Identifying areas of high entanglement risk

The Right Whale Density Model and Risk Reduction Decision Support Tool

13 November 2019

Photo: NOAA Fisheries/Leah Crowe (Permit #17355)

Jason Roberts, Duke MGEL

Burton Shank, NOAA NEFSC

Marine Geospatial Ecology Lab • Duke University

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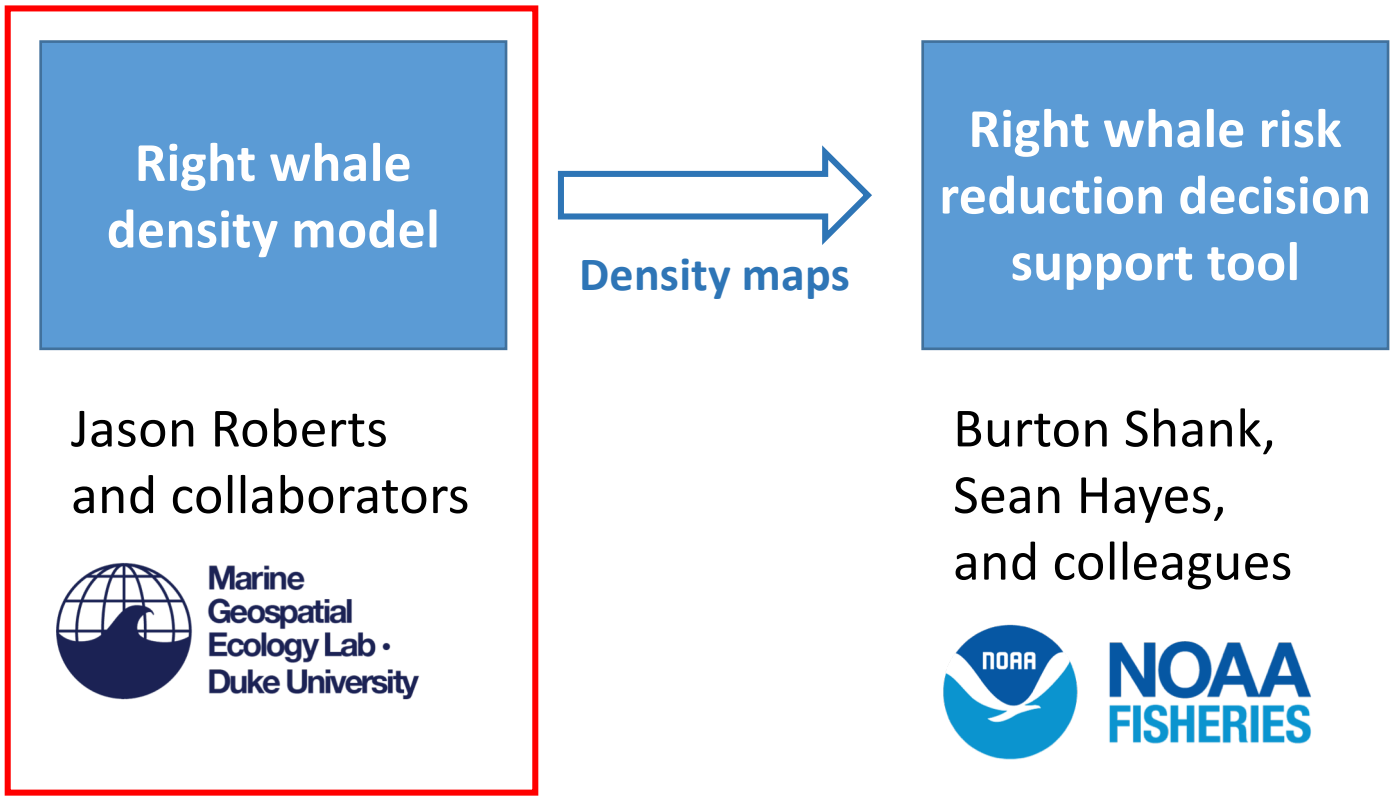
Right whale density model and risk reduction decision support tool



In collaboration with survey programs and scientists from:

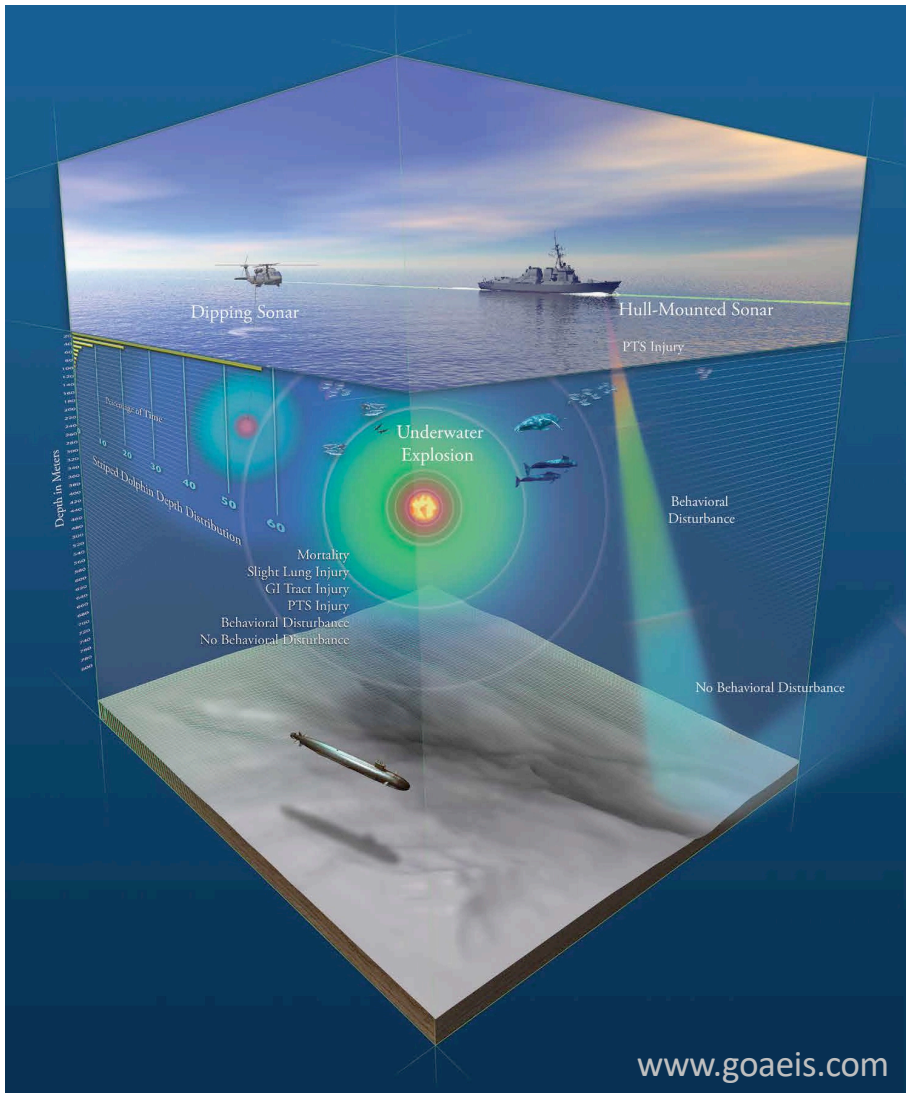
Should your logo be here? My apologies! Please email me!

