Acoustic communication of North Atlantic right whale (*Eubalaena glacialis*) mother-calf pairs on the calving grounds

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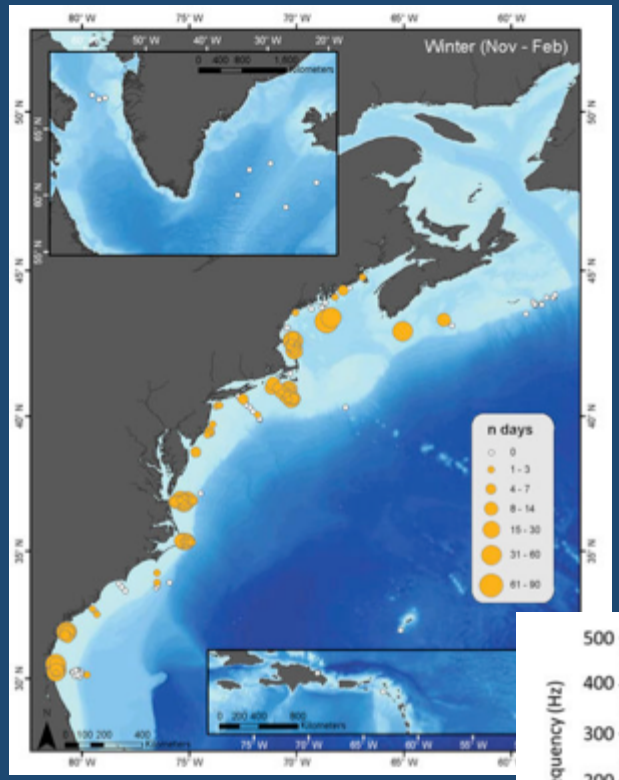
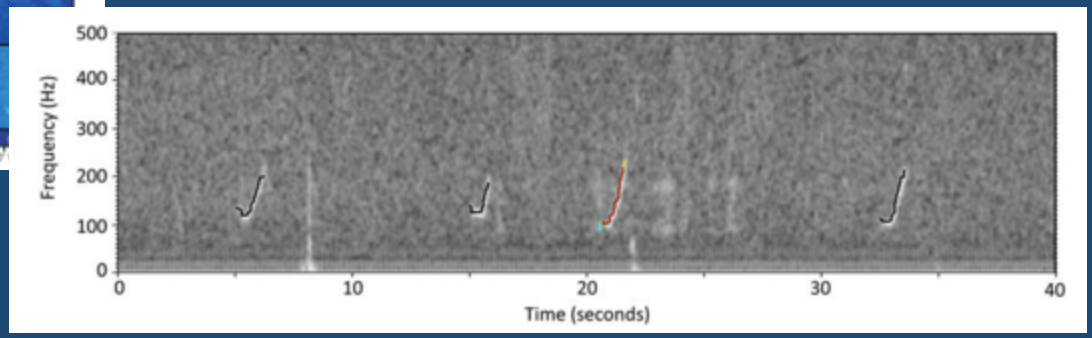
North Atlantic right whales

- Large baleen whale
- Endangered species (~ 451 individuals)
- Mortality from vessel collisions and entanglement in fishing gear
- High rate of ship strikes in reproductive females and their calves

Passive acoustics to assess right whale distribution



- Variety of methods from near-real-time to long-term archival
- Primarily focus on detection of a single call type



