

# Density model for Sei whale in the AFTT area - version 1

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This report documents the density model developed for Sei whale in the AFTT area. It provides information on available data, methodological decisions, the selected model, predictions, uncertainty and qualitative evaluation of predictions based on the literature. Information on classification of ambiguous sightings, detection function fitting and  $g(0)$  estimates can be found in the EEZ model report for this taxon (Roberts et al. 2015).

Citation for this model: Mannocci L, Roberts JJ, Miller DL, Halpin PN (2015) Density model for Sei whale in the AFTT area. Version 1, 2015-01-23. Marine Geospatial Ecology Lab, Duke University, Durham, NC.

Citation for the related peer-review publication: Mannocci L, Roberts JJ, Miller DL, Halpin PN. Here be dragons: extrapolating cetacean densities into the unsurveyed high seas of the western North Atlantic. Submitted to Ecological Applications.

## 1- Available data

Table 1: Effort (km) and sightings per region (CAR: Caribbean, EC: East coast, EU: European Atlantic, GM: Gulf of Mexico, MAR: Mid-Atlantic ridge).

Region	Effort	Sightings
EC	381281.5	35
All regions	381281.5	35

Table 2: Effort (km) and sightings per month.

	Month	Effort	Sightings
1	January	71406.04	5
2	February	96993.70	3
3	March	98664.69	11
11	November	60008.94	15
12	December	54208.17	1
13	All Months	381281.54	35

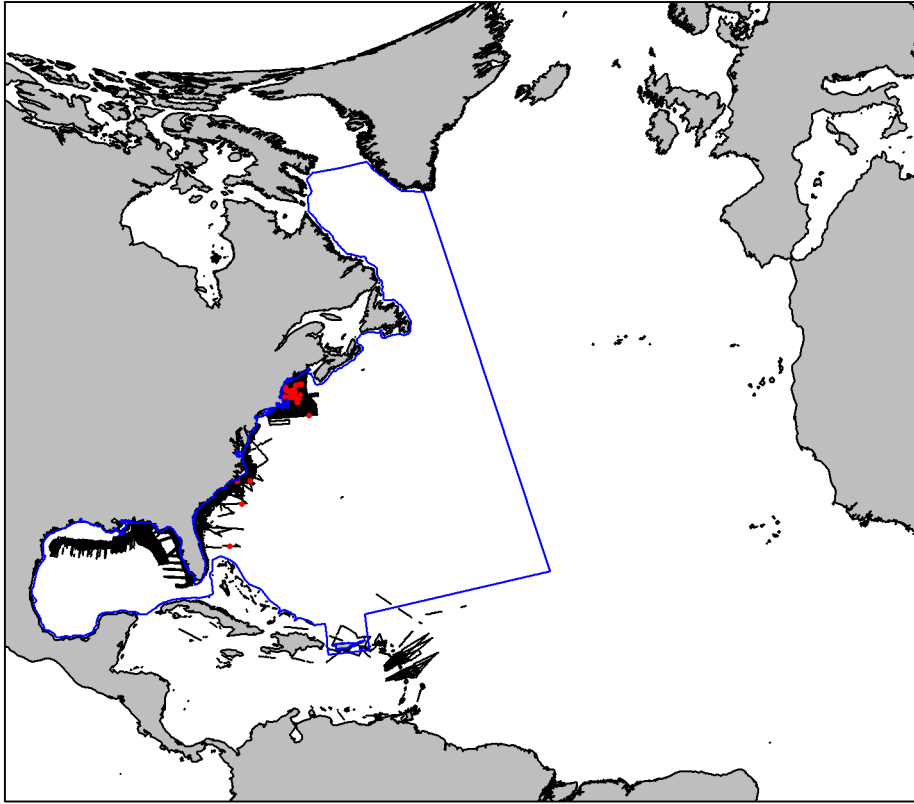


Figure 1: Map of segments (black lines) and sighting locations (red dots). An Albers equal area projection optimized for the AFT area is used.

## 2- Methodological decisions

### *Modeled taxon*

Sei whale (*Balaenoptera borealis*)

### *Model type*

The small sample size in winter did not allow us to fit a habitat-based density model; as a result, we fitted a stratified density model.

### *Modeled season*

Sei whales undertake seasonal migrations from low-latitude wintering areas to high-latitude summer feeding areas in the North Atlantic (but their migration patterns are complex and have not been completely elucidated) (Prieto et al. 2012). In addition, there were sufficient sightings in each season. We therefore fitted separate models in the summer and winter. We designated November as the first month of winter because tagged individuals remained in the Labrador Sea feeding grounds until early fall (Prieto et al. 2014).

### *Segments*

We used segments from the east coast since it was the only region which included sightings.

### *Area of assumed presence*

Sei whales were assumed present from the south of Florida to the northern Gulf of Maine since the northernmost sighting was made at 43.4°N and there was no evidence for their occurrence further north in winter. Sei whales were assumed absent in the Gulf of Mexico as they are considered of accidental occurrence there (Jefferson and Schiro 1997).