Primary funding for modeling from:

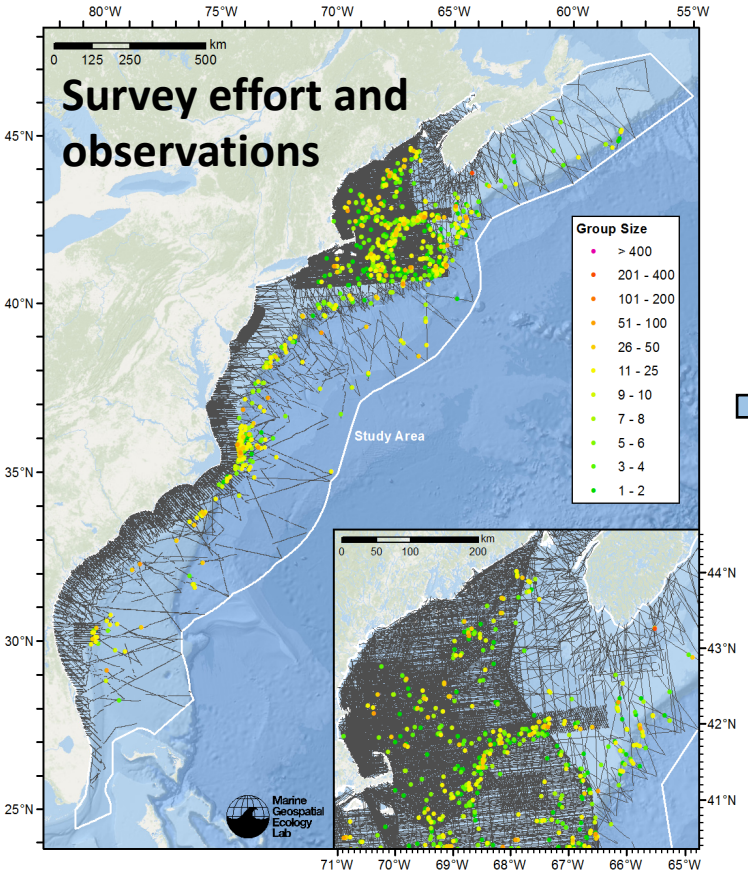
Additional funding from:

Navy MMPA compliance

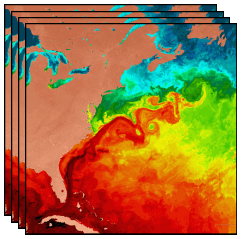
- Every 7 years, the Navy must obtain a Letter of Authorization permitting the “take” of marine mammal during training and testing activities
- The permit must estimate the *number of individual animals* of each mammal stock that would be taken
- For the U.S. Atlantic and Gulf of Mexico waters, the Navy models takes from marine mammal density models developed by a collaboration led by Duke MGEL



