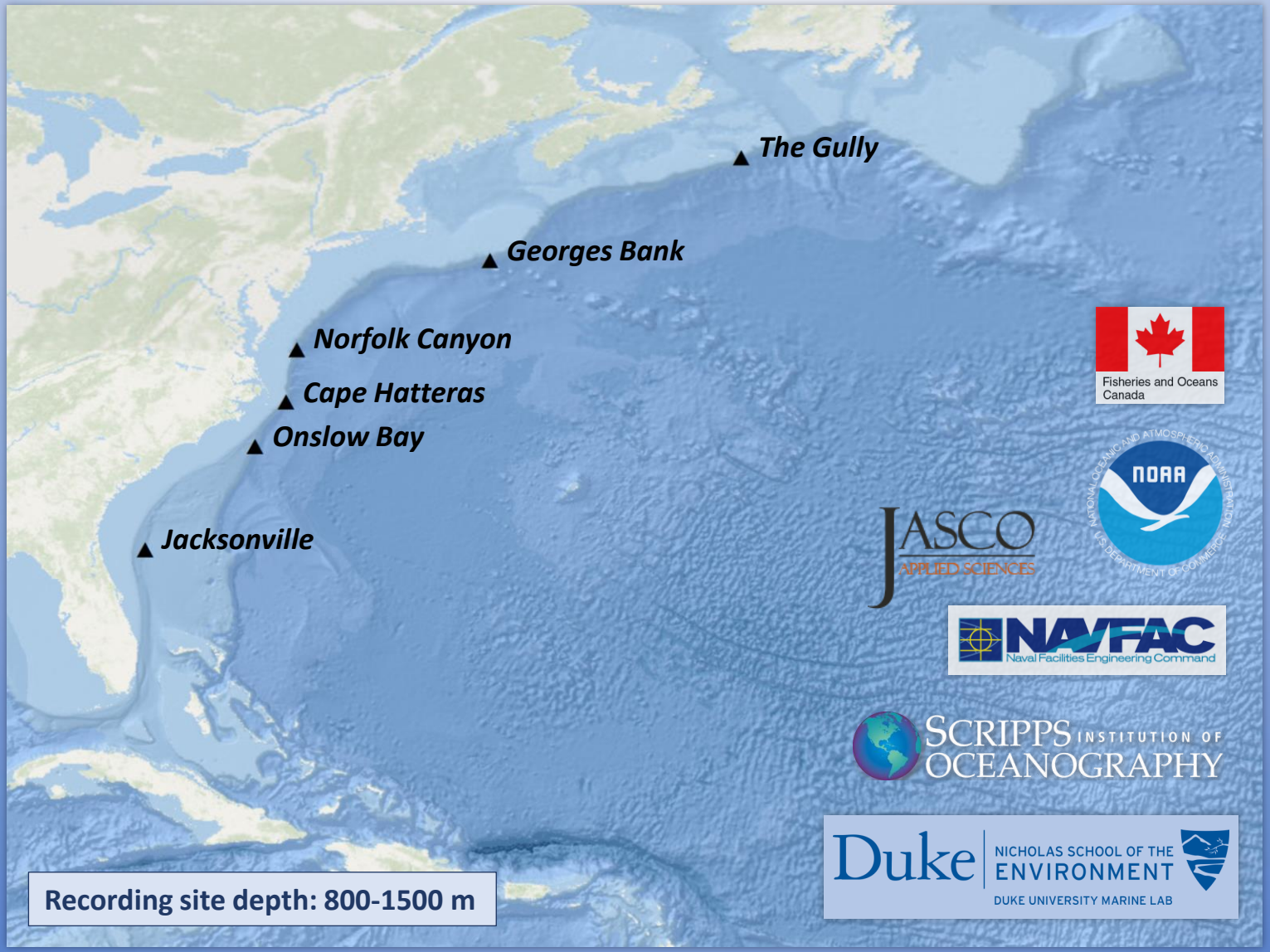
Introduction

- Deep-diving odontocetes are challenging to observe and study
- Distribution, seasonality, and habitat preferences are poorly known

Research Objective

Use long-term passive acoustic monitoring to describe the distribution and seasonal occurrence of beaked whales and sperm whales along the continental slope in the western North Atlantic Ocean

Data collection: study sites



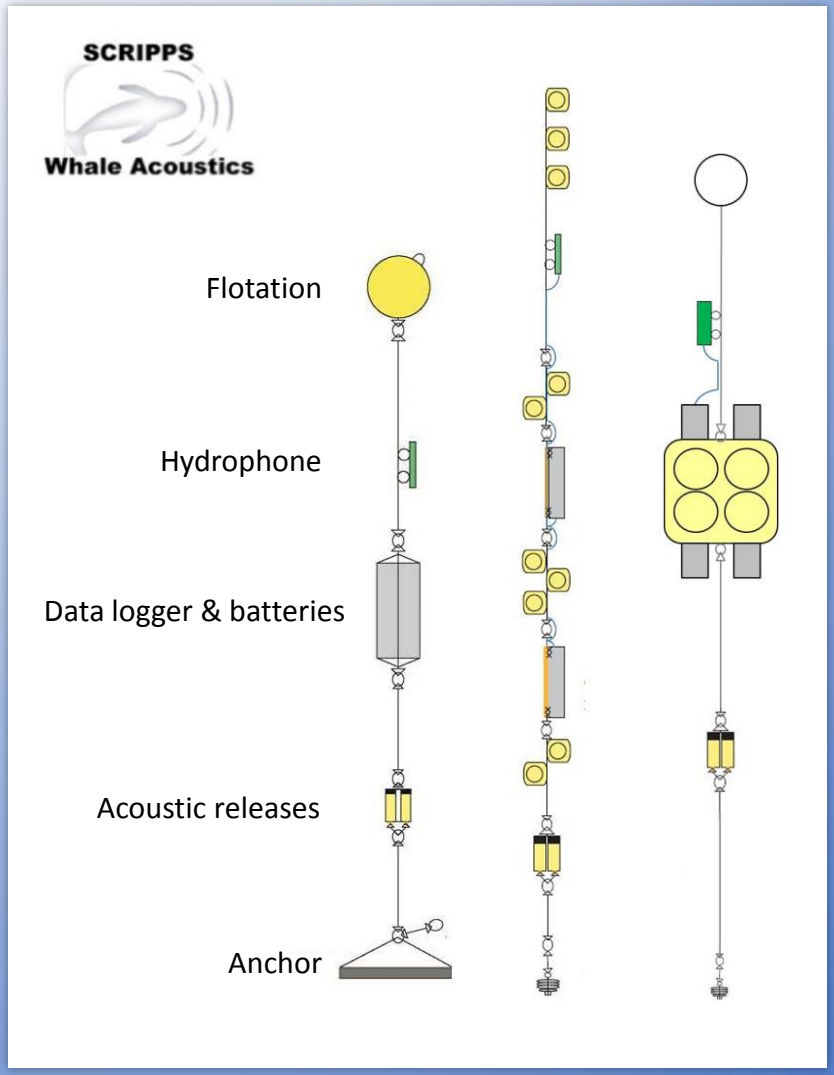
Data collection: passive acoustic monitoring

High-frequency Acoustic Recording Package (HARP)