Davis et al. (2017). *Scientific Reports* 7, Article number: 13460

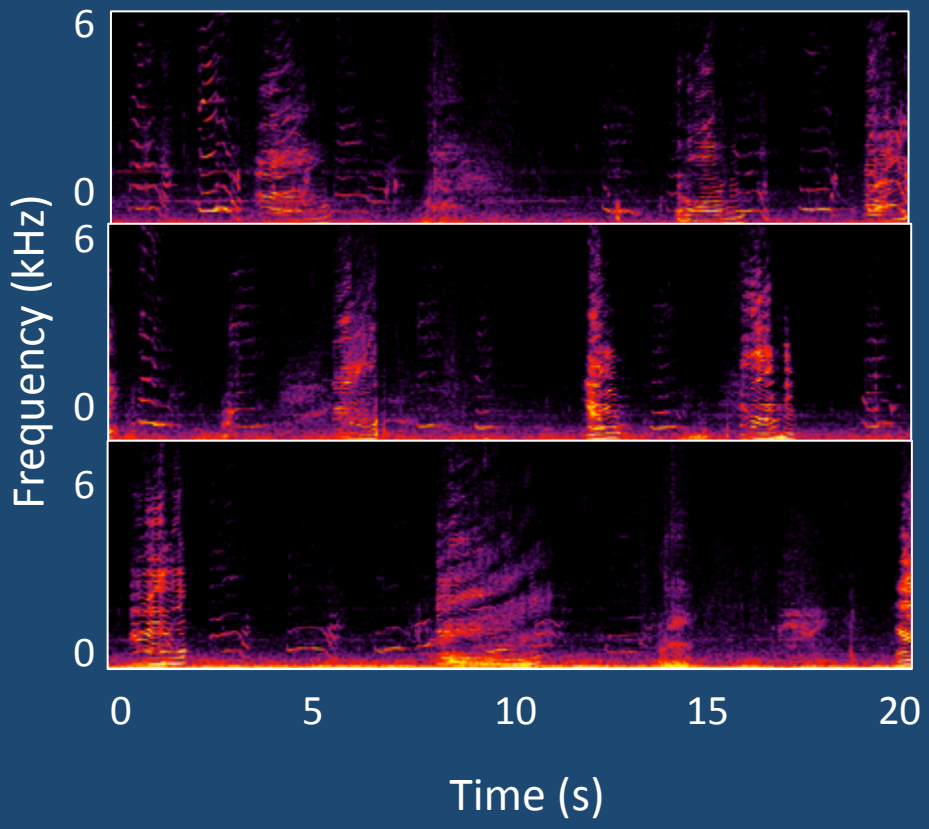
Individual right whale vocal behavior

What we know:

- Wide variety of call types
- Individuality and age encoded in upcalls
- Lombard effect in noisy environments

Where we need more data:

- <u>Variation</u> in call types and rates by habitat and age/sex



Parks & Tyack, 2005 JASA; Parks, Searby *et al*. 2011 ESR; McCordic, J. *et al.*, 2015 ESR; Parks, S.E. *et al.*, 2011 Biology Letters; Van Parijs *et al.*, 2009 MEPS

Filling in the gaps

Figure courtesy of M. Thompson - SBNMS

Towed array data (2011-2015)

- Monitor behavior and sound production of individual mother-calf pairs in 3 habitat areas

Suction cup acoustic tags (2014-2016)

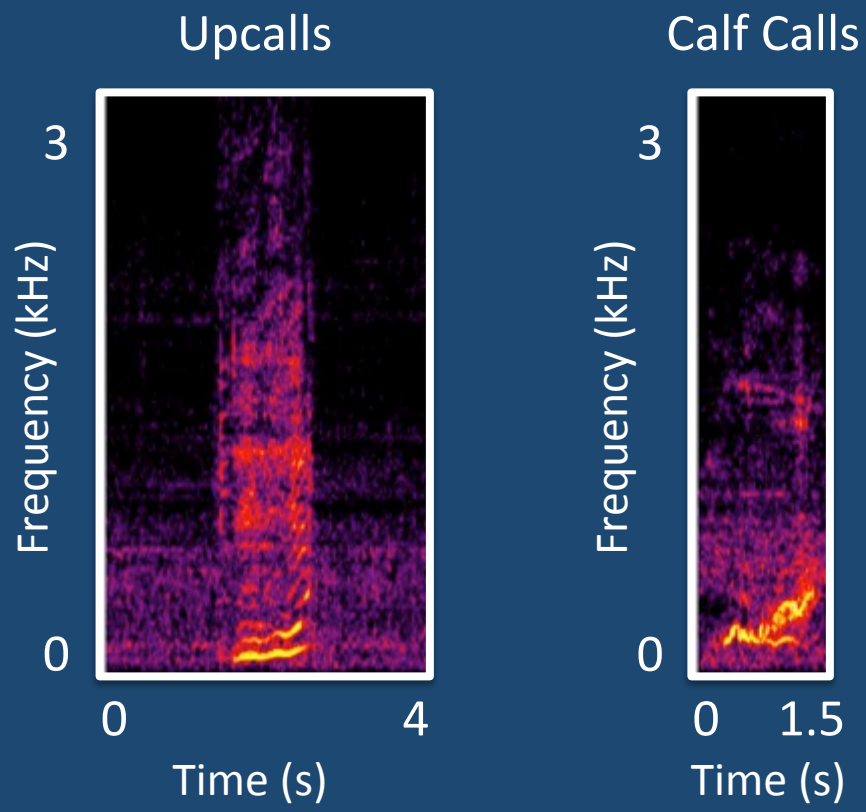
- Focused study on dive patterns and sound production by mother-calf pairs on calving grounds with Duke University

