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

US Navy Marine Species Monitoring Program – Annual Technical Review Meeting
San Diego, CA *14-17 March 2016*

Tagging and Tracking of North Atlantic Right Whales in the SE U.S.

D.P. Nowacek
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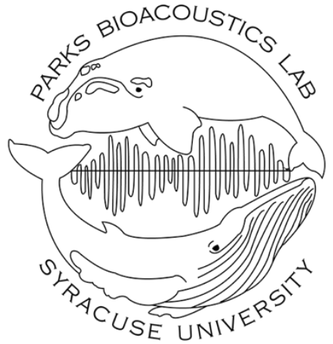

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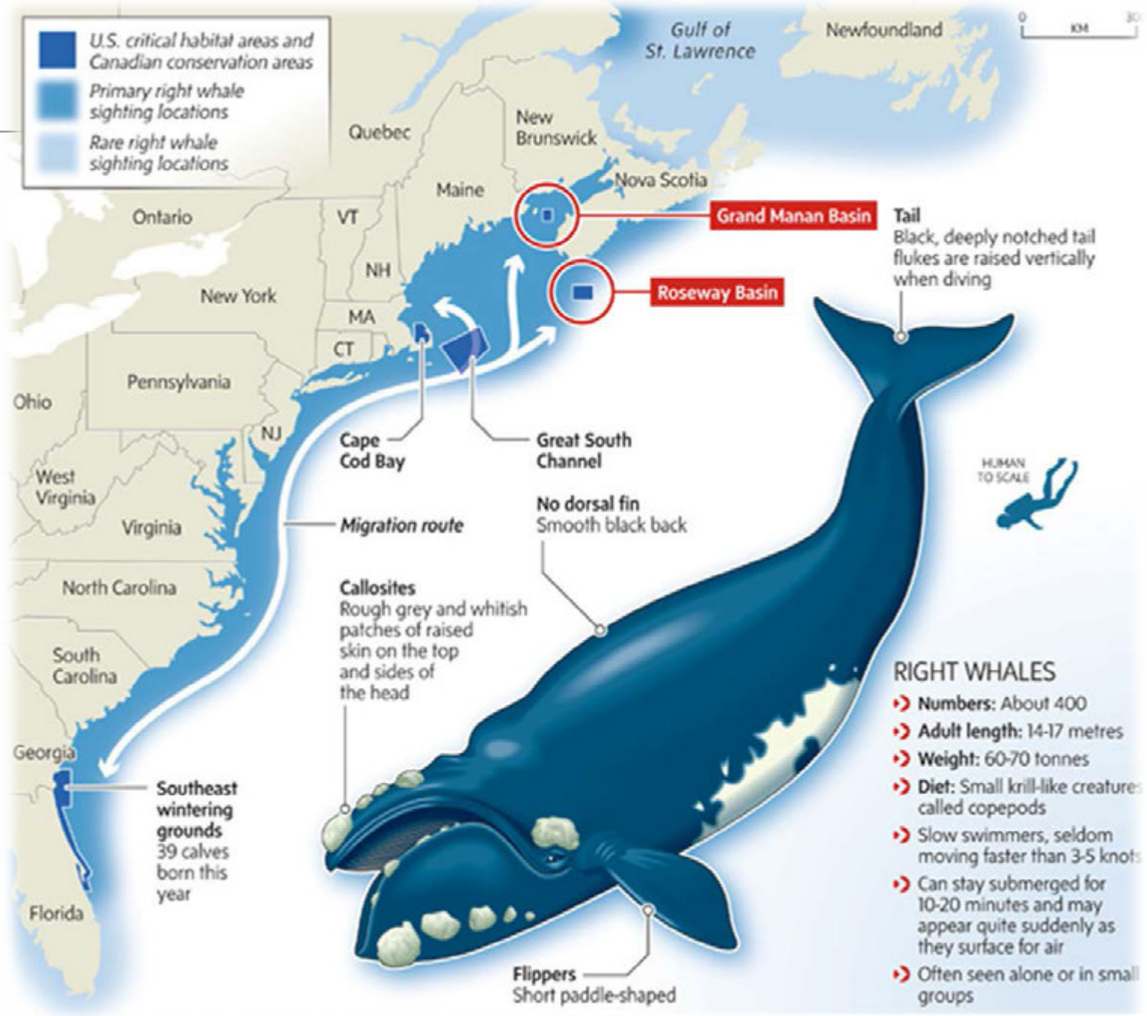
Introduction & Outline

- right whales - range, numbers, conservation issues
- southeast US - mother/calf pairs and juveniles in warm, shallow coastal waters
    - ports of JAX and Brunswick
    - naval stations: Mayport and Kings Bay
- motivations for the study -
    - need information to inform monitoring and mitigation of potential impacts of USWTR activities
    - focus on movement patterns and vocalization rates
        - proximity to USWTR
        - rates and types of vocalizations to inform PAM
- **Looking forward** – wise use of existing, planned and future data for monitoring and managing right whales in the SEUS