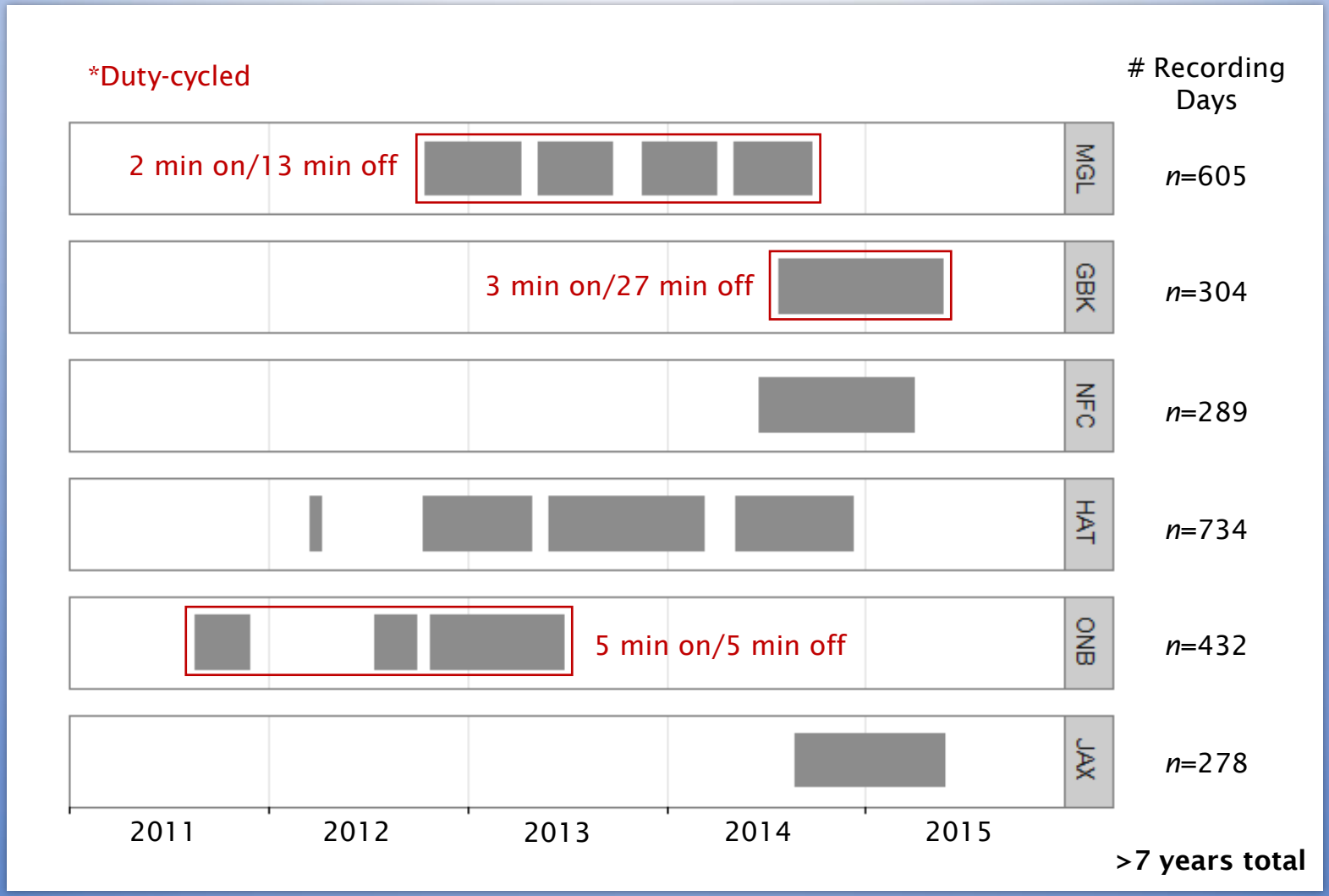
Autonomous Multi-channel Acoustic Recorder (AMAR)