Towed array results

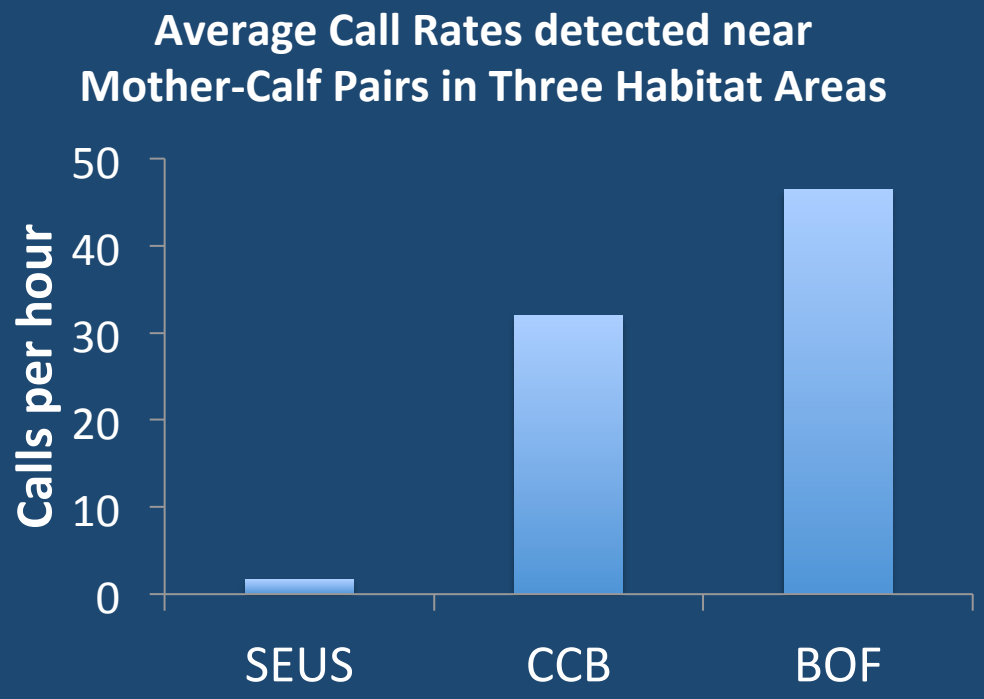
Data Collection

- 64 focal follows of 34 different mother-calf pairs
- 13 pairs sampled more than 1 time during the year
- >122 h of behavioral observations
- 238 h of acoustic recordings

Call Types



Very low call rates of tonal calls on the calving grounds



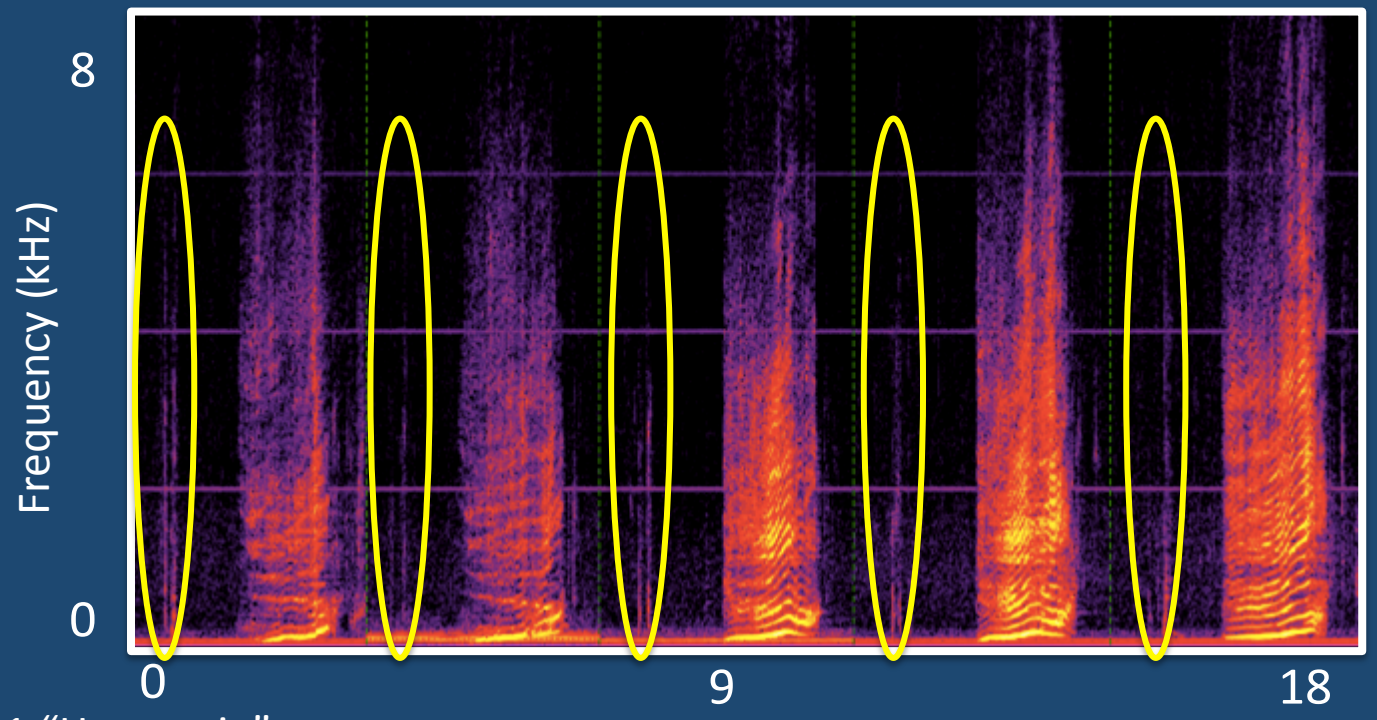
The average call rate on the calving grounds was low (< 2 calls/h) with only 6/32 follows detecting any tonal calls

