North Atlantic Right Whales

South Atlantic Fisheries Management Council

Protected Resources Committee

NOAA FISHERIES
Southeast Regional Office
Protected Resources Division

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Overview

- Population
- Habitat/Spatial Distribution
- Temporal Distribution (Migration)
- Right whale entanglements/gear

NARW Population

- 444 individuals: minimum number alive in 2009[1]
- 2.6% estimated mean annual growth rate (1990-2010)[1]
- Slow growth rate compared to other large whale populations
- Precariously small population frequently exposed to anthropogenic threats
- One of the most critically endangered populations of large whales in the world[2]

[1] Waring *et al*., 2013

[2] Clapham *et al*. 1999)

Recruitment

- Not all calves live to be adults.
- Annually, 0-4 known calf deaths from 1993-2010.
- Calf mortality may be as high as 3/year[1]
- Population contains a smaller proportion of juveniles than expected[2]
  - May reflect high juvenile mortality rates.

[1] Browning *et al.*, 2010
[2] Hamilton *et al.*, 2007)

Population Status: Summary

- Small population size and low growth rates
- Even low levels of human-caused mortality poses a significant obstacle for recovery
  - Anthropogenic activities are likely among the primary causes for the species' failure to recover[1]
- Population modeling studies in the late 1990s[2]: preventing the death of two adult females per year could be sufficient to reverse the slow population decline observed in the 1990s.

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[1] Kraus, 1990; Knowlton and Kraus, 2001; Moore *et al.*, 2005; NMFS, 2005; van der Hoop *et al.*, 2013

[2] Caswell *et al.*, 1999; Fujiwara and Caswell, 2001

Northern Right Whale Critical Habitat[1]

- Designated in 1994
- Only known calving ground
- Used as winter ground by adults and juveniles
- Boundaries based on sightings

[1]50 CFR 226.203

Sighting Limitations

Lack of sightings does not necessarily = whale absence

- Availability bias (whales submerged, quiet)
- Perception bias (observer error)
- Incomplete coverage (poor weather)

Modeling

- Better characterize whale distribution than sightings
- Relate cetacean distribution to environmental variables and predict cetacean occurrence based on those variables
- Predict cetacean distribution within a study area not sampled

Gowan, T., and J. Ortega-Ortiz. (2013). Wintering Habitat Model for the North Atlantic Right Whale (*Eubalaena glacialis*) in the Southeastern United States. Manuscript submitted for publication.