Sampling rates 128 – 375 kHz

Continuous or duty-cycled recordings

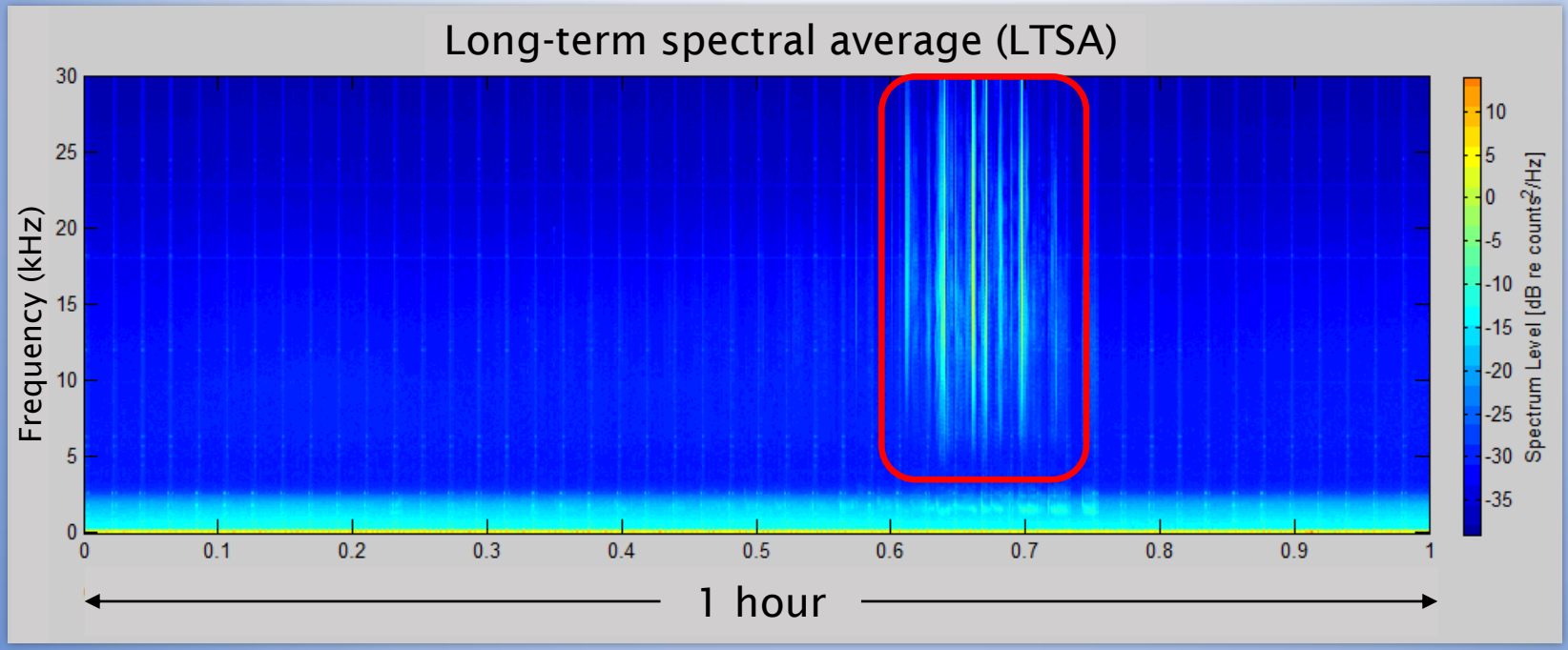


Data collection: recording effort



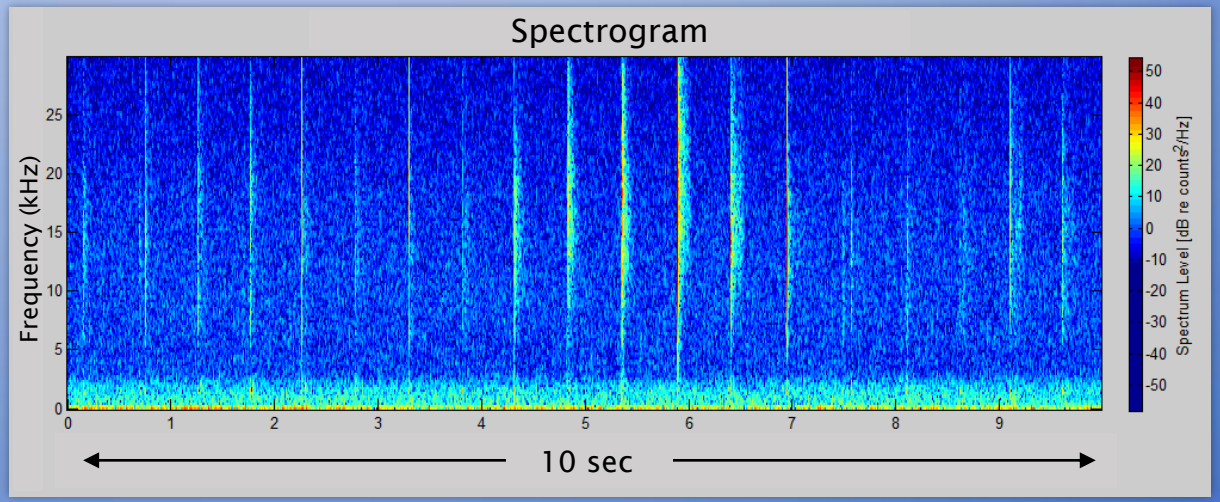
Stanistreet et al. (2016) Effects of duty-cycled passive acoustic recordings on detecting the presence of beaked whales in the northwest Atlantic. *Journal of the Acoustical Society of America* 140(1):EL31

Analysis methods: detecting sperm whale clicks

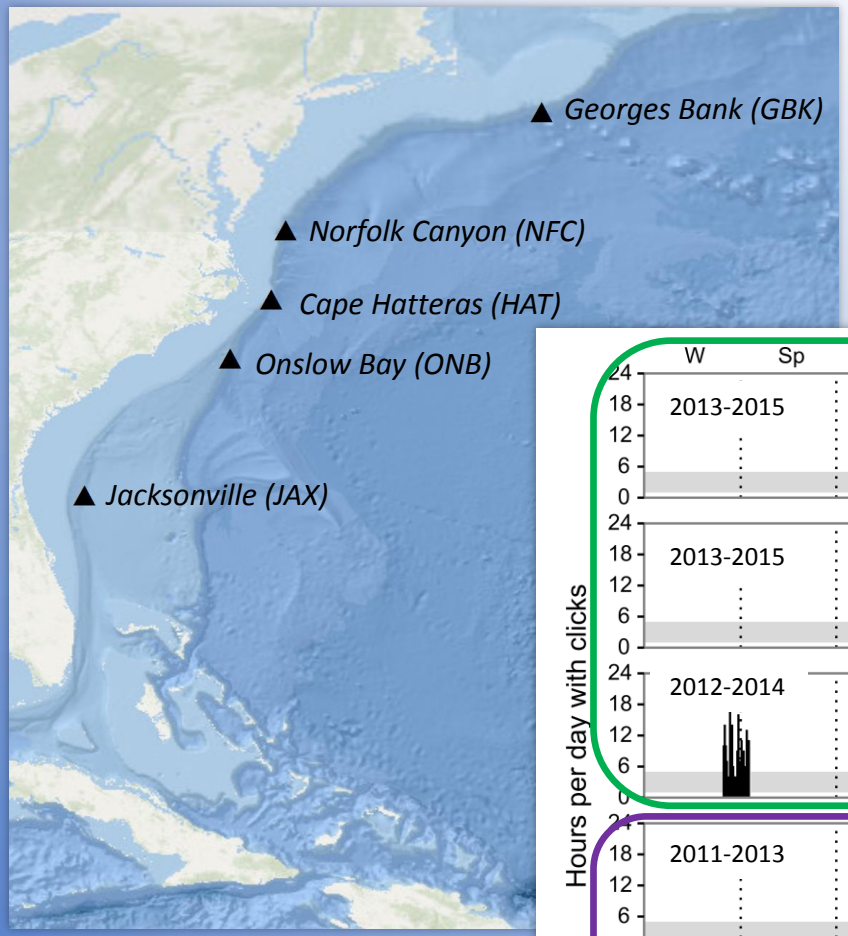


Visual review of data using LTSAs/spectrograms

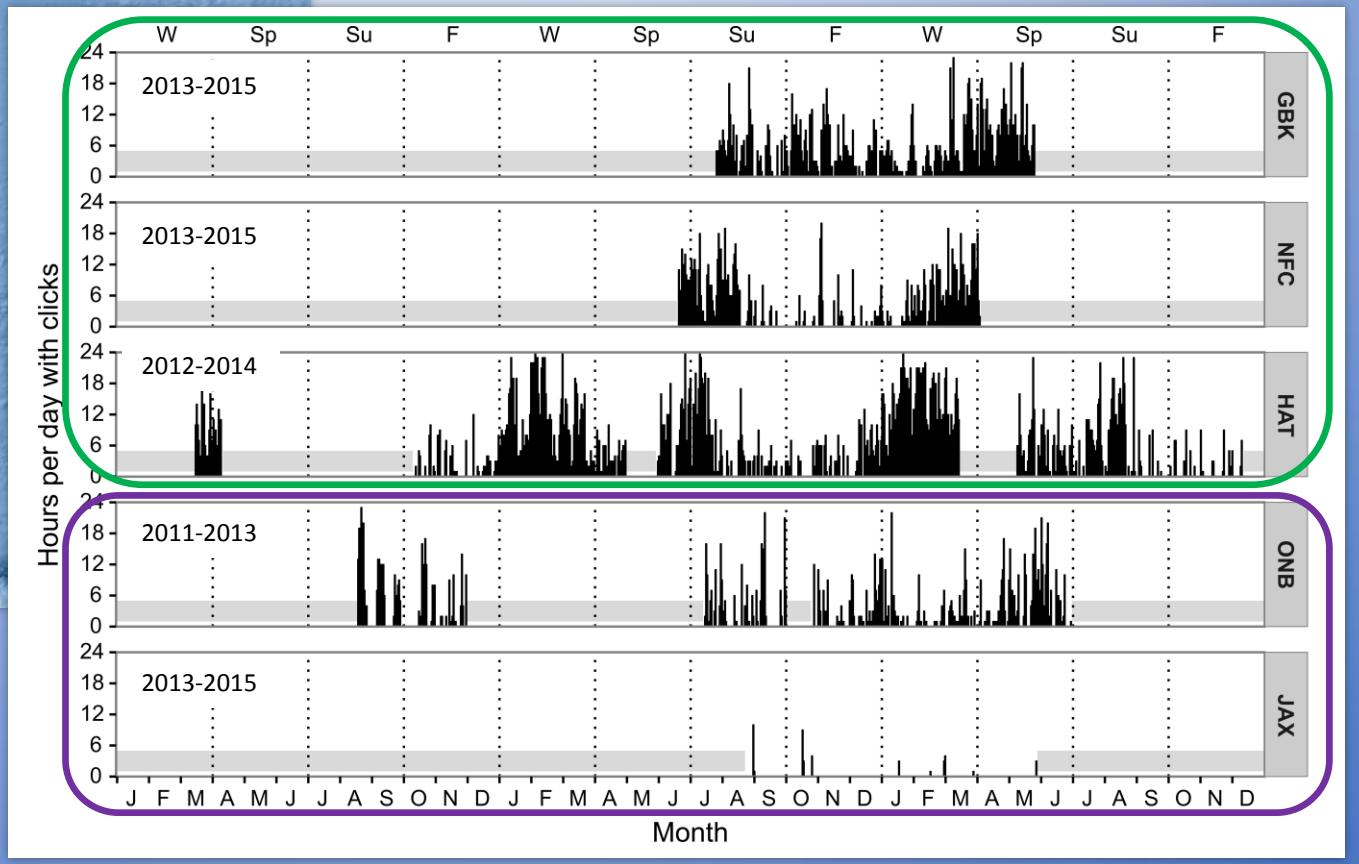
Logged hourly presence of sperm whale regular clicks