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Our Team

- Duke and Syracuse
- Equipment
  - DTags, CTDs, gliders, UASs & R/V *Richard T Barber*
- Timing and location
  - Jan-Feb based in Fernandina Beach, FL ranging north, south and east to find whales
  - **Set within the EWS system as well as the USWTR program** (HARP, aerial surveys)

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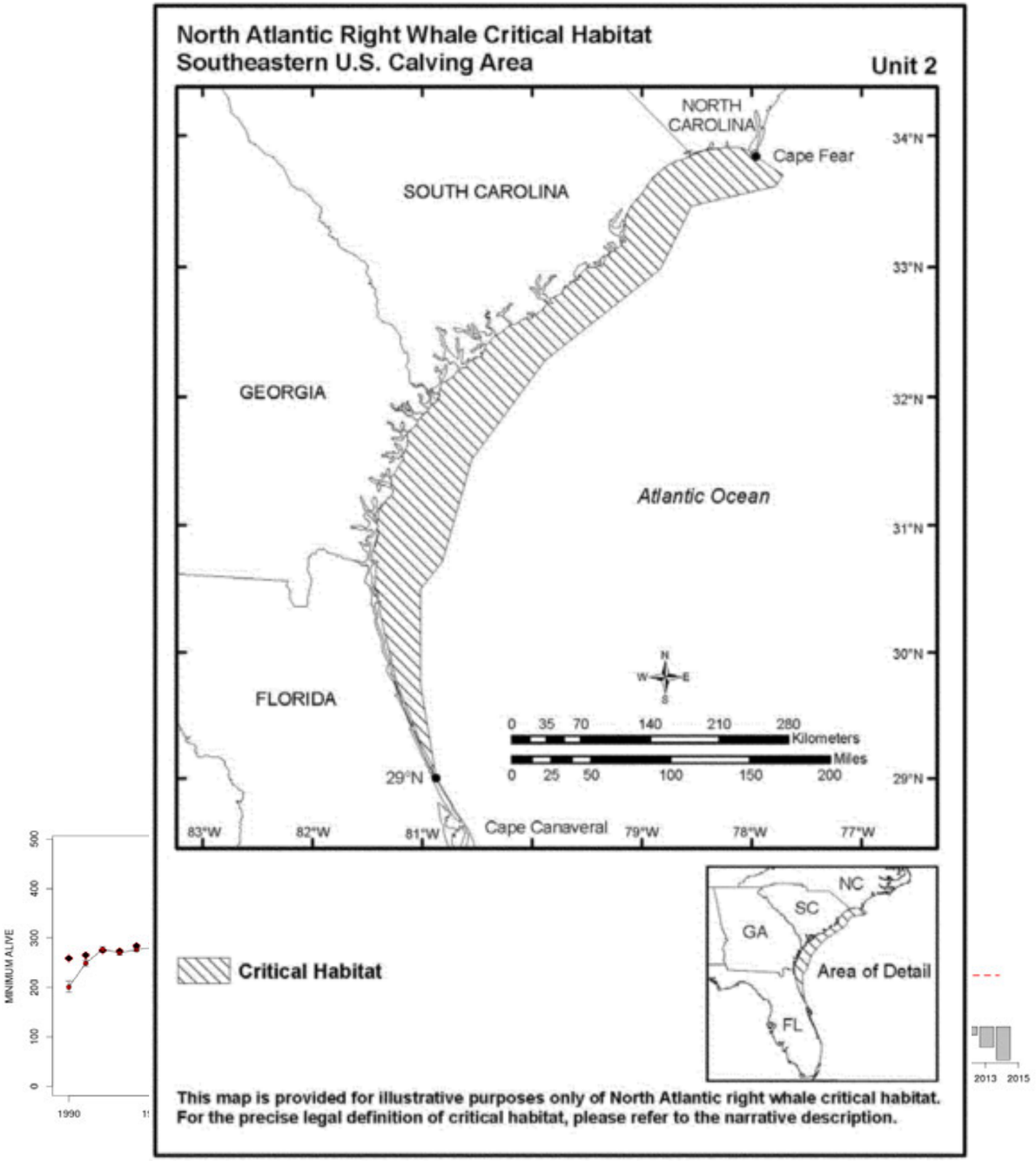
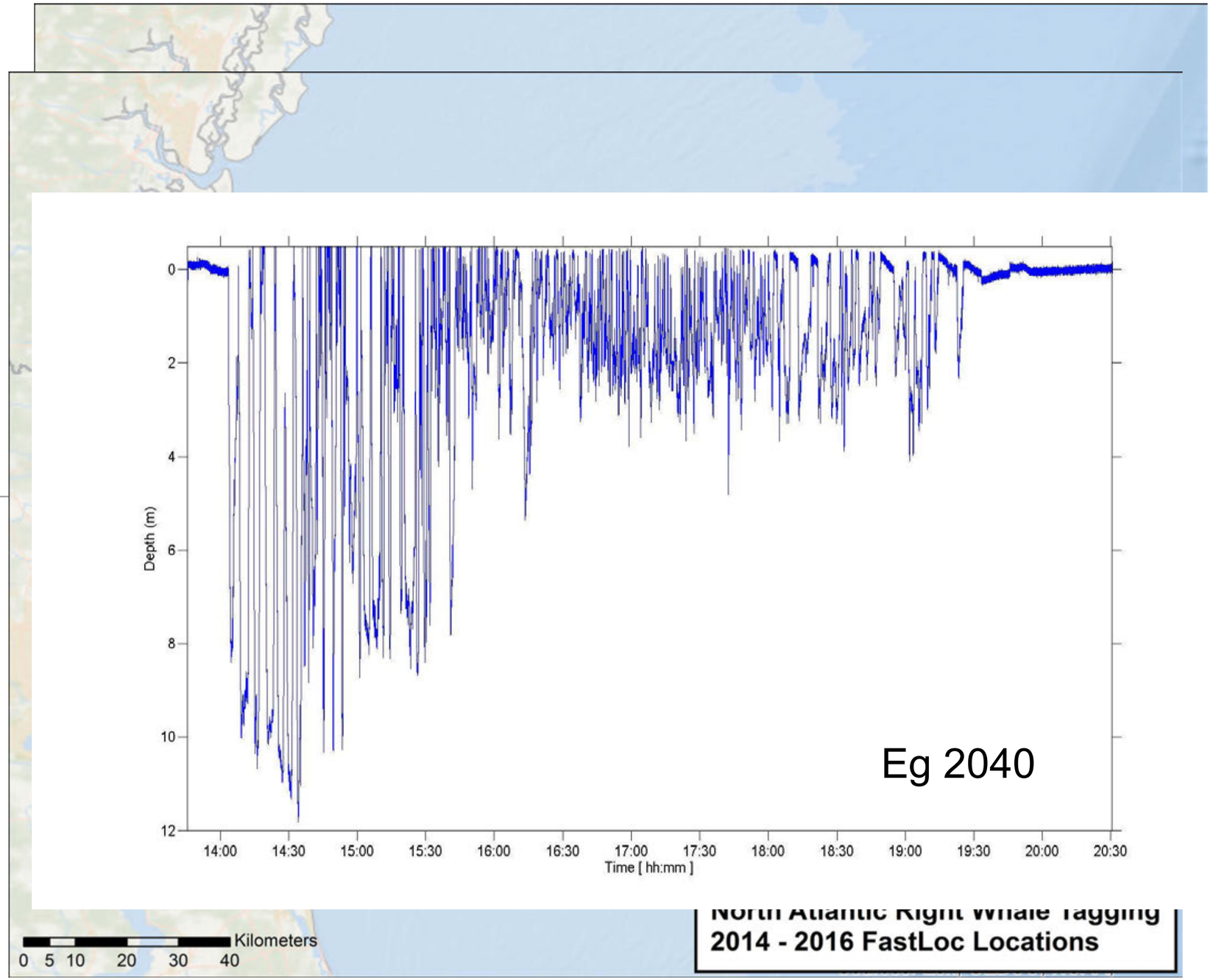
Right whales in the Southeast US – some big picture thoughts