Habitat Models: based on air survey data

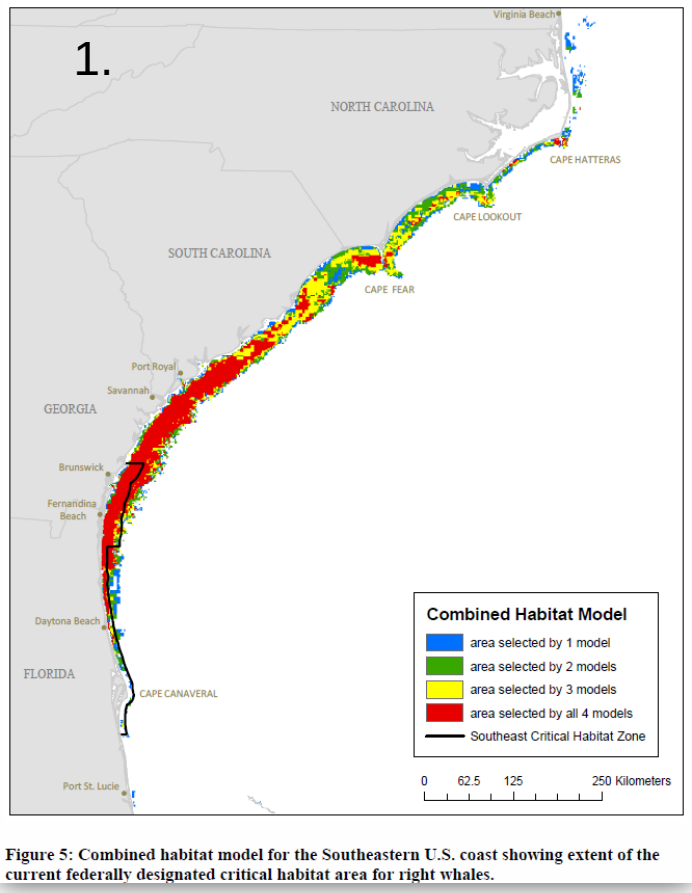


Figure 5: Combined habitat model for the Southeastern U.S. coast showing extent of the current federally designated critical habitat area for right whales.

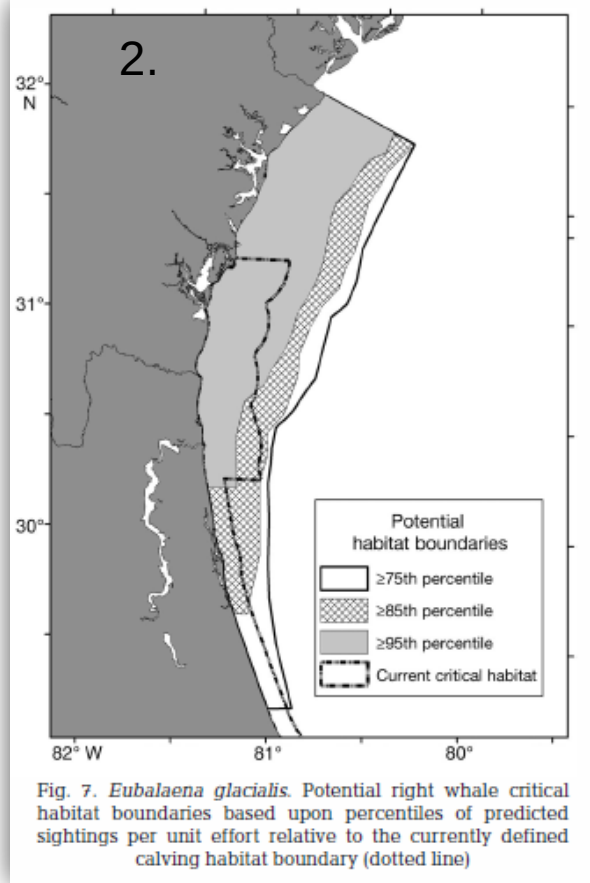


Fig. 7. *Eubalaena glacialis*. Potential right whale critical habitat boundaries based upon percentiles of predicted sightings per unit effort relative to the currently defined calving habitat boundary (dotted line)

[1]Good, C. 2008. Spatial Ecology of the North Atlantic Right Whale (*Eubalaena glacialis*). Dissertation. Duke University, Durham, NC.

[2]Keller, C. A., L. Garrison, R. Baumstark, L. I. Ward-Geiger, and E. Hines. 2012. Application of a habitat model to define calving habitat of the North Atlantic right whale in the southeastern United States. Endangered Species Research 18(1):73-87.

Wintering Habitat Model for the NA Right Whale in the Southeastern U.S.

(Gowan and Ortega-Ortiz, 2013)

- Significant predictors:
  - Water temperature (12-16ºC)
  - Water depth (10-20m)
  - Survey year
  - Distance to shore
  - Distance to the 22ºC SST isotherm (Gulf Stream)
  - Interaction between semimonth and latitude

Gowan, T., and J. Ortega-Ortiz. (2013). Wintering Habitat Model for the North Atlantic Right Whale (*Eubalaena glacialis*) in the Southeastern United States. Manuscript submitted for publication.