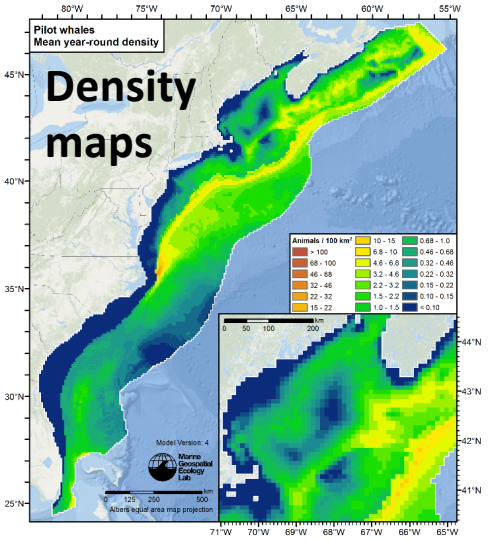
Density modeling

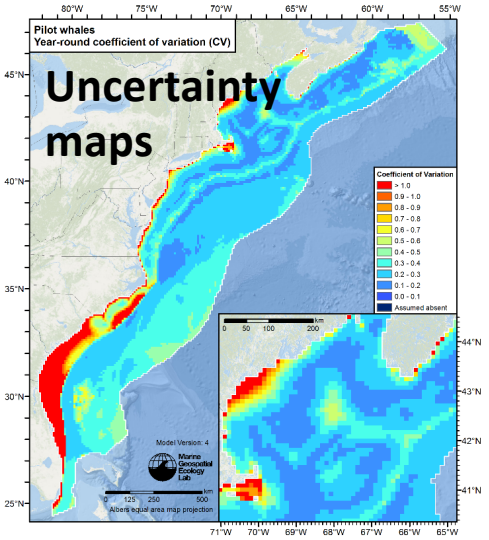


Oceanographic maps



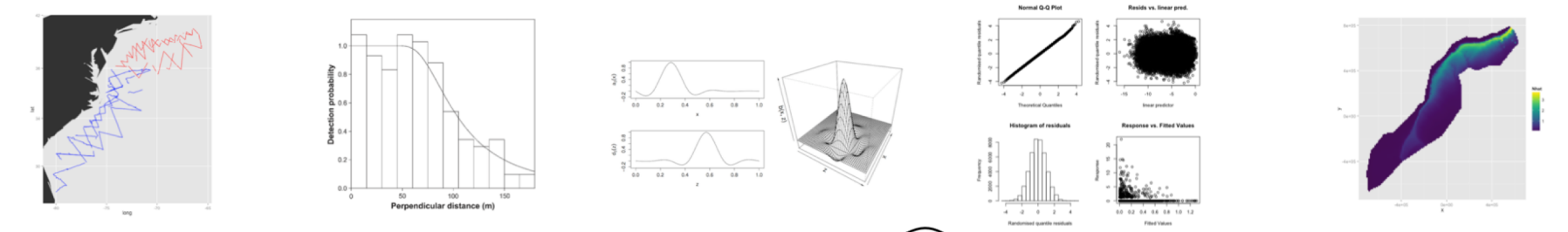
Statistical models



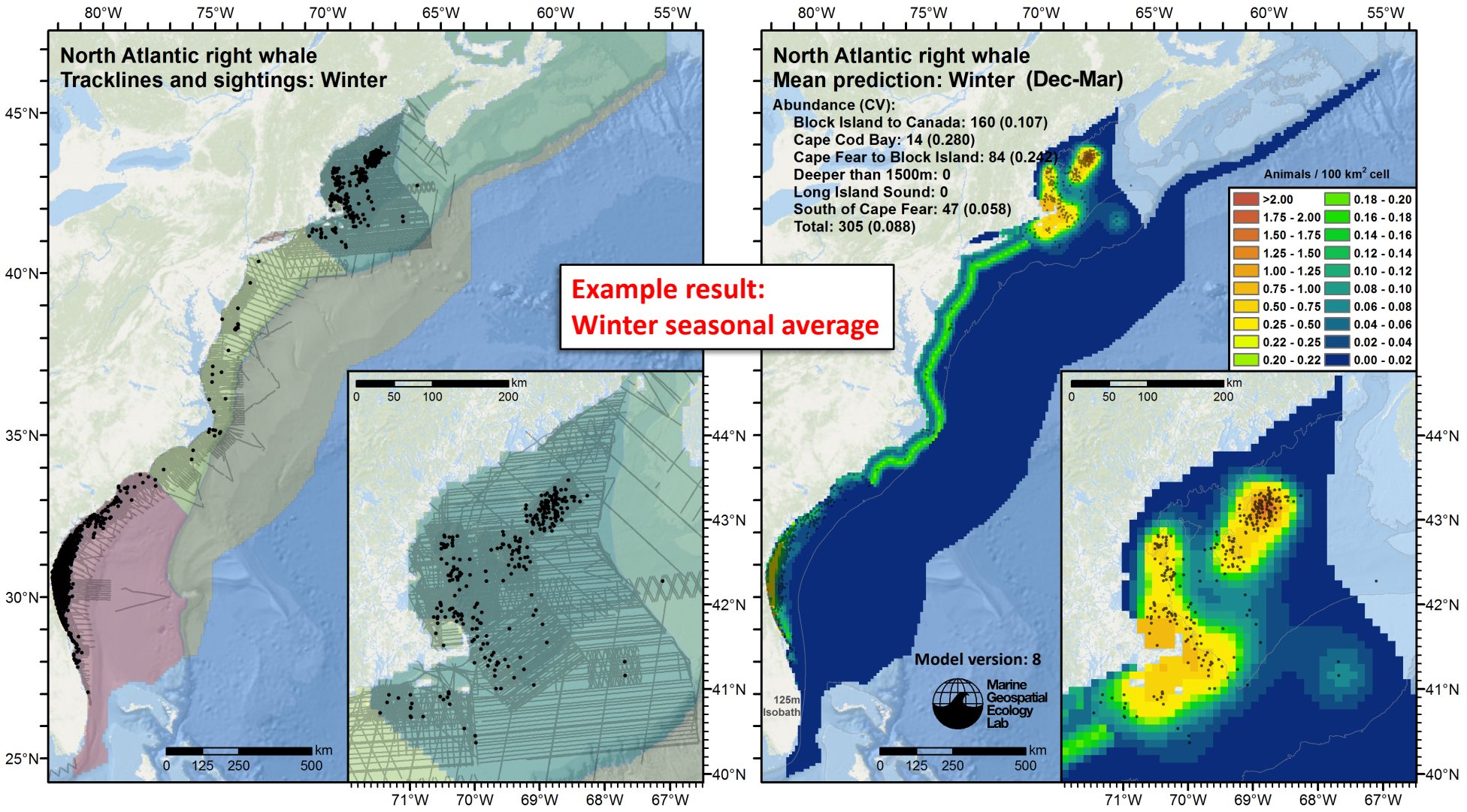


Density surface modeling (DSM)

(Hedley and Buckland 2004; Thomas et al. 2010; Miller et al. 2013)