Results: spatial patterns in sperm whale detections



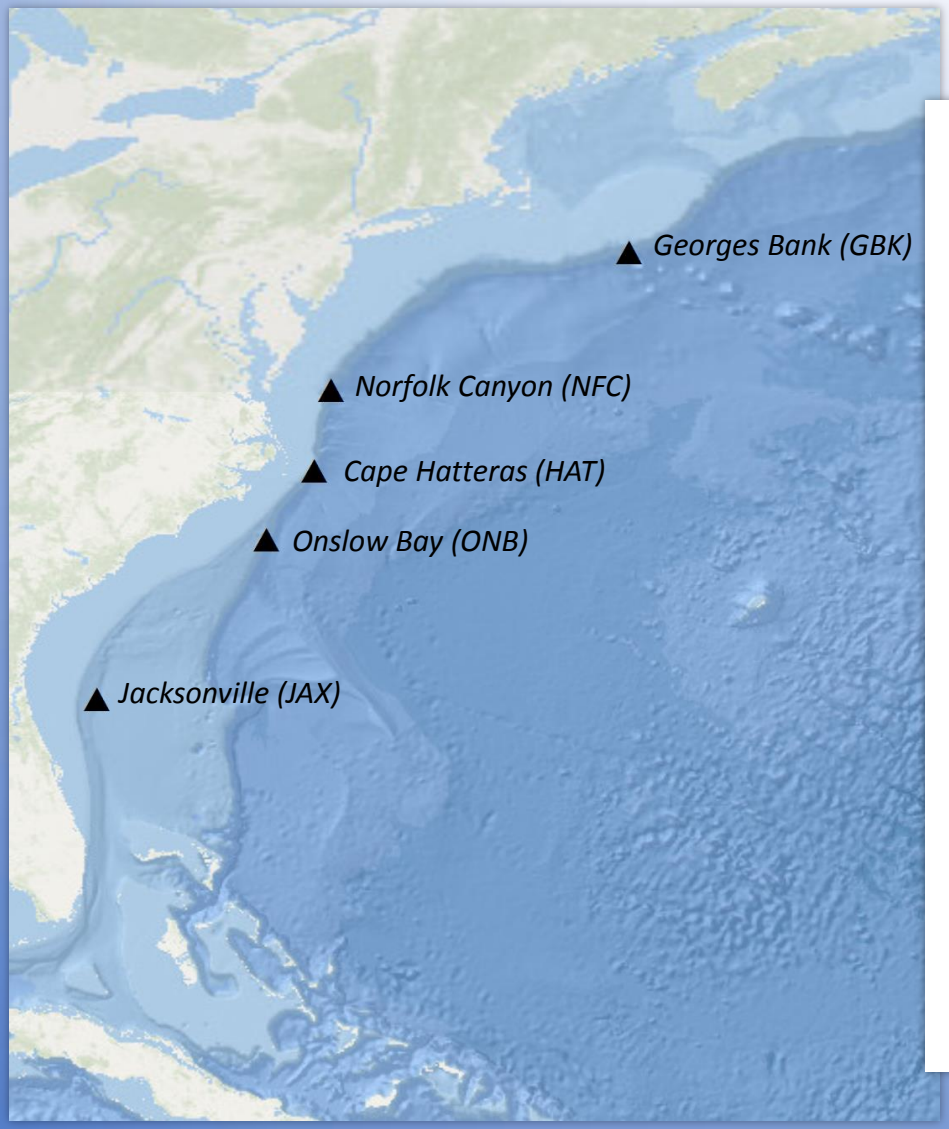
Detections on ~ 60-80%
of recording days



Detections on <50%
of recording days

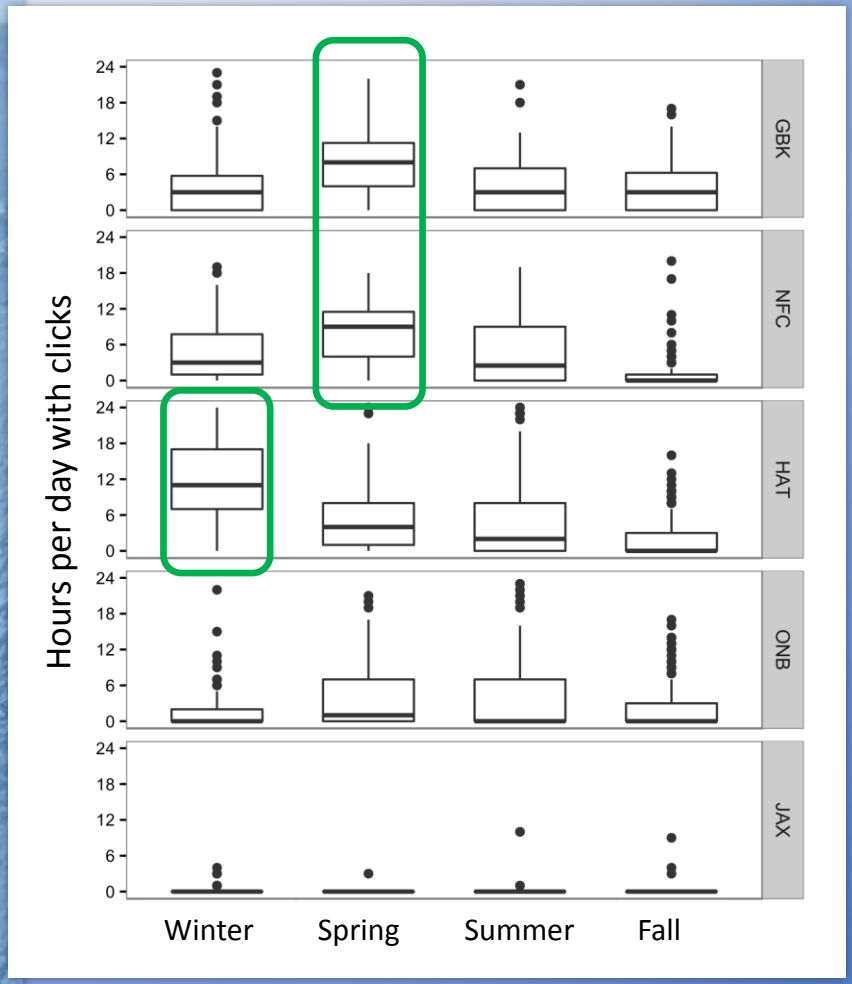
Stanistreet et al. (in press) *Endang. Species Res.*