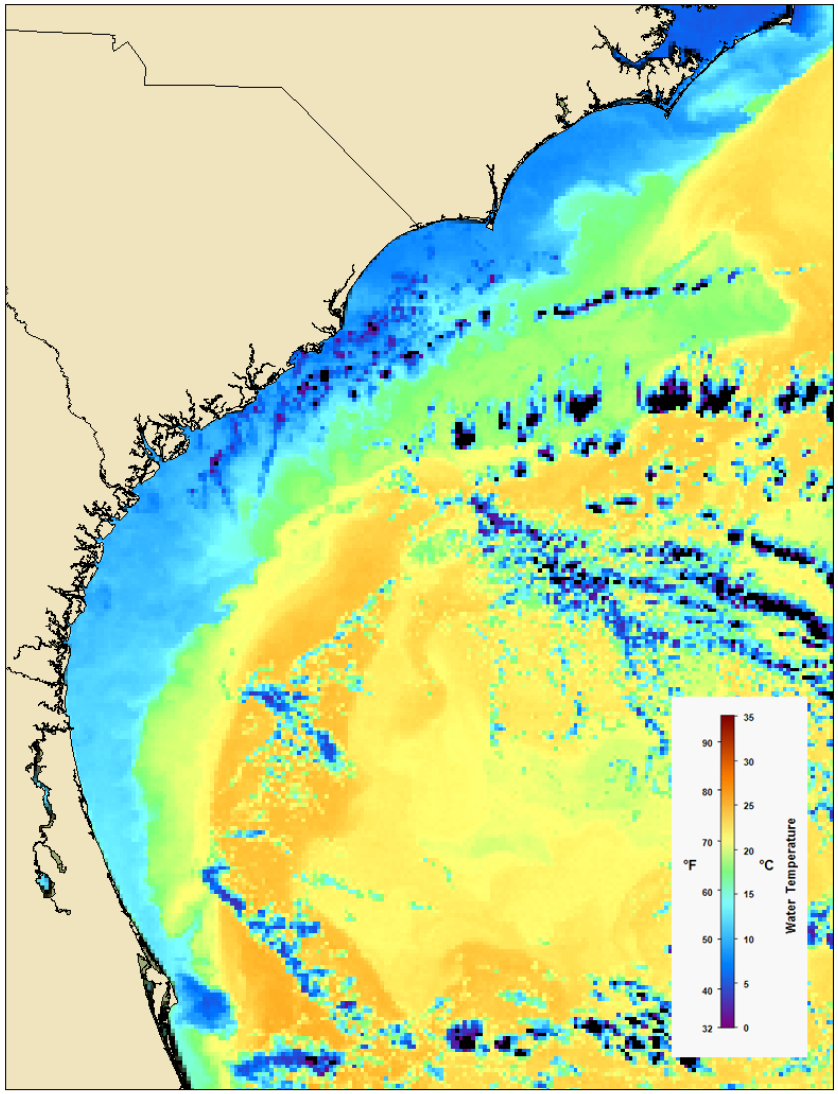
“Cold”

“Warm”