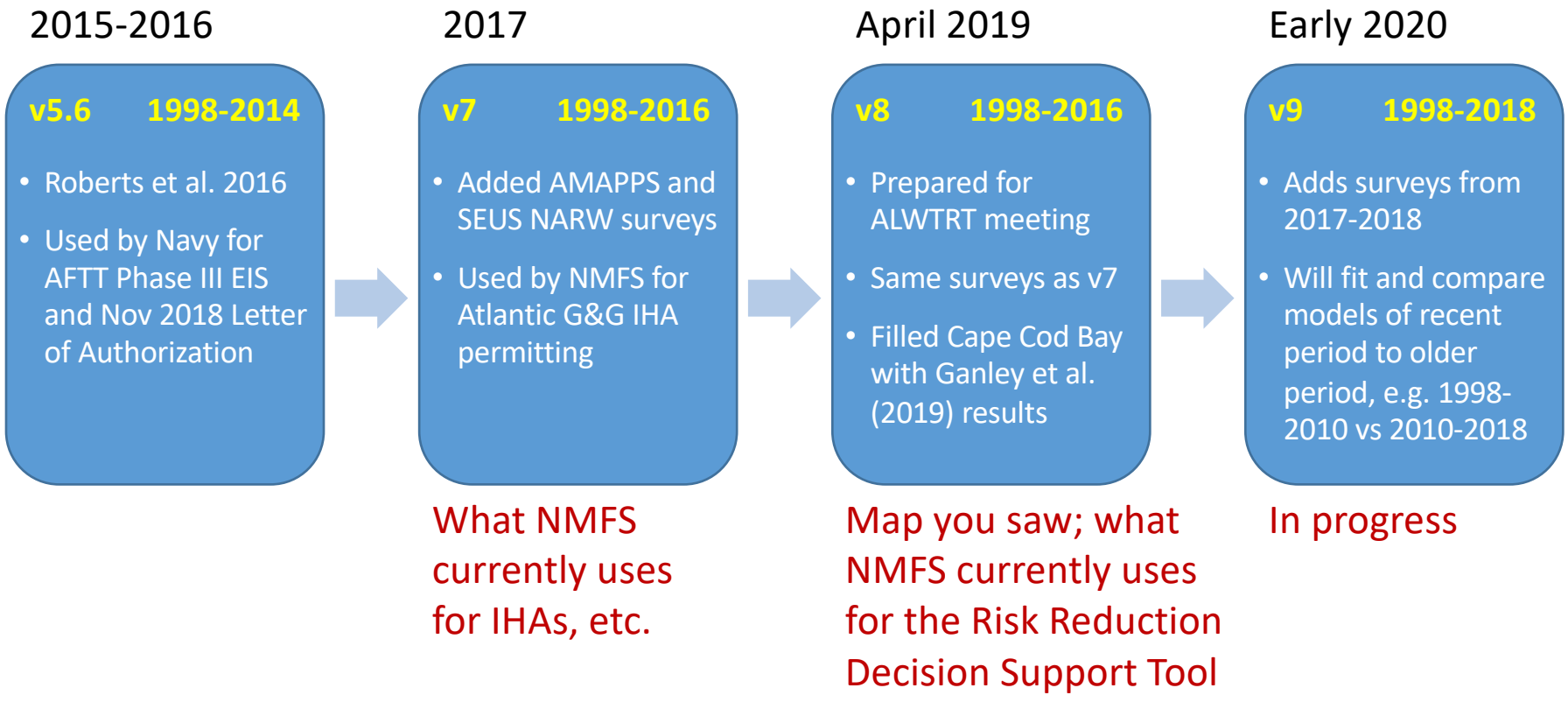
Adapted from figure by David L. Miller


North Atlantic right whale
Tracklines and sightings: Winter
North Atlantic right whale
Mean prediction: Winter (Dec-Mar)
Abundance (CV):
Block Island to Canada: 160 (0.107)
Cape Cod Bay: 14 (0.280)
Cape Fear to Block Island: 84 (0.242)
Deeper than 1500m: 0
Long Island Sound: 0
South of Cape Fear: 47 (0.058)
Total: 305 (0.088)
Animals / 100 km² cell
>2.00
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
0.22 - 0.25
0.20 - 0.22
0.18 - 0.20
0.16 - 0.18
0.14 - 0.16
0.12 - 0.14
0.10 - 0.12
0.08 - 0.10
0.06 - 0.08
0.04 - 0.06
0.02 - 0.04
0.00 - 0.02
Example result:
Winter seasonal average
Model version: 8
Marine Geospatial Ecology Lab
125m Isobath
km
0 125 250 500
0 50 100 200
80°W 75°W 70°W 65°W 60°W 55°W
45°N 40°N 35°N 30°N 25°N
44°N 43°N 42°N 41°N 40°N
71°W 70°W 69°W 68°W 67°W