Results: seasonal patterns in sperm whale detections



Spring

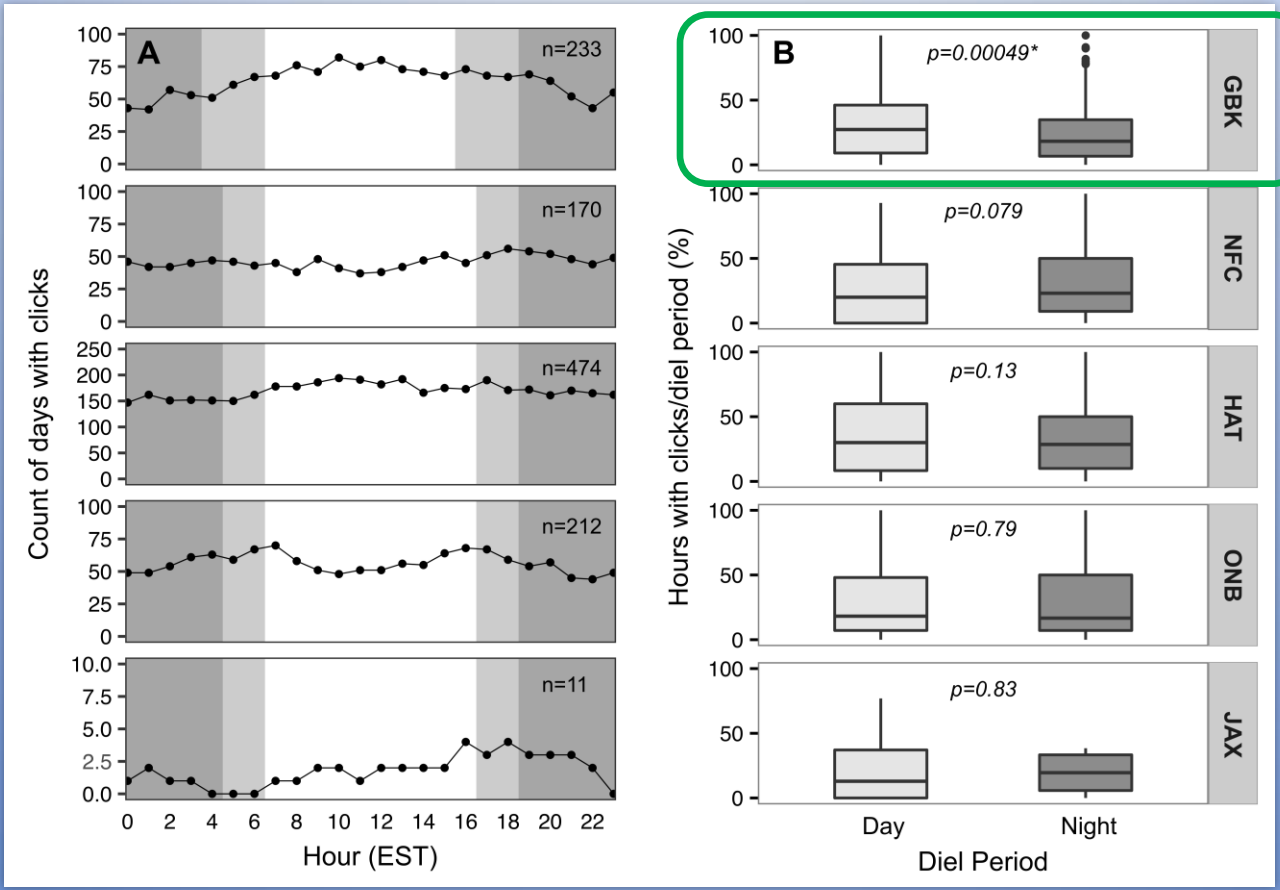
Winter



Stanistreet et al. (in press) *Endang. Species Res.*

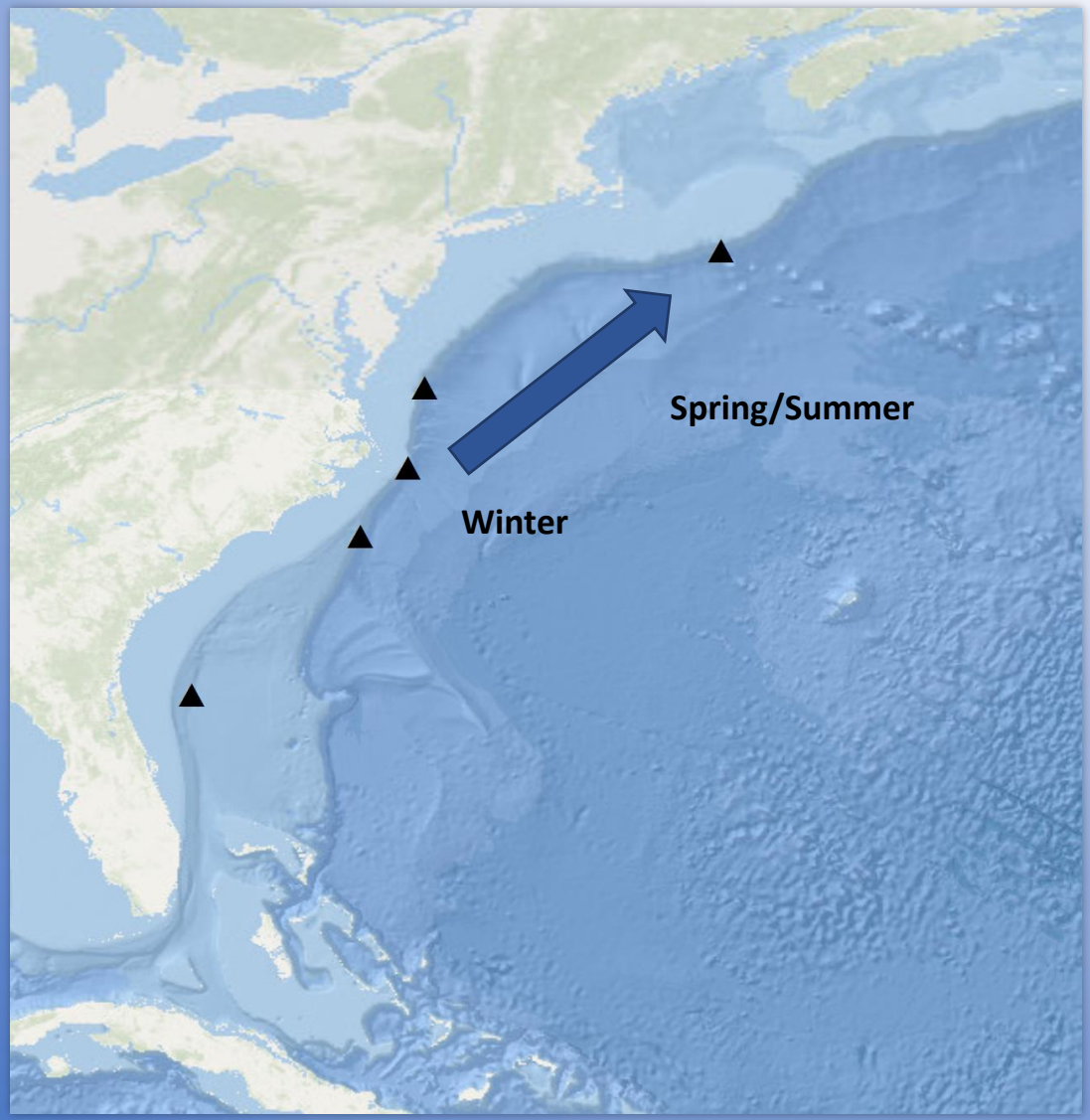
Results: temporal patterns in sperm whale detections

Diel patterns in sperm whale detections?