### 3- Predictions

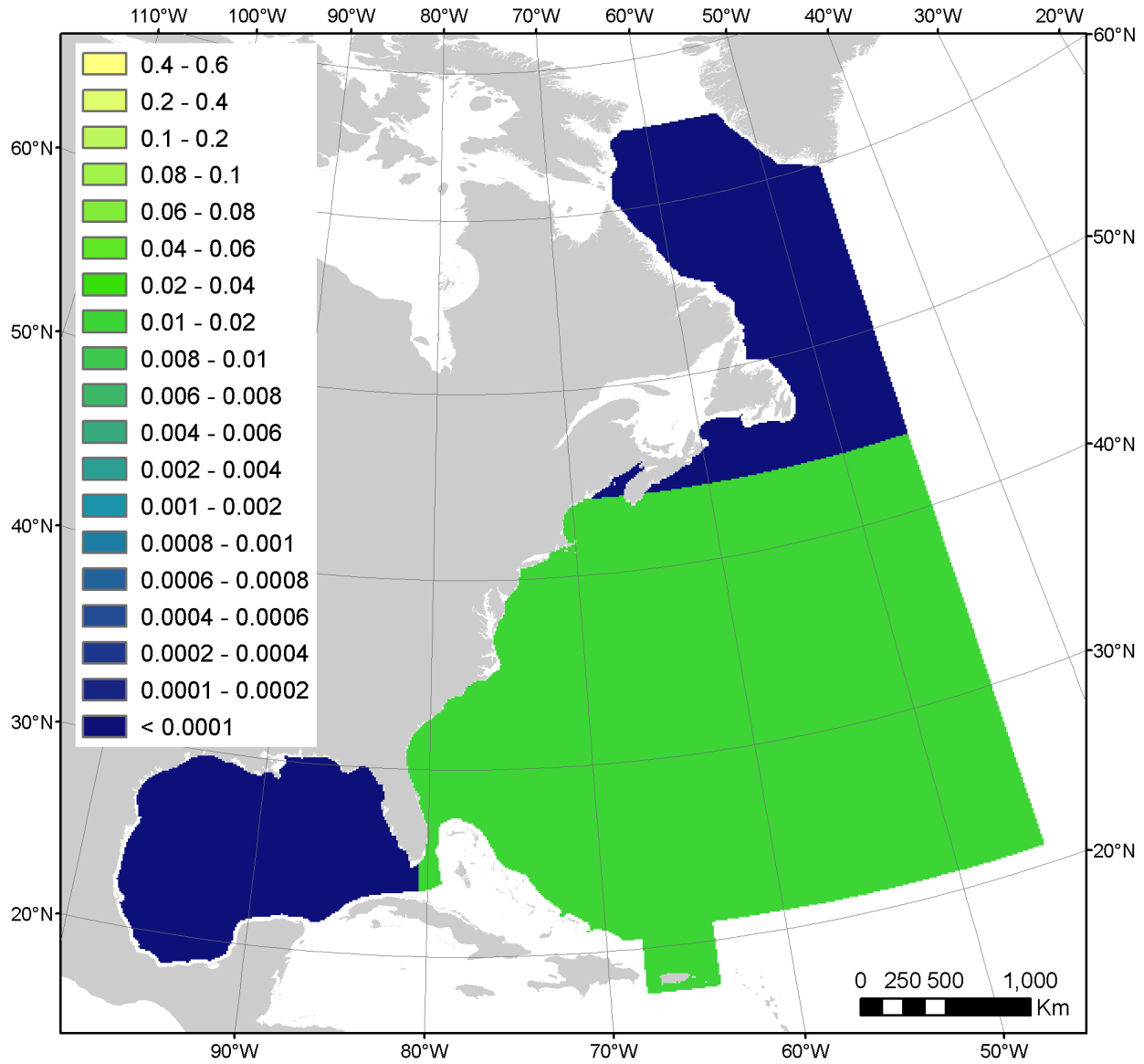


Figure 5: Mean predicted densities (individuals 100 km<sup>-2</sup>) in the AFTT area. An Albers equal area projection is used.

Table 3: Mean predicted abundance (individuals) in the AFTT area and associated coefficient of variation (CV). The CV only reflects uncertainty in the estimated GAM parameters (in this case only the intercept) and is therefore strongly underestimated.