- Recent changes in NARW distribution
- Possible changes in population trajectory (- ??)
- Diving, movement and vocal behavior
- PAM as mitigation tool: sound propagation, detections and detection probability
- Health: mothers-calves, entanglements
- Highly visible species

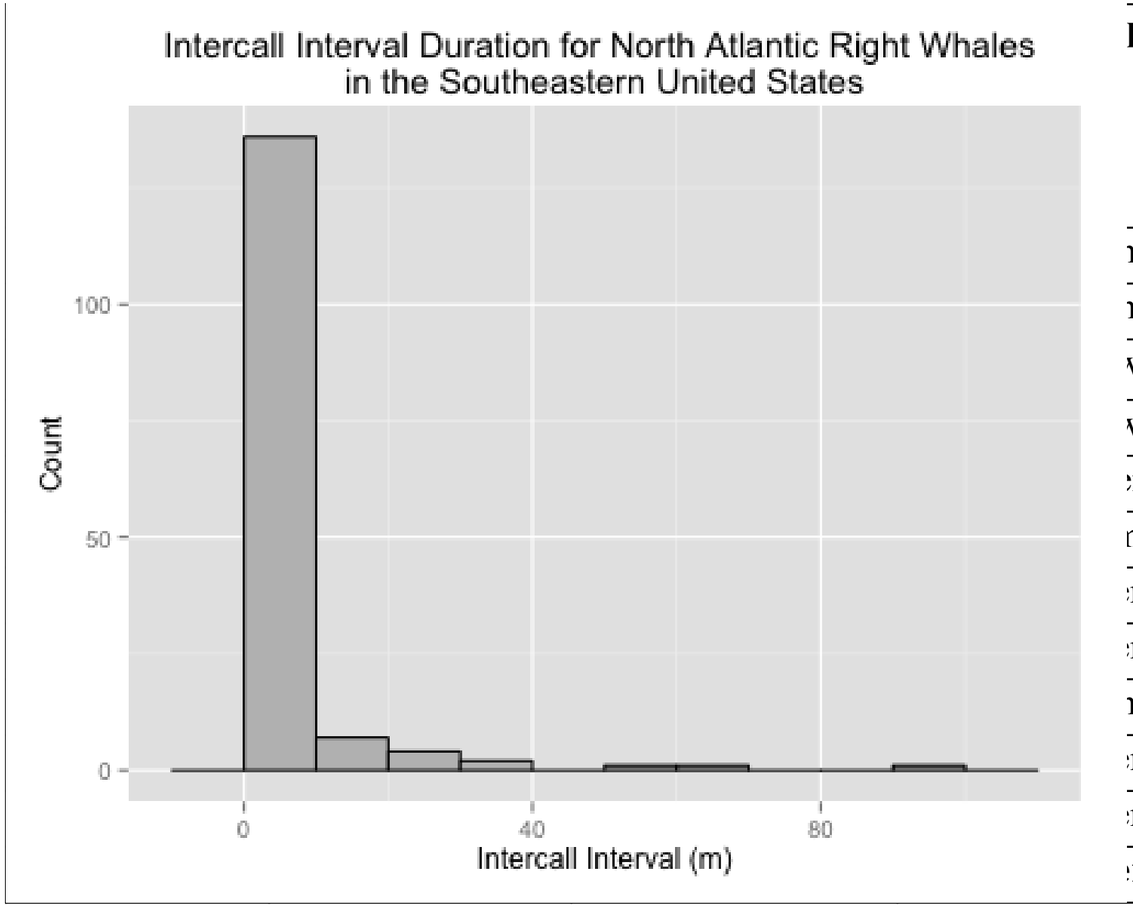


Tagging and tracking

Movement, dive behavior, vocal patterns – amassing a data set



Vocal behavior: extremely variable, clumped distribution and affected by reproductive status?



phic	Right whale calls detected (all SNR including calls from other whales	Estimated calls per hour of tag recording
nale	51	37.8
nale	267	140.5
vn	18	30
vn	102	266.1
emale	98	108.9
nale	8	0.43
emale	36	24
emale	108	19.6
nale	0	0
emale	7	0.6
emale	8	1.4
emale	0	0

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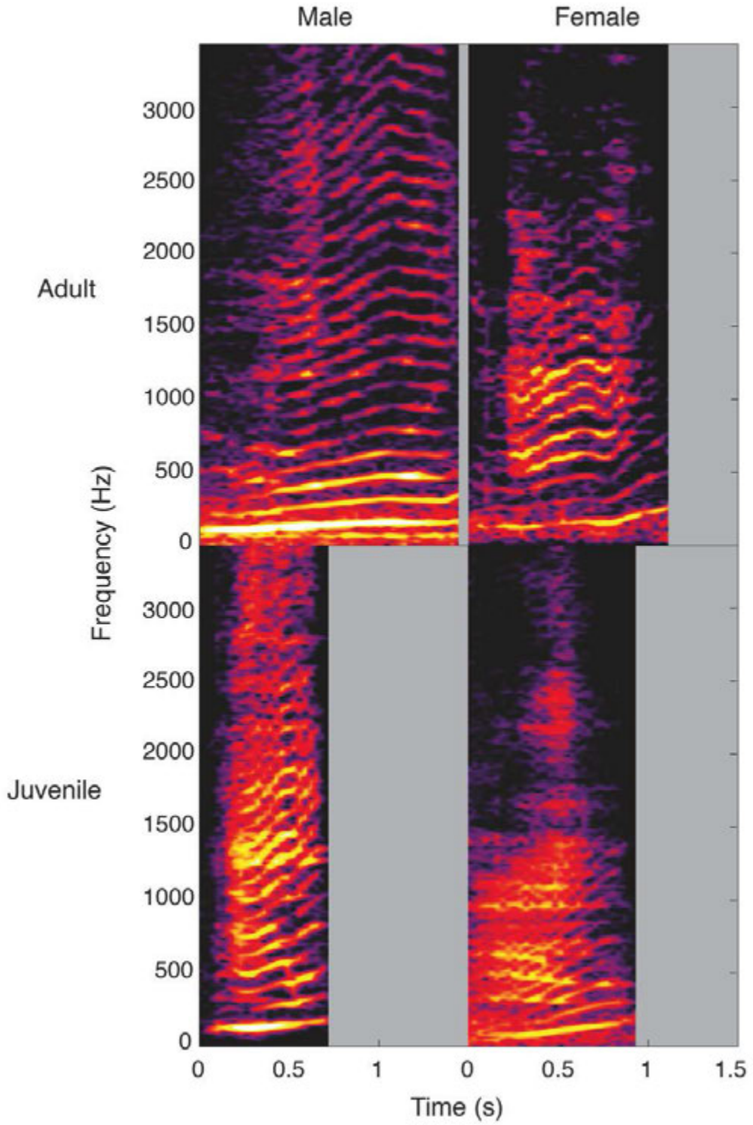