Stanistreet et al. (in press) *Endang. Species Res.*

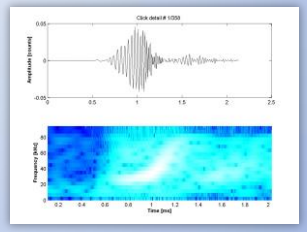
Summary: sperm whales



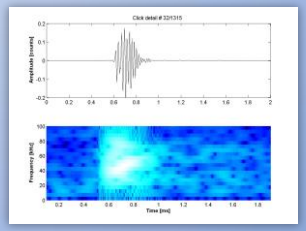
- Higher detection rates in the northern half of the study region
- Apparent seasonal shift in sperm whale occurrence
- Little evidence of diel patterns

Atlantic beaked whale species

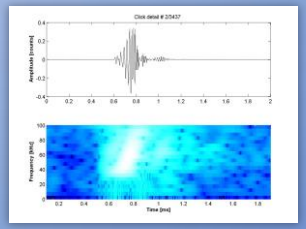
	Verified recordings?
Northern bottlenose whale (*Hyperoodon ampullatus*)	✓
Cuvier's beaked whale (*Ziphius cavirostris*)	✓
Sowerby's beaked whale (*Mesoplodon bidens*)	✓
Blainville's beaked whale (*Mesoplodon densirostris*)	✓
Gervais' beaked whale (*Mesoplodon europaeus*)	✓
True's beaked whale (*Mesoplodon mirus*)	??



N. bottlenose whale



Cuvier's beaked whale



Gervais' beaked whale

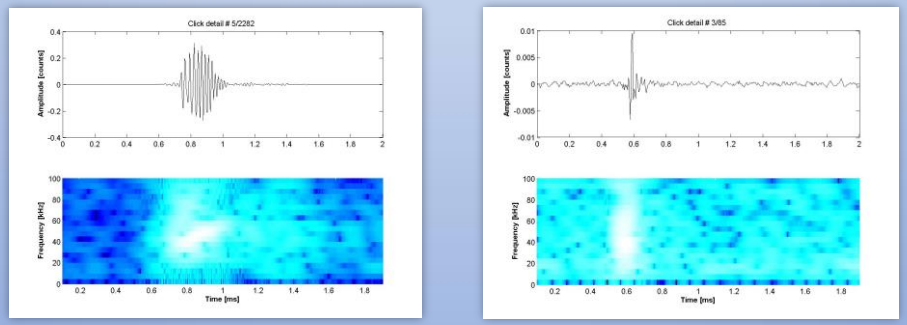
See talk by Annamaria Izzi on Thursday at 15:30, Room 200C:

Is it truly True's? First description of True's beaked whale clicks

Analysis methods: beaked whale detection & classification

1) Run automated detection algorithm[1], apply criteria based on peak frequency, slope, duration and shape of signal envelope[2], group clicks separated by <5 min into a detection event

2) Manual species classification of each detection event based on acoustic characteristics

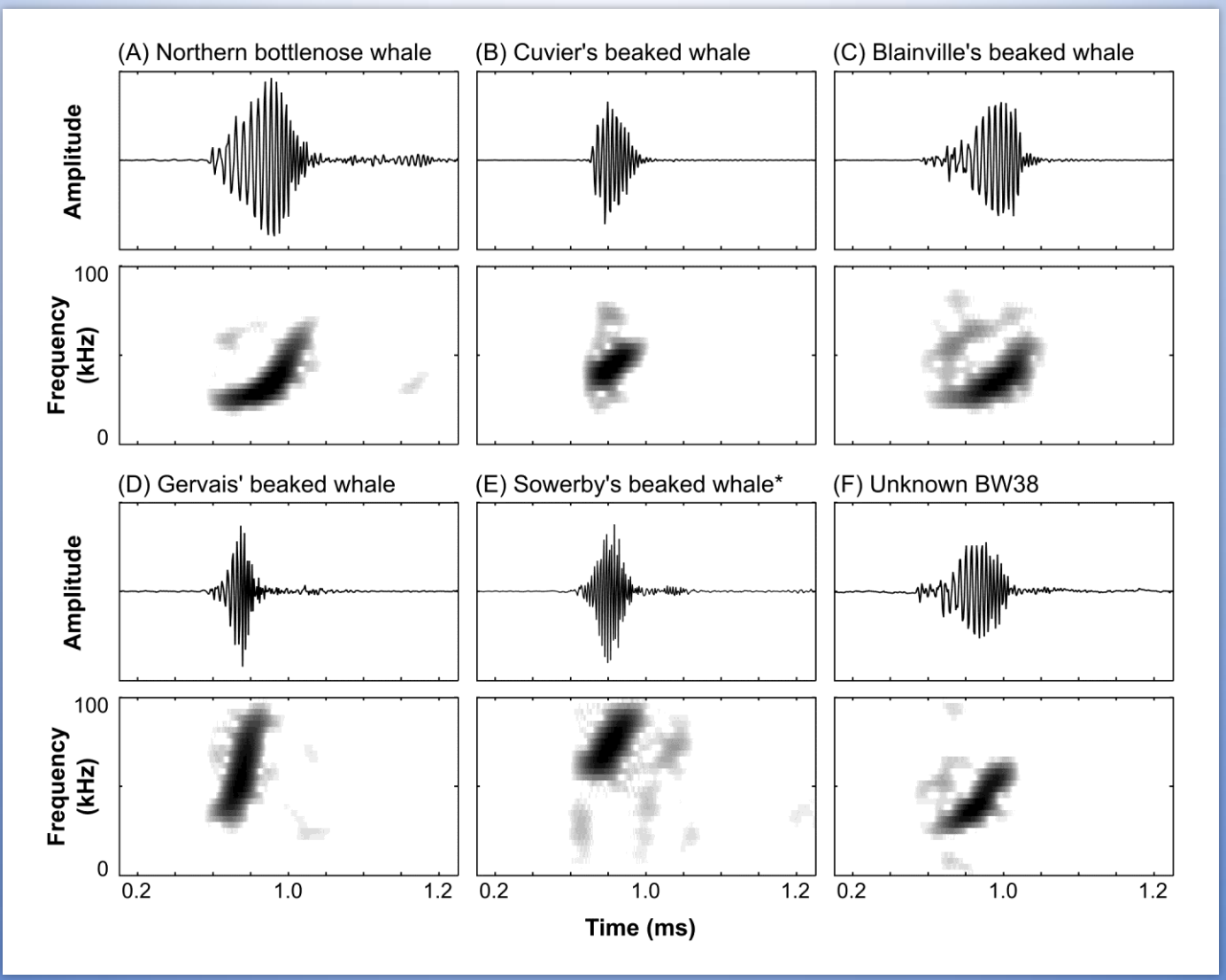


[1] Soldevilla et al. (2008) *J. Acoustical Society of America* 124(1):609-624

[2] Baumann-Pickering et al. (2013) *J. Acoustical Society of America* 134(3):2293-2301