Abundance	CV
1170	0.191

## 4- Uncertainty

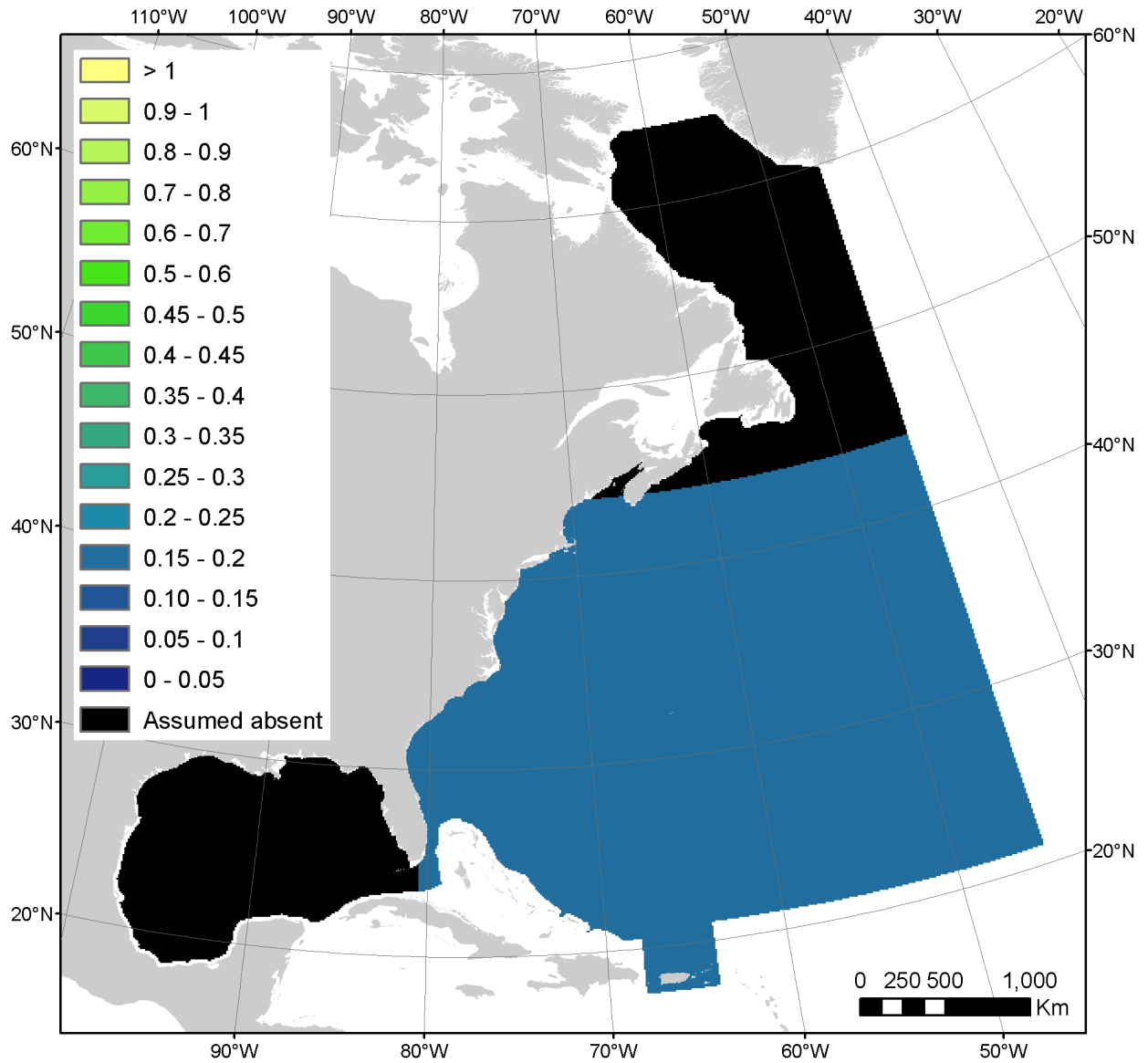


Figure 6: Mean predicted coefficient of variation (unit-less) in the AFTT area. An Albers equal area projection is used.

## 5- Qualitative evaluation of predictions

Very few records of sei whales are available for winter months in the western north Atlantic and the location of their wintering grounds is largely unknown (Prieto et al. 2012). Two possible sightings have been reported off Puerto Rico and the Virgin islands (Mignucci-Giannoni 1998). In the eastern North Atlantic, satellite telemetry data suggest a possible wintering ground southeast of the Azores (Prieto et al. 2014).

### *Future model improvements*

More information on the location of sei whale's wintering grounds and additional sightings in that season are needed to increase the reliability of model predictions and potentially fit a habitat-based density model.

## REFERENCES

- Jefferson, T. A., and A. J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. *Mammal Review* 27:27-50.
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- Prieto, R., D. Janiger, M. A. Silva, G. T. Waring, and J. M. Gonçalves. 2012. The forgotten whale: a bibliometric analysis and literature review of the North Atlantic sei whale *Balaenoptera borealis*: North Atlantic sei whale review. *Mammal Review* 42:235-272.
- Prieto, R., M. A. Silva, G. Waring, and J. M. Gonçalves. 2014. Sei whale movements and behaviour in the North Atlantic inferred from satellite telemetry. *Endangered species Research*.