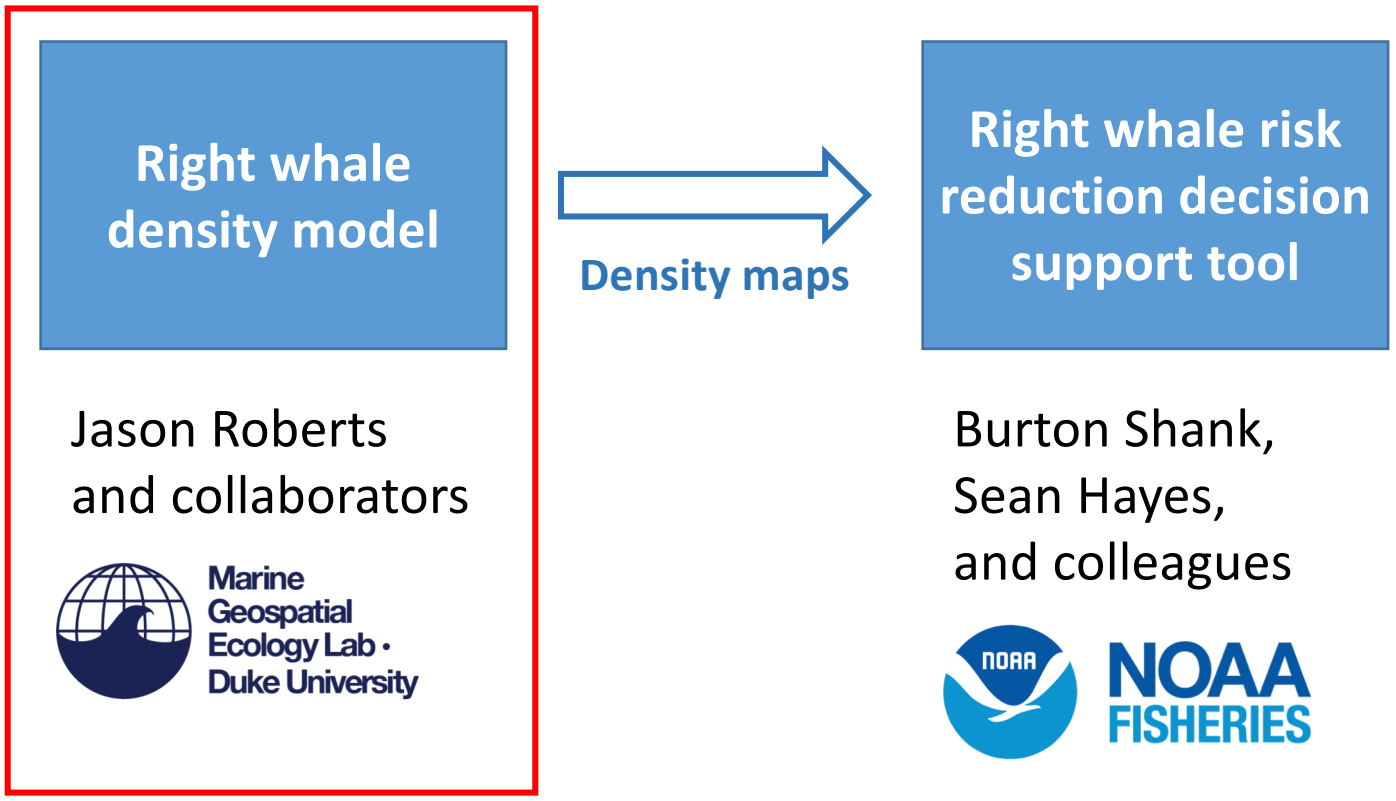
Density model predictions

- Predictions estimate absolute density: number of whales / km^2
- Corrected for availability and perception bias
- Spatial resolution: 10 km
- Temporal resolution: monthly
- Available as:
  - GIS raster files (contact us to download)
  - GIS web services on the NROC and MARCO websites

Project timeline and model versions



Right whale density model and risk reduction decision support tool



Right whale risk reduction decision support tool

- Allows comparison of different management measures intended to reduce risk of whale entanglements in vertical fishing lines
- Developed by NOAA NEFSC for the April 2019 ALWTRT meeting
- Models the relative risk of entanglement by month and location:

$$Risk = whale\ density \times \sum gear\ density \times threat$$

- Each component is currently under revision based on ALWTRT feedback

For complete details, attend next week's review

Public peer review of the right whale decision support tool

- November 19-21 in Woods Hole, MA
- Open to the public; webinar available
- All model components will be covered in detail
- https://www.fisheries.noaa.gov/event/peer-review-right-whale-decision-support-tool

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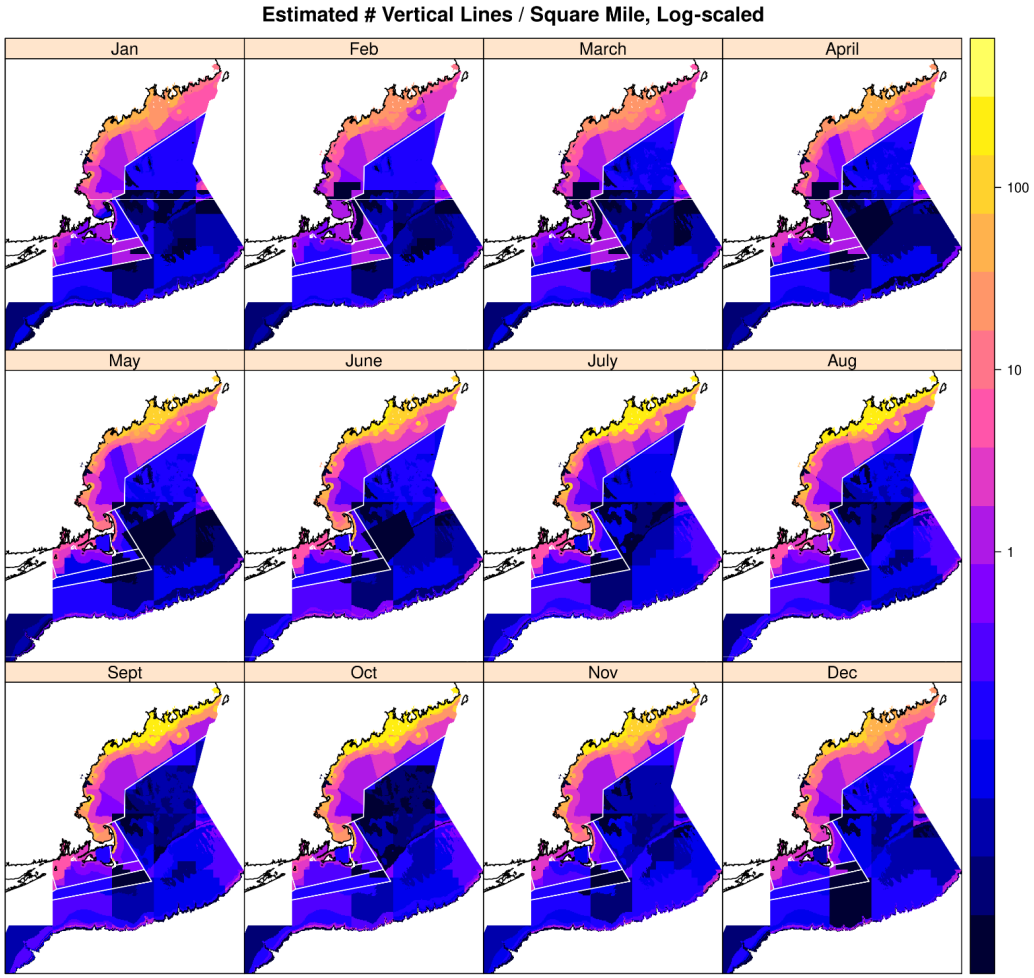
Burton's experiment for the ropeless meeting

- Motivating question: at minimum, how many endlines would need to be converted to ropeless and how large of an area would be affected to achieve different risk reduction goals?
- Approach: use the tool to achieve a range of reductions while minimizing either endlines converted or area converted, not caring about anything else
  - These extreme optimizations yield fragmented areas; maps will not be shown
- Intended to give an initial sense of scope and spark discussion, not provide management advice or recommendations