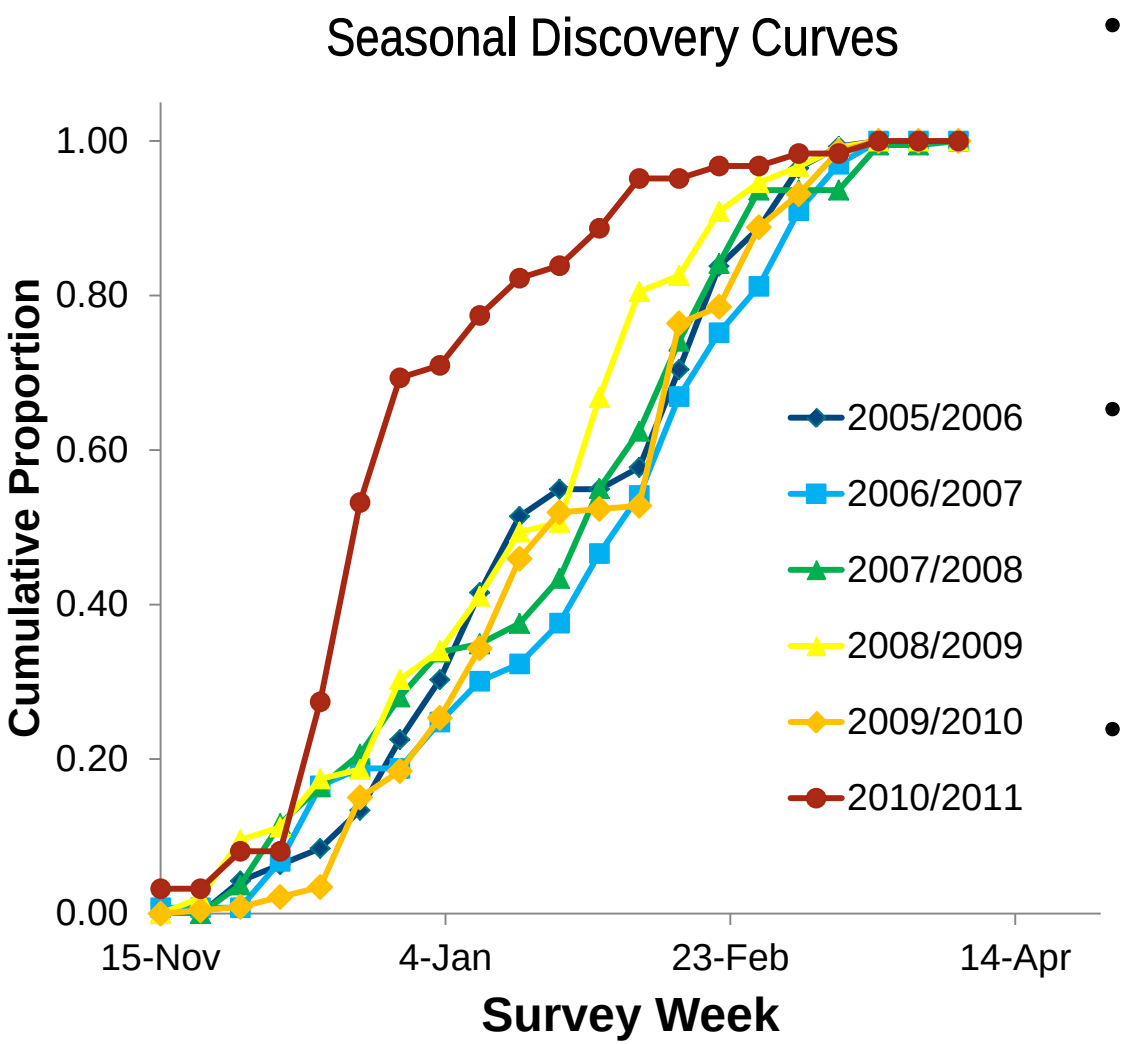
Gowan, T., and J. Ortega-Ortiz. (2013). Wintering Habitat Model for the North Atlantic Right Whale (*Eubalaena glacialis*) in the Southeastern United States. Manuscript submitted for publication.

Mid-Atlantic U.S.

- Data poor (sampling bias)
- Models non-existent
- Gulf Stream is limiting boundary



Timing and Temporal Extent



- New individuals are being observed late into the survey season with most curves not reaching asymptotes until mid to late March
- There appears to be a mid-season "surge" in new individuals in late-Jan to mid-Feb in most years
- 2010/2011 was clearly an odd year with most new animals seen early in the season and an early asymptote.