Individual distinctiveness of right whale upcalls

- North Atlantic right whales produce a stereotyped social sound termed an ‘upcall’ that is considered important for maintaining social contact and contains information on the individual producing the call
- Duration of upcalls is important for discriminating between individuals
- Adults, regardless of sex, typically produce longer upcalls than juvenile whales

McCordic, J.A., Root-Gutteridge, H., Cusano, D.A., Denes, S.L., and Parks, S.E. Under review. Calls of North Atlantic right whales (*Eubalaena glacialis*) contain information on individual identity and age. *Endangered Species Research*.

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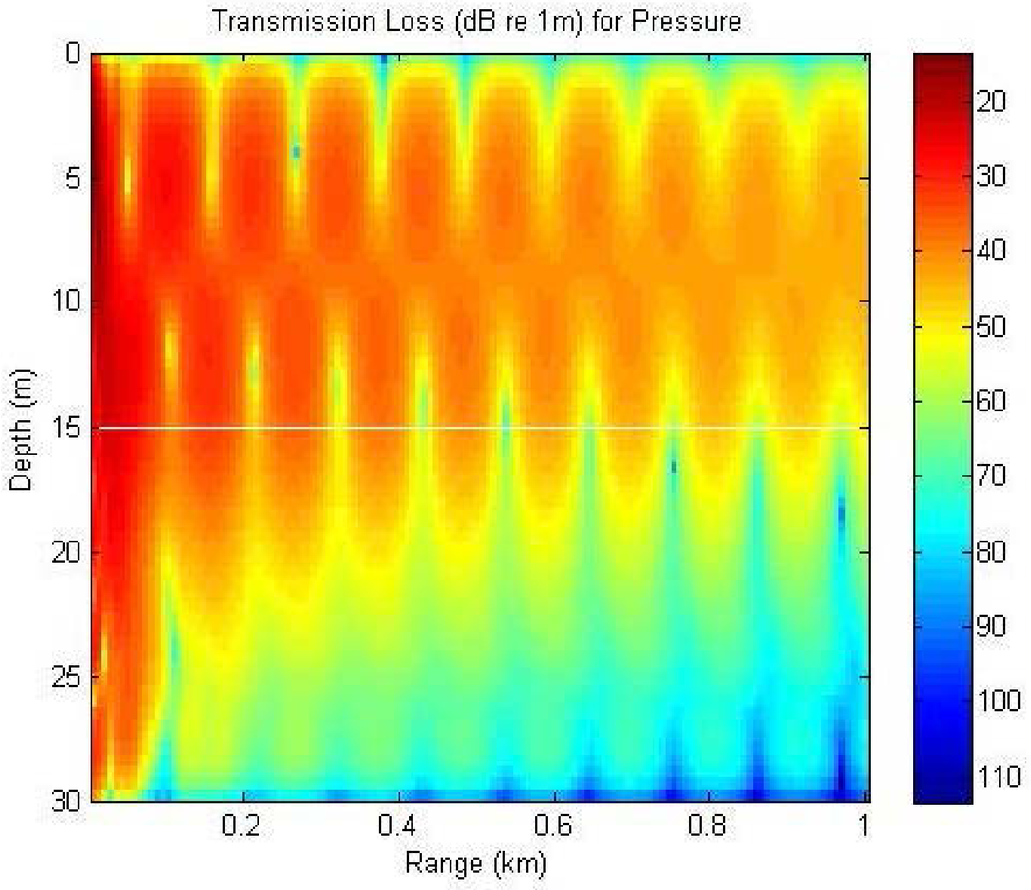
Propagation estimates for transmission loss in the Southeastern U.S. habitat



- Monterey-Miami Parabolic Equation model used to estimate transmission loss of right whale social calls
- Model results indicate that calls produced at or **near the surface** will likely suffer significant transmission loss (>30 dB) at ranges as close as 100 meters from the source
- Could limit the effective range of detection for right whale acoustic signals