Experiment setup

Whales: Duke v8 model

Gear:

- Inshore LMAs: IEc model
- LMA 3: NMFS model

Threat:

- New model not ready
- For simplicity, assumed all gear has same threat

Resolution: 1 nmi: 58,000 cells

Existing closures maintained

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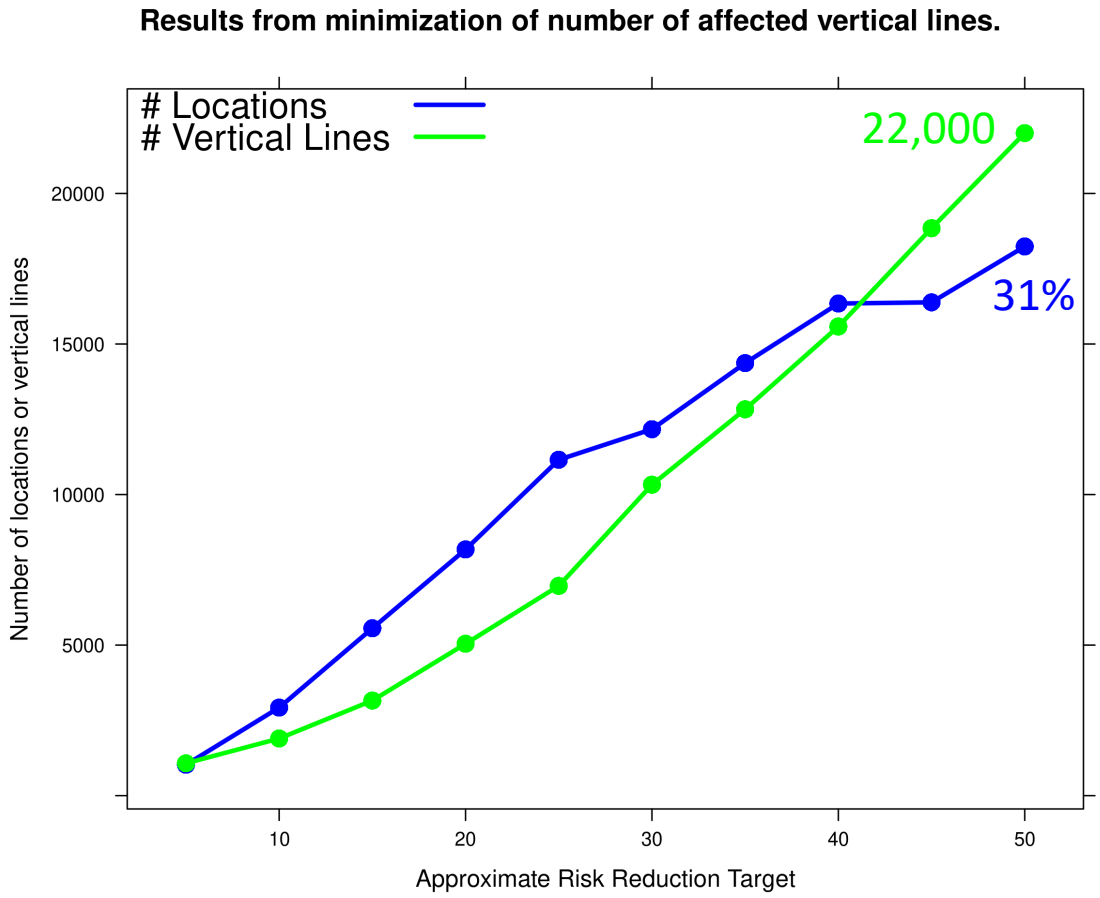

Results: Scenario 1

Convert minimum number of lines to ropeless

- To reach 50% reduction, 22,000 lines must be converted; they happen to cover 31% of the study area
- By coincidence, the area converted increases at a comparable rate to lines, as reduction target increases

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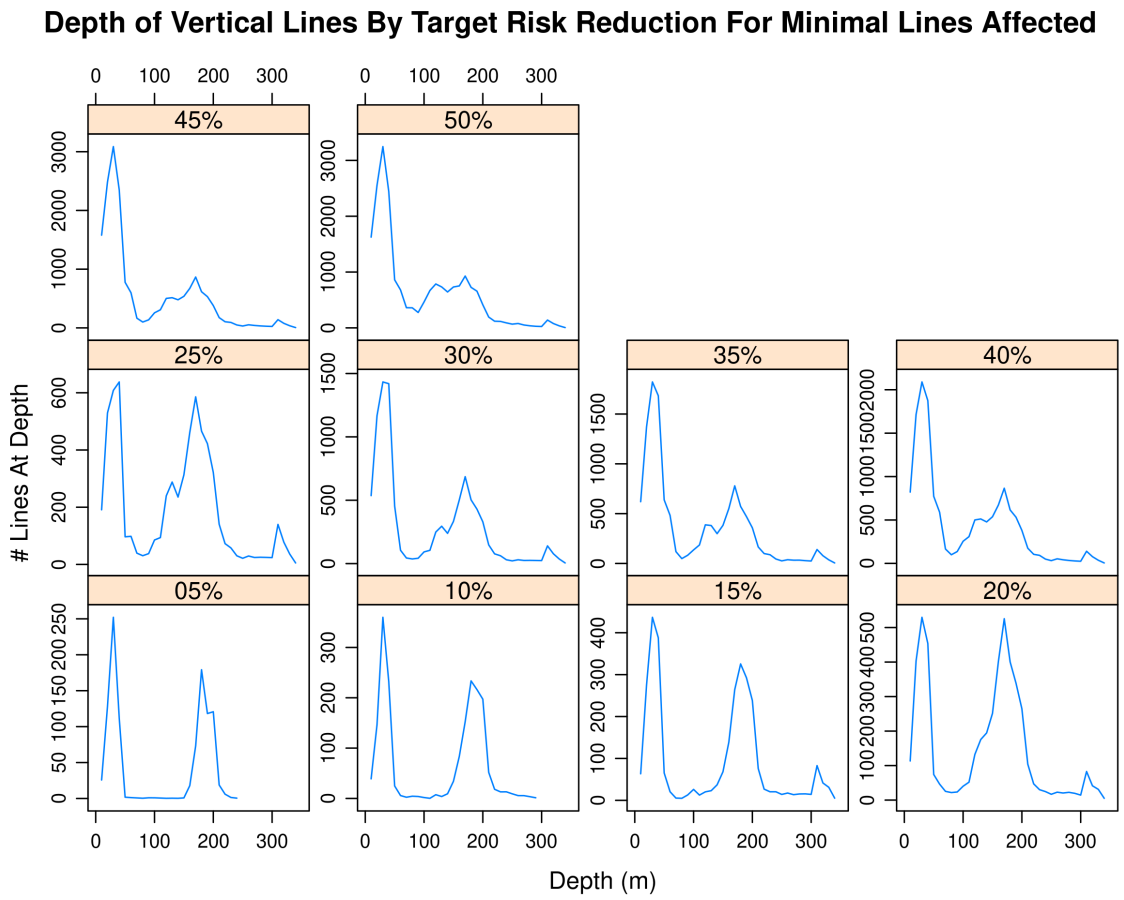