What did the Dtag data tell us?

M. Moore (WHOI) Permit #17355

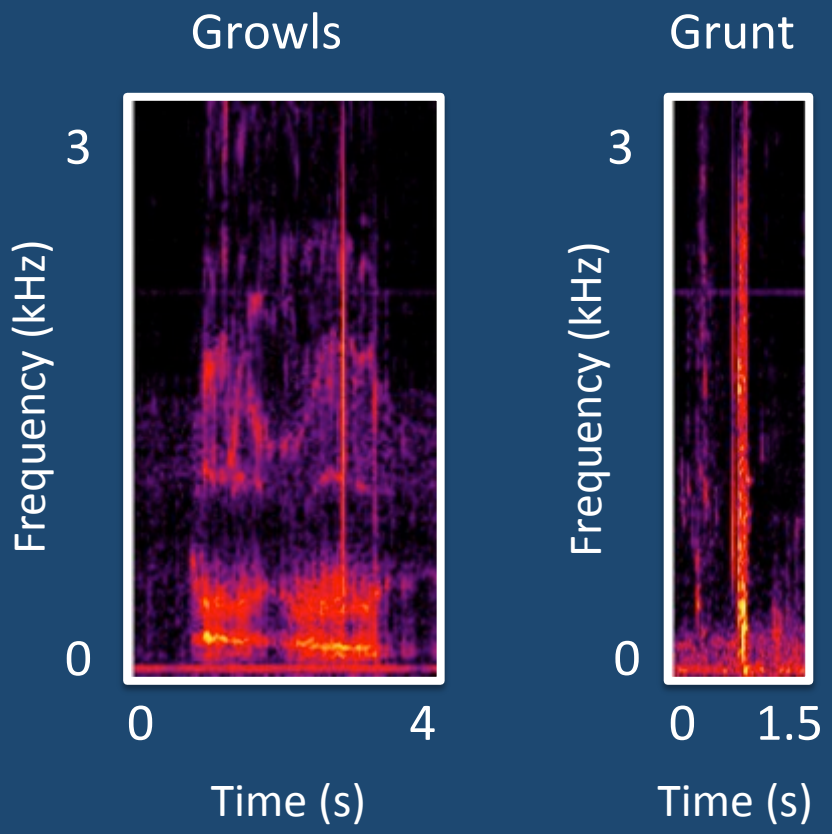
- 11 tags attached to lactating females
- 1 tag attached to pregnant female
- 85 h of data (1.5 - 23 h attachments)
- Upcall rate for lactating females = 0.7 (0 – 4.5/h)
- Call rate for any focal tonal calls = 2 (0 – 10/h)

But then we noticed something weird



EGNO #3101 “Harmonia”

Lactating females make quiet calls on the calving grounds



- Grunts detected on 8 of 11 lactating female tags
- Call rates of low amplitude signals from all mother –calf tags ranged from 0 – 30/h (8.3 ± 8/h)

Behavior and sound production are tied to calf maturity for mother-calf pairs

- Tonal sound production rates increase as the calf matures
- Low call rates of tonal calls on the calving grounds
- Increased rates of low amplitude signal production on the calving grounds

Why whisper?

- Several potential hypotheses to explain this behavior
- What does this mean for Passive Acoustic Monitoring for mother-calf pairs?
  - Mother-calf pairs have relatively high call rates on the feeding grounds
  - Our data suggest very low detectable call rates from mother-calf pairs on the calving grounds
  - When does the transition to higher call rates happen?

Acknowledgements

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  - Florida Wildlife Research Institute – Florida Wildlife Conservation Commission (FWRI)
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  - Marineland Volunteer Sighting Network
  - Sea to Shore Alliance
  - New England Aquarium
  - Duke University