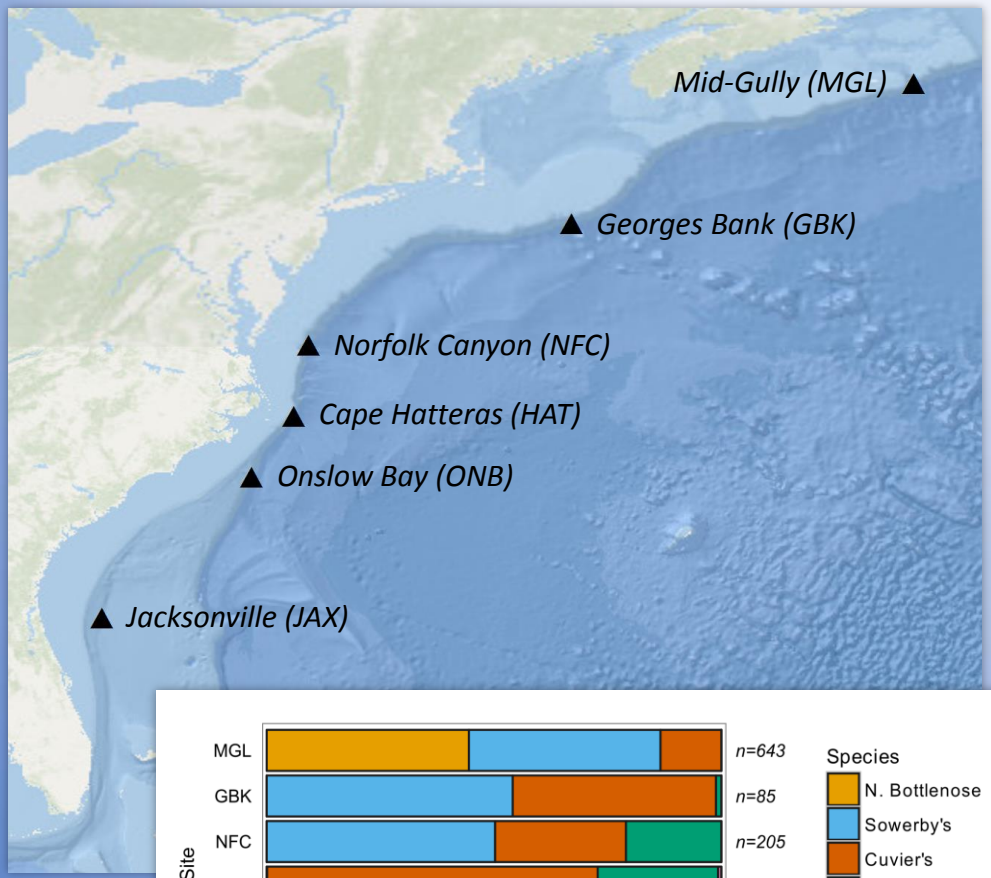
Stanistreet et al. (2017) Using passive acoustic monitoring to document the distribution of beaked whale species in the western North Atlantic Ocean. *Canadian Journal of Fisheries and Aquatic Sciences.* [e-First version; published online on 21 February 2017]