Source: L. Garrison, SEFSC, preliminary/unpublished results

Timing and Temporal Extent: Discovery Curves

Week	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011
15-Nov	0.00	0.01	0.00	0.00	0.00	0.03
22-Nov	0.00	0.01	0.00	0.02	0.00	0.03
29-Nov	0.04	0.01	0.04	0.10	0.01	0.08
6-Dec	0.06	0.07	0.12	0.11	0.02	0.08
13-Dec	0.08	0.17	0.16	0.17	0.03	0.27
20-Dec	0.13	0.19	0.21	0.19	0.15	0.53
27-Dec	0.23	0.19	0.28	0.30	0.18	0.69
3-Jan	0.30	0.25	0.34	0.34	0.25	0.71
10-Jan	0.42	0.30	0.35	0.41	0.34	0.77
17-Jan	0.51	0.32	0.38	0.49	0.46	0.82
24-Jan	0.55	0.38	0.43	0.51	0.52	0.84
31-Jan	0.55	0.47	0.55	0.67	0.52	0.89
7-Feb	0.58	0.54	0.62	0.80	0.53	0.95
14-Feb	0.70	0.67	0.74	0.83	0.76	0.95
21-Feb	0.84	0.75	0.84	0.91	0.79	0.97
28-Feb	0.89	0.81	0.94	0.95	0.89	0.97
7-Mar	0.96	0.91	0.94	0.97	0.93	0.98
14-Mar	0.99	0.97	0.94	0.99	0.99	0.98
21-Mar	1.00	1.00	0.99	1.00	1.00	1.00
28-Mar	1.00	1.00	0.99	1.00	1.00	1.00
4-Apr	1.00	1.00	1.00	1.00	1.00	1.00

5% of detections by early December, suggesting that animals are already in the SEUS by the time the core surveys start on 1 December. 95% or more of animals detected by mid-March.

Source: L. Garrison, SEFSC, preliminary/unpublished results

Summary of Timing and Temporal Extent

1) Discovery curves and durations suggest two “waves” of adults entering the SEUS. Early arriving adults and calves have long durations, late arriving adults have shorter durations.
2) New animals are detected throughout the core calving area from early December through mid- to late March
3) Whales are present off NC prior to, during, and subsequent to Dec–Mar calving period in core calving area.

A Fraction of NARW Entanglements are Detected

- 83% of all right whales have been entangled at least once
- 60% entangled more than once
- Juveniles were entangled at a higher rate than adults
- 26% of adequately photographed animals acquired new entanglement wounds or scars annually

Knowlton, A., P. Hamilton, M. Marx, H. Pettis, and S. Kraus. 2012. Monitoring North Atlantic right whale (*Eubalaena glacialis)* entanglement rates: a 30 yr retrospective. Marine Ecology Progress Series 466:293-302.

Any Vertical Line is an Entanglement Risk

- Pot and gill net fisheries implicated in 89% of Mn and Eg entanglement cases examined by Johnson et al. (2005)
- When gear type was identified, right whales found to be entangled in pot gear 71% of time (gill net 14%)
- 56% of entanglements for both species involved buoy line
- "…any line rising into the water column poses a significant entanglement risk for these two species."

Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. Fishing Gear Involved in Entanglements of Right and Humpback Whales. Marine Mammal Science 21(4):635-645.

Entangling Line Removed from NARWs: 2010

Date	Status	SI Determination	Gear Collected	Fishery Type	Line Info
5/13	Alive	Non-SI	Yes	Unk	5/8” poly-dac float rope, white
6/27	Dead	SI	No	Unk	
9/10	Alive	SI	No	Unk	
10/20	Alive	Non-SI	No	Unk	
12/25	Dead	SI	Yes	Trap/pot	7/16” polypro float rope, gangions, plastic coated wire mesh (2” x 2”)

Morin, D. and J. Kenney. 2010. 2010 Large Whale Entanglement Report. 70 pp.

NARW Potential Biological Removal

Potential Biological Removal (PBR) Level: defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The PBR level is the product of the following factors--

- the minimum population estimate of the stock;
- one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size; and
- a recovery factor of between 0.1 and 1.0.