Southeast U.S. Habitat Information

Water Properties	Sound Speed	1500 m/s
Bottom Properties	Sound Speed	1700 m/s
	Density	1.9 g/cm3
	Compressional Attenuation	0.2 dB/m/kHz
	Shear Speed	120 m/s
	Shear Attenuation	30 dB/m/kHz
Source Parameters	Depth	5 m
	Center Frequency	200 Hz
	Frequency Bandwidth	200 Hz

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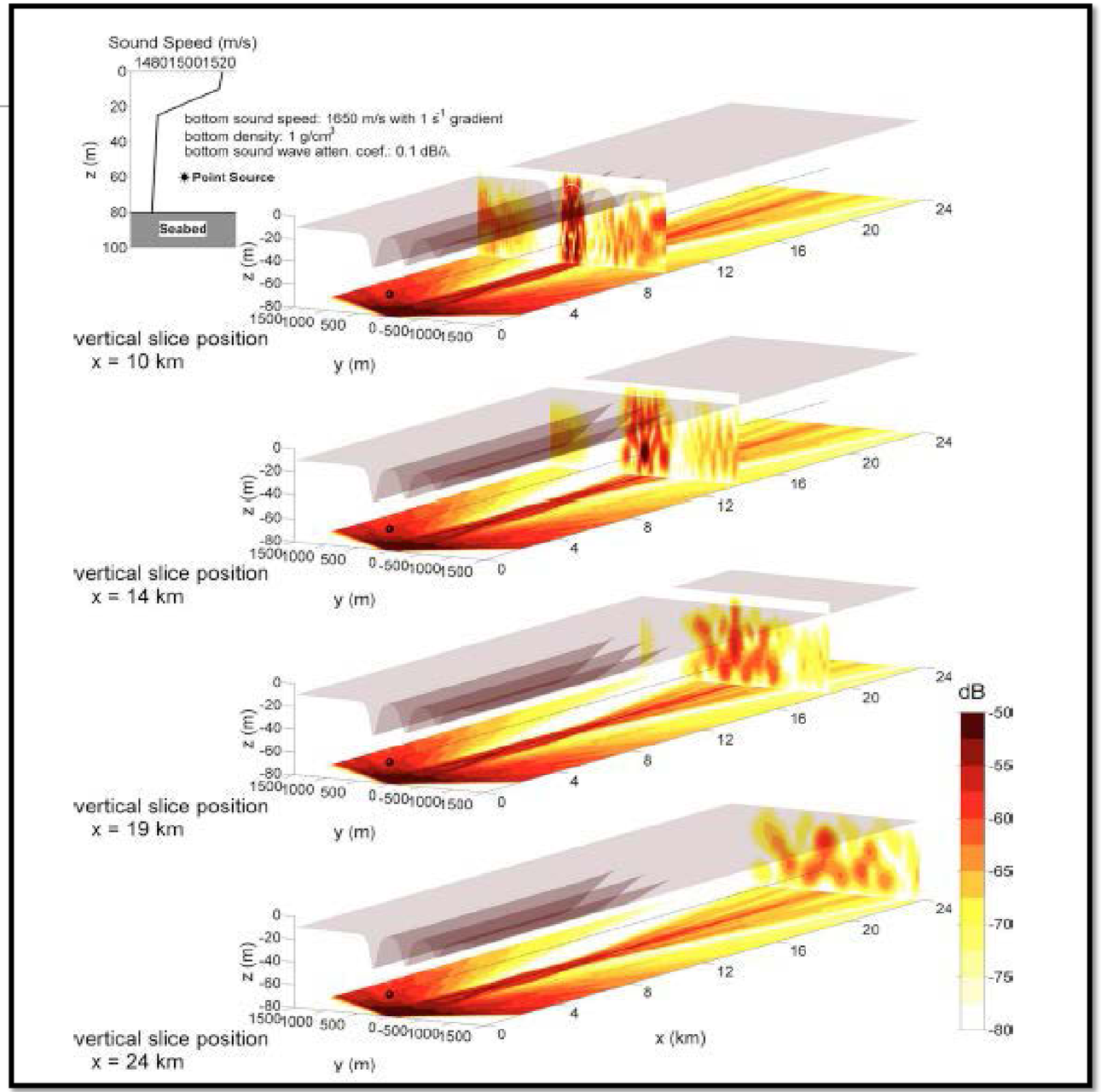
Detection probability: what we need to know – what we know = what we still need to figure out

- Pieces of the puzzle:
  - Vocalization rates and patterns
  - Source levels
  - Source location in water column
  - Environmental data: water mass, bottom type