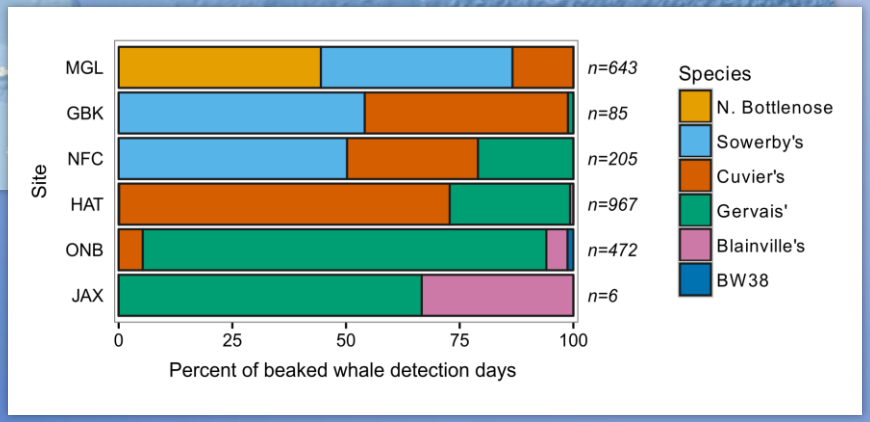
Results: beaked whale click types

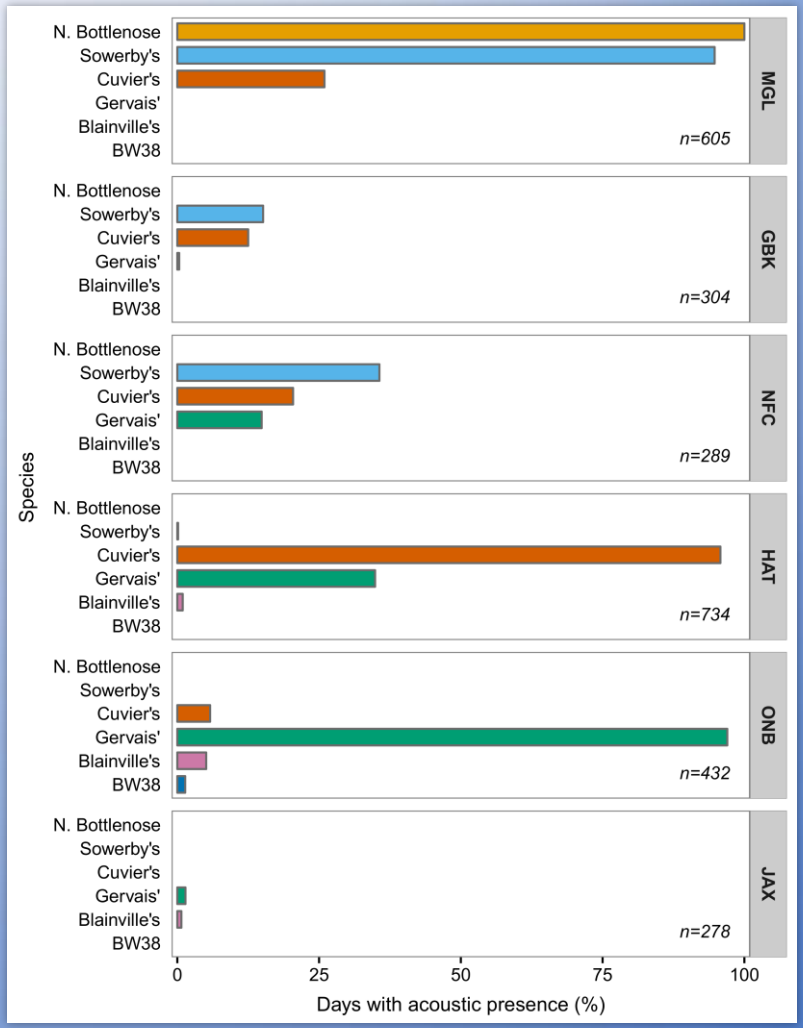


Stanistreet et al. (2017) *Canadian J. Fisheries & Aquatic Sciences*

Results: spatial patterns in beaked whale detections

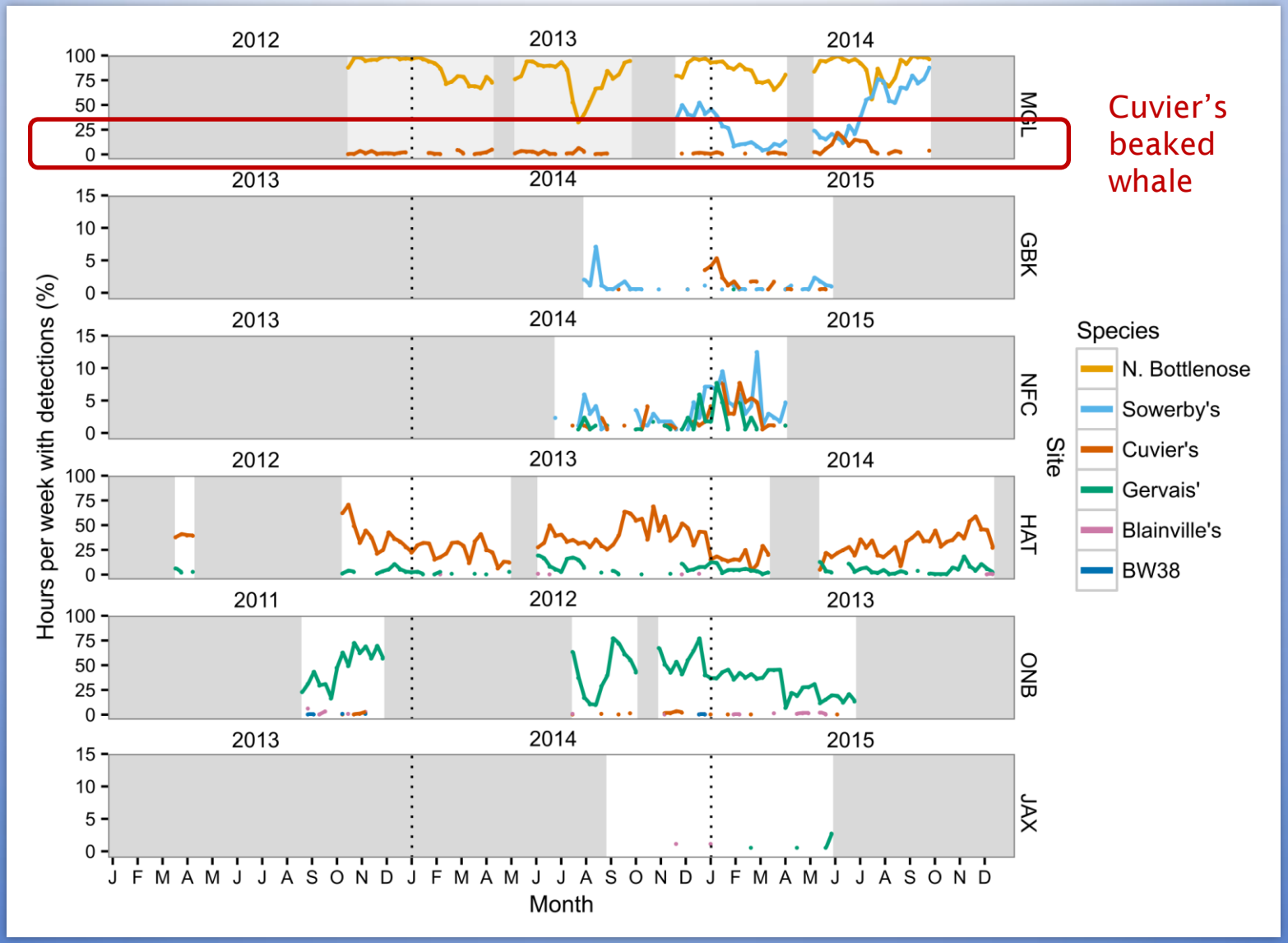






Stanistreet et al. (2017) *Canadian J. Fisheries & Aquatic Sciences*

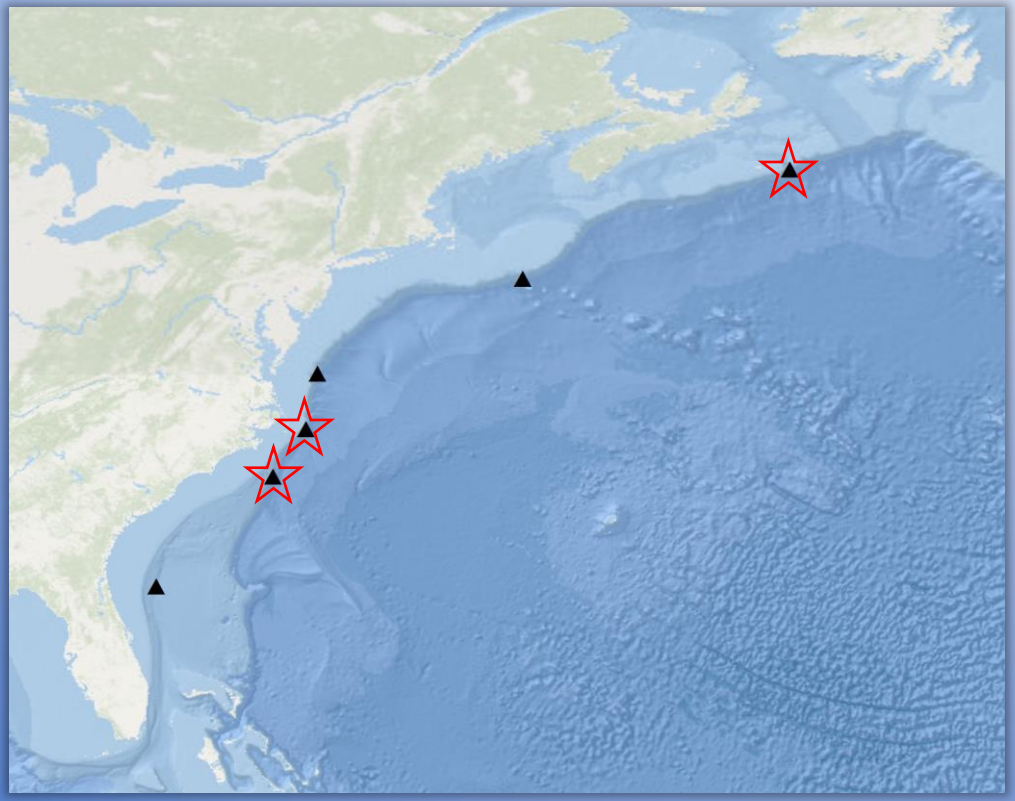
Results: seasonal patterns in beaked whale detections



Stanistreet et al. (2017) *Canadian J. Fisheries & Aquatic Sciences*

Summary: beaked whales

- Beaked whale species community changes with latitude
- Year-round detections
- Beaked whales consistently present at Onslow Bay, Cape Hatteras, and the Gully



Conclusions

- Passive acoustic monitoring provides baseline information on the occurrence of sperm whales and beaked whales throughout the year

- **Species-specific** information on beaked whale occurrence is important – and possible using acoustics

Acknowledgements

Field and logistical support

Tim Boynton, Zach Swaim, Jennifer Dunn, Heather Foley, Sean Wiggins, Ryan Griswold, John Hurwitz

Vessel captains & crews

R/V Cape Fear, R/V Cape Hatteras, Tiki XIV, NOAA Ship Henry B. Bigelow

Data processing support

Erin O'Neill, Bruce Thayre, Jenny Trickey, Bruce Martin

Duke | NICHOLAS SCHOOL OF THE ENVIRONMENT
DUKE UNIVERSITY MARINE LAB

SCRIPPS INSTITUTION OF OCEANOGRAPHY

JASCO APPLIED SCIENCES

Fisheries and Oceans Canada

NOAA — National Oceanic and Atmospheric Administration — U.S. Department of Commerce

NDSEG
NATIONAL DEFENSE SCIENCE & ENGINEERING GRADUATE FELLOWSHIP

NAVFAC
Naval Facilities Engineering Command

Duke
UNIVERSITY PROGRAM IN ECOLOGY

Questions?