Conversions by depth

- Distribution of converted lines by depth is consistently bimodal with peaks around 30m and 200m
- Burton is curious: would different ropeless gear setups be required at these two depths? What are the cost implications?

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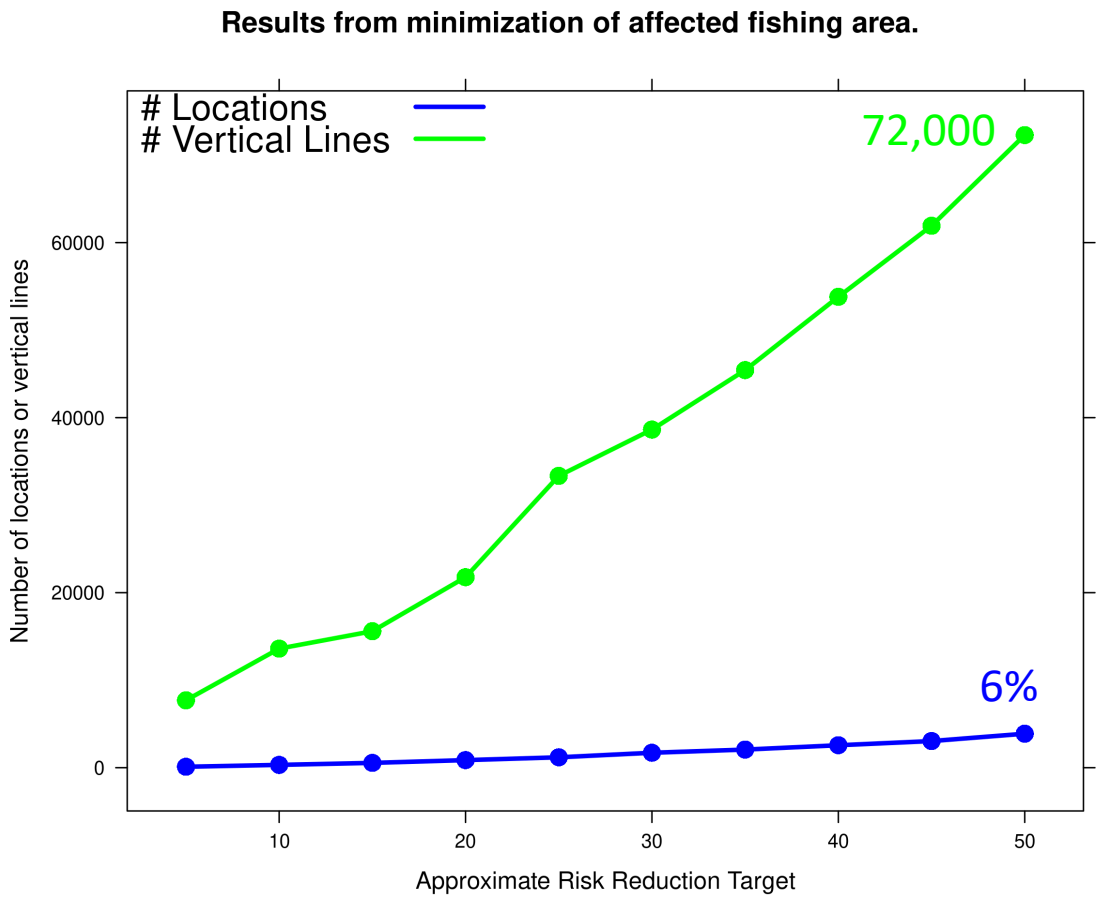

Results: Scenario 2

Convert minimum area to ropeless

- To reach 50% reduction, 6% of area must be converted, containing 72,000 lines
- Jason's opinion: only 6%?
  - Must be areas of both high whales and high gear
  - Needs further investigation