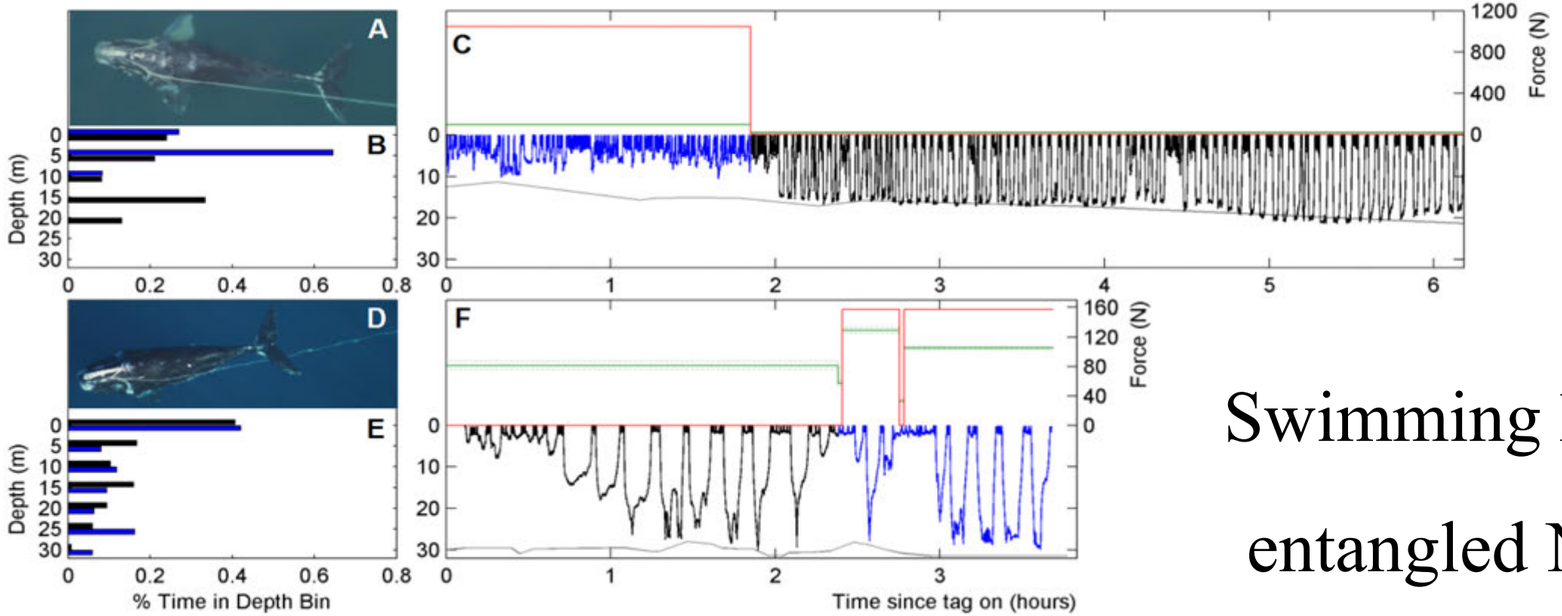
Lin et al 2009

Whale health

- Entanglements
- Aerial imagery for health assessment, photogrammetry, calf growth rates(?)
- Blow collections: hormones, illness

Permit #16473

Entanglements



	Drag before	Drag after	Change in drag	Buoyancy before	Buoyancy after
Eg 3911	93 N	19 N	-131%	1058 N	-
Eg 4057	81.5 N	105 N	+40%	-	157 N

Swimming kinematics and efficiency of entangled North Atlantic right whales

Julie M. van der Hoop[1,2], Douglas P. Nowacek[3], Michael J. Moore[2], M. S. Triantafyllou[4]

In review – Journal of Exp Biol

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Whale health & UAS Operations

- Duke Marine Conservation UAS Center
- Aerial imagery for health assessment, photogrammetry, calf growth rates(?)
- Blow collections: hormones, illness
- Working in close collaboration with WHOI, NEFSC, NARW Consortium

Sensitivity *vis* à *vis* right whales

- Sensitivity of the species:
  - Struggling to recover, recent numbers not encouraging
  - Ship strikes down, but entanglements are not
  - SEUS area still important for particularly sensitive segment of the population
    - New moms appear to be less vocal than others (stay tuned!)
    - Increasingly urbanized and noisy environment (e.g., G&G)

- Sensitivity of studying the species:
  - Southeast US during calving season:
    - Many teams operating
    - Managing takes
    - Importance of coordinating among teams
  - Off season coordination
  - Collective efforts to minimize impacts

Wrap-up and processing 2016 and plans for 2017

- **Analyses**
  - Acoustic data
    - vocalization types and rates for 2016 tags
    - depth during vocal production
  - Movement data incl. proximity to proposed range
- **Other activities**
  - AFTT surveys and biopsy samples

- **Plans for 2016**
  - Analyze tag data
  - Run propagation models using CTD data and vocalization amplitudes
  - Generate detection probabilities
  - Glider operations on shelf
- **Plans for 2017**
  - Additional tagging including llonger durations
  - Multi-day survey of offshore area
  - Continue UAS data collection