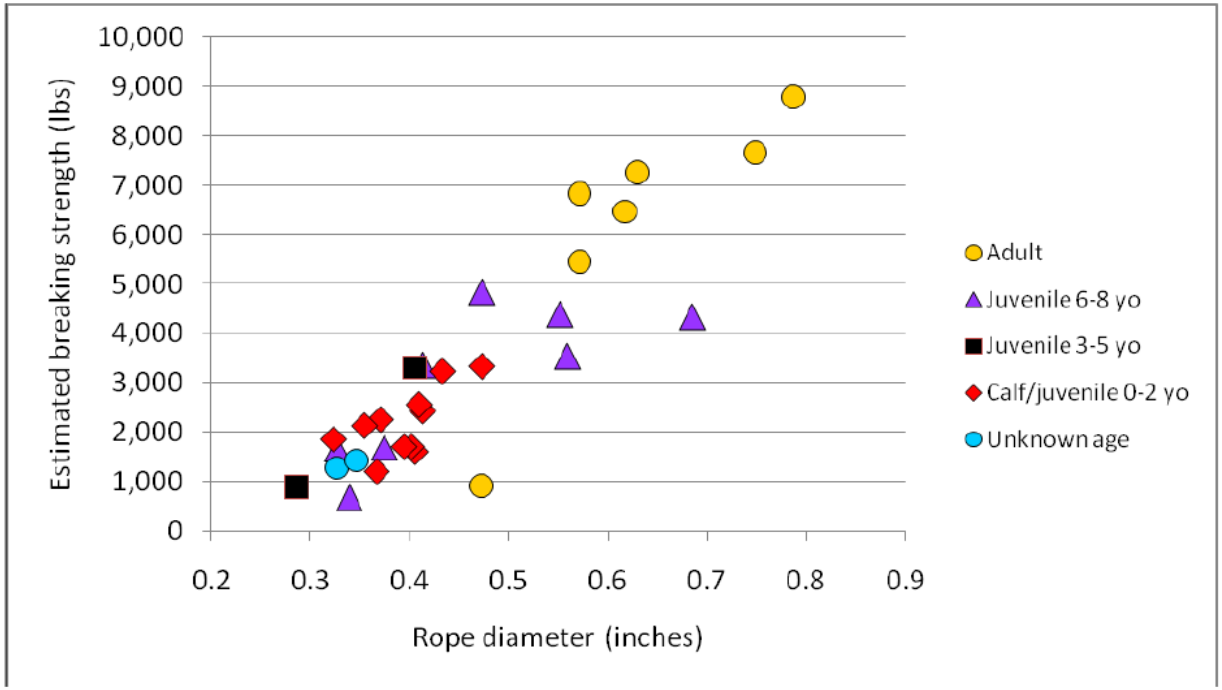
PBR for North Atlantic Right Whales: .9

Annual SI and Mortality (2006-2010)

- Avg = 3/year (2.4 U.S.)
  - Incidental fishery entanglement – 1.8/yr
  - Vessel strike – 1.2/yr

Rope Breaking Strength and Diameter and NARW Entanglement

Figure 7. Right whales by age versus rope parameters.



Knowlton, A., J. Robbins, S. Landry, H. McKenna, S. Kraus, and T. Werner. (2013). Implications of Fishing Gear Strength on the Severity of Large Whale Entanglements. Draft manuscript submitted in partial fulfillment of a final report by the Consortium for Wildlife Bycatch Reduction, NOAA Award NA09NMF4520413.

Implications of Fishing Gear Strength on Severity of Large Whale Entanglements

(Knowlton *et al*. 2013)

Recommendations:

1. 1,200 lb maximum breaking strength north of Cape Hatteras
2. 600 lb maximum breaking strength south of Cape Hatteras

Knowlton, A., J. Robbins, S. Landry, H. McKenna, S. Kraus, and T. Werner. (2013). Implications of Fishing Gear Strength on the Severity of Large Whale Entanglements. Draft manuscript submitted in partial fulfillment of a final report by the Consortium for Wildlife Bycatch Reduction, NOAA Award NA09NMF4520413.

Entanglement Risk Factors

- Temporal/Spatial distribution of gear
- Temporal/Spatial distribution of whales
- Gear type (rope breaking strength, weight, etc.)
- Whale behavior (mouth open)
- Whale size/age (strength)
- Etc.

Questions?