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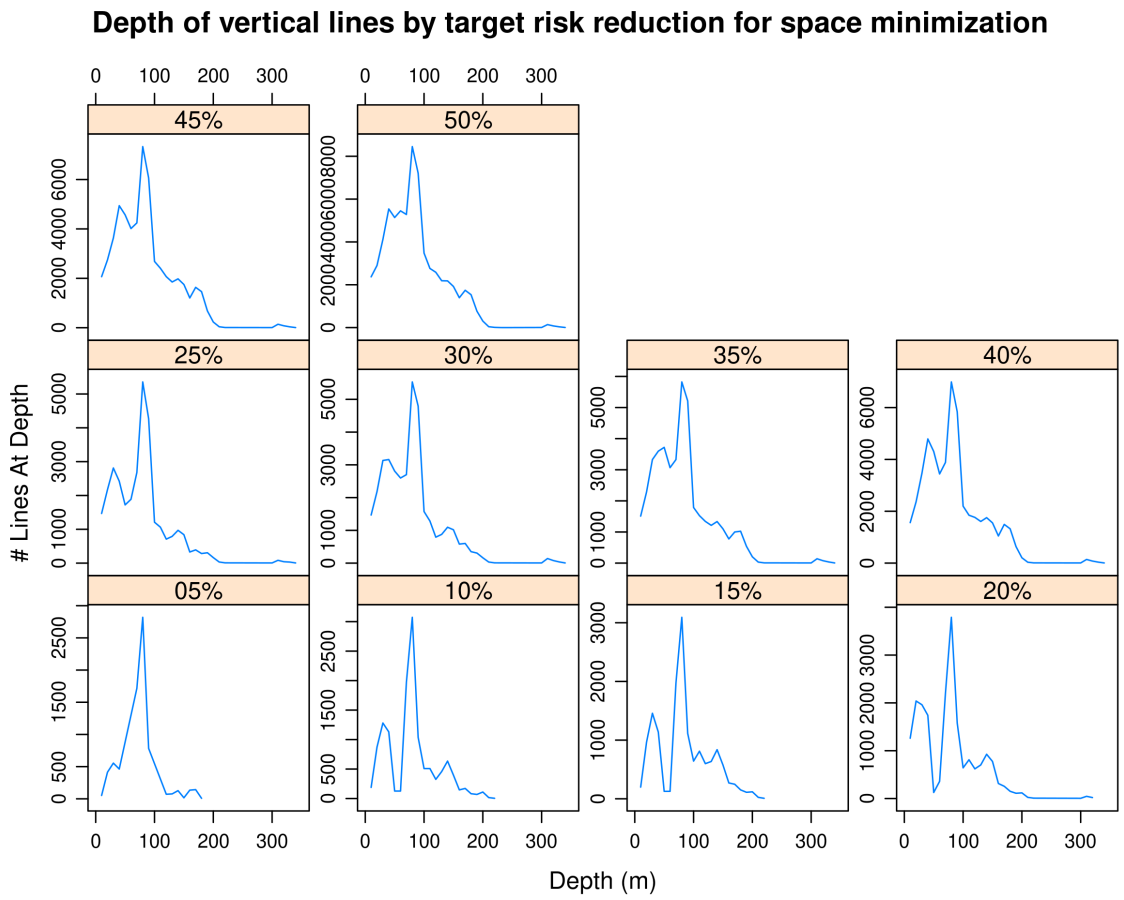

Conversions by depth

- This scenario shows a more even distribution of depths in converted lines
- Most lines are shallower than 150m, with a peak at 100m

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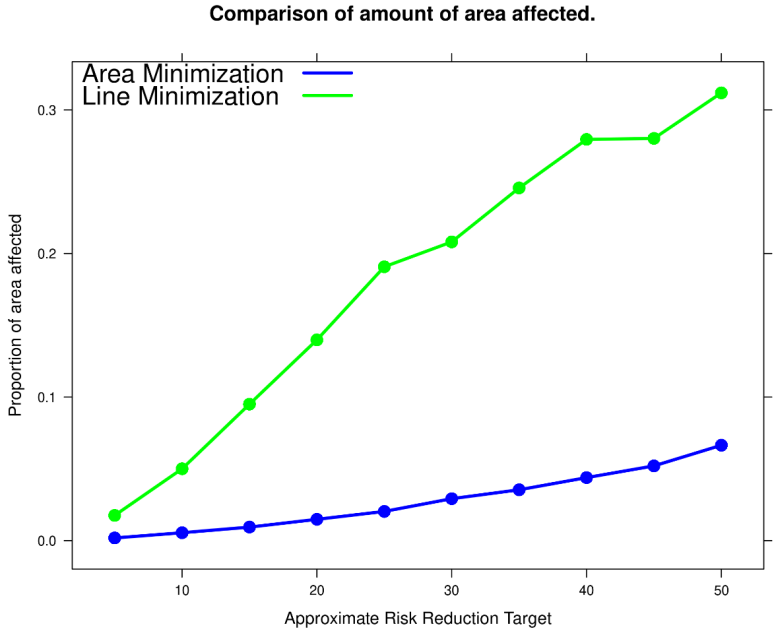

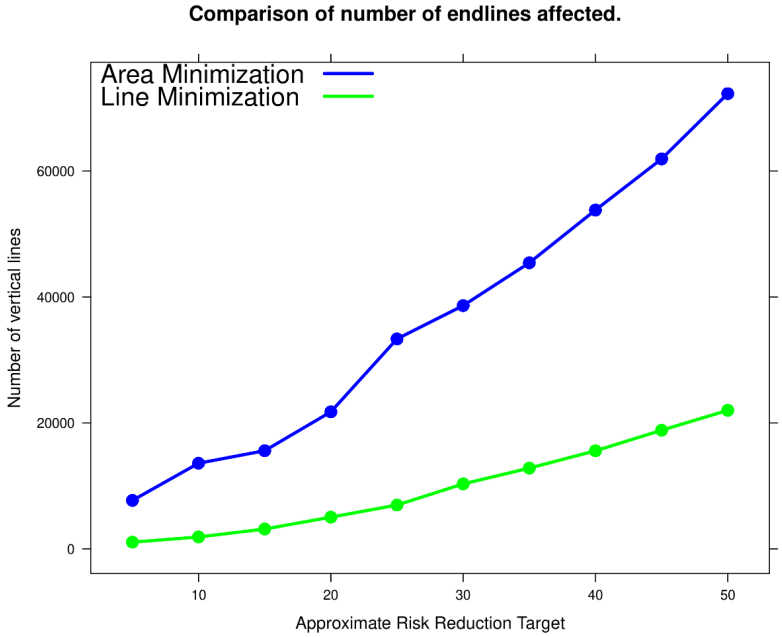

- Key takeaway: the two optimizations yielded different trajectories in the required conversions of lines and area, and different depth distributions
- This suggests a tradeoff decision between minimizing lines vs. minimizing area

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Thank you!

- Density model: jason.roberts@duke.edu
- Risk reduction tool: burton.shank@noaa.gov

- Attend NOAA's Peer Review of the Right Whale Decision Support Tool
  - November 19-21 in Woods Hole, MA
  - Right whale density model review is November 20 at 9:10-11:15 AM
  - https://www.fisheries.noaa.gov/event/peer-review-right-whale-decision-support-tool

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