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- NARW colleagues: S. Kraus, A. Knowlton, P. Hamilton, M. Zani, H. Pettis, P. Corkeron, S. VanParijs
- Permit - NMFS #17355 to P. Corkeron and #14791 to D. Nowacek
- #StewardsOfTheSea

NAVFAC Naval Facilities Engineering Command

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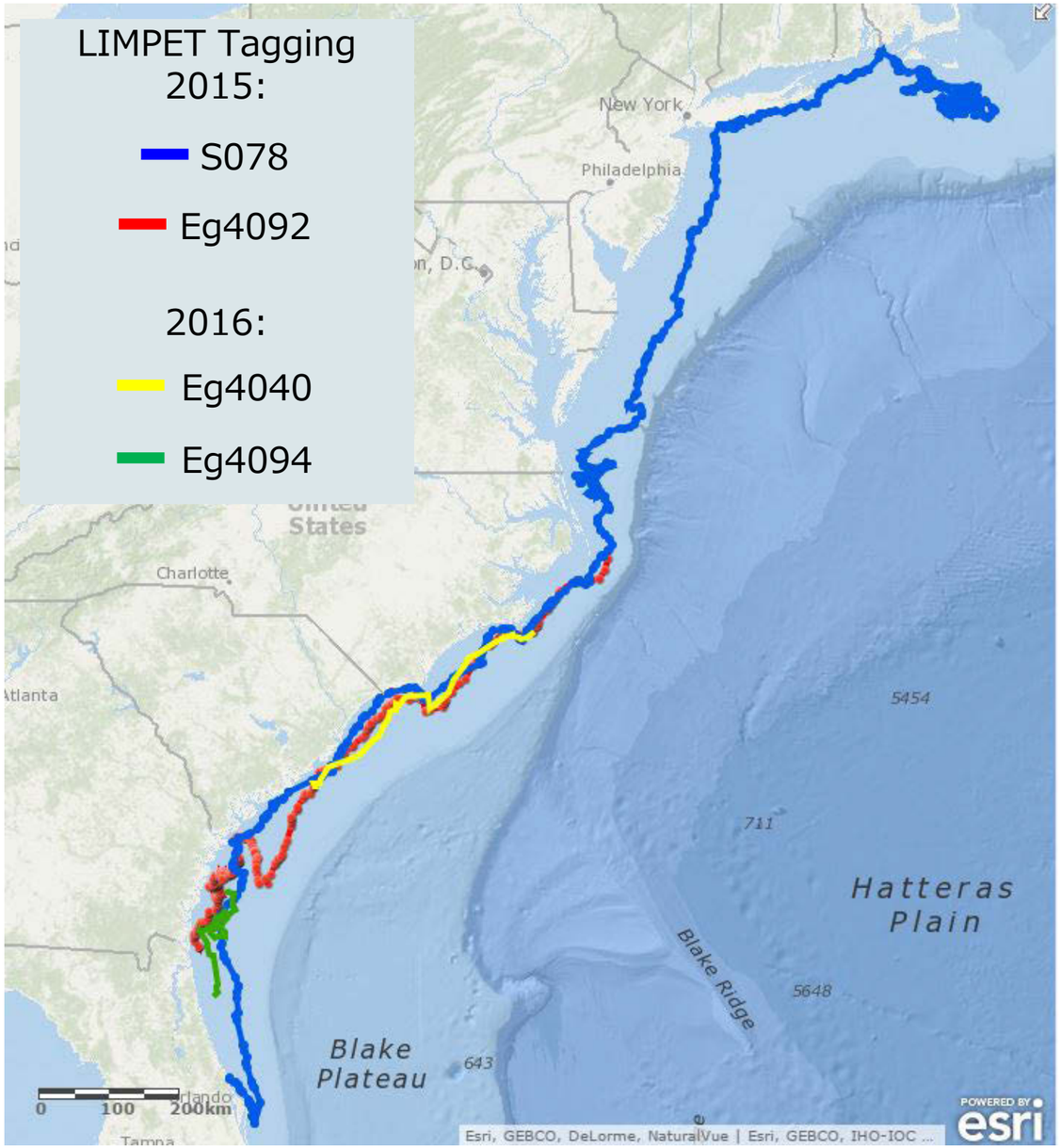
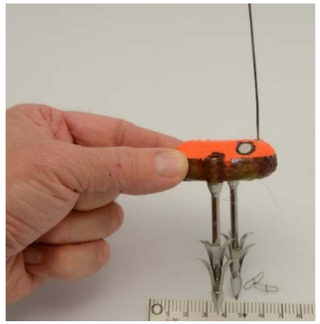
North Atlantic Right Whale Satellite Tagging in the Southeast U.S.

Development and application of an improved satellite tag and attachment package





Andrews, George, Jackson, Martinez, Owen, Pitchford, White and Zoodsma unpublished data; Funded by NOAA Southeast Regional Office

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