

INFERRING THE DISTRIBUTION OF CETACEAN SPECIES IN DEEP WATERS OF GABON

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THE POTENTIAL OF SEISMIC PROSPECTING SURVEYS AS A SOURCE OF MARINE MAMMALS DATA IN DATA-SCARCE REGIONS

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CONCLUSIONS

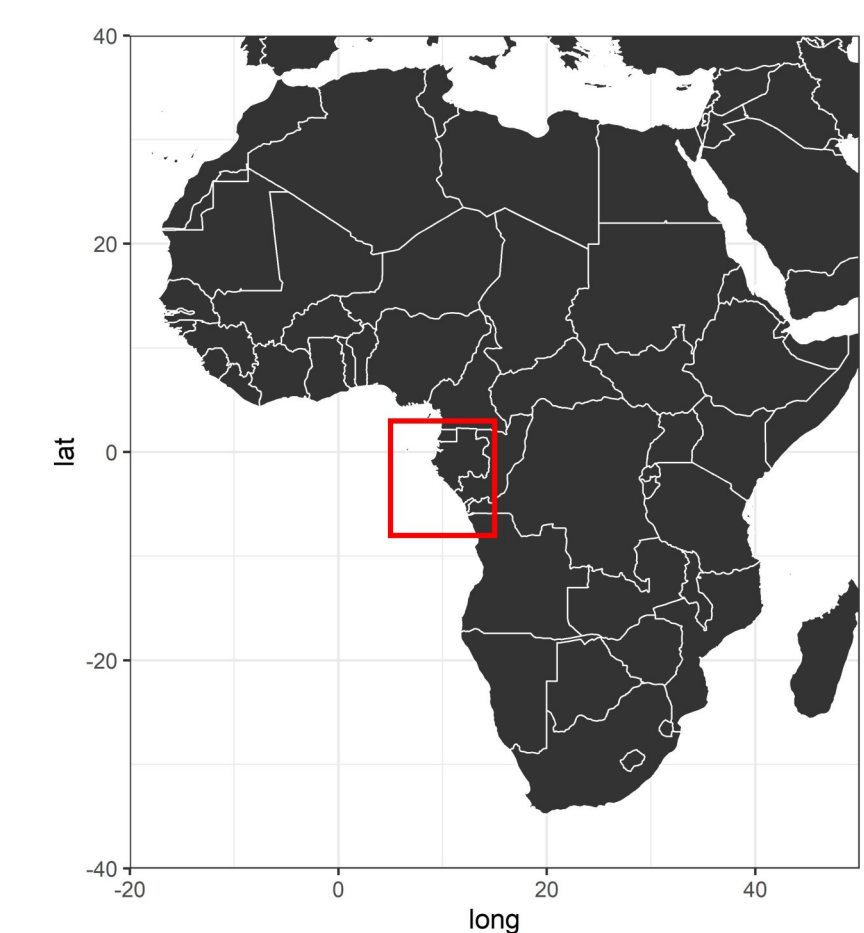
- DATA COLLECTED DURING SEISMIC SURVEYS CAN OFFER NEW INSIGHTS ABOUT MARINE MAMMALS HABITAT PREFERENCES IN DATA-SCARCE AREAS
- THE INLA-SPDE APPROACH OFFERS AN APPROPRIATED METHOD TO MODEL MARKED POINT DATA FROM BOAT-BASED SURVEYS

INTRODUCTION

- GABON HAS CREATED THE AFRICA'S LARGEST NETWORK OF MARINE PROTECTED AREAS^[1]. HOWEVER THE DISTRIBUTION OF CETACEAN SPECIES IN GABONESE DEEP WATERS REMAIN SCARCELY STUDIED^[2,3]
- AS PART OF THE NOISE MITIGATION MEASURES, MARINE MAMMAL DATA IS REGULARLY COLLECTED DURING SEISMIC PROSPECTION SURVEYS
- EVEN IF THIS DATA CAN BE BIASED DUE TO THE VESSEL ACTIVITY; SIGHTS AND EFFORT DATA STILL CAN BE USED TO INFER THE PRELIMINARY DISTRIBUTION OF SPECIES IN A DATA-SCARCITY CONTEXT

METHODS

- DATA:** VISUAL AND ACOUSTIC DATA FROM 13 SEISMIC AND OPORTUNISTIC SURVEYS PERFORMED BETWEEN 2013 AND 2017
- SAMPLING METHOD:** DEDICATED AND EXPERIENCED MARINE MAMMAL OBSERVERS ONBOARD
- STUDY AREA:** GABONESE DEEP WATERS. SURVEYS PERFORMED FROM OCTOBER TO MAY
- STATISTICAL METHODS:** WE MODELED DISTANCE SAMPLING SPECIES PRESENCES AS A THINNED SPATIAL POINT PROCESS BY FITTING A SPATIAL LOG-GAUSSIAN COX PROCESS USING A BAYESIAN INLA-SPDE APPROACH^[4,5,6] ANALYSIS WERE PERFORMED IN R-SOFTWARE^[7] USING THE LIBRARY INLABRU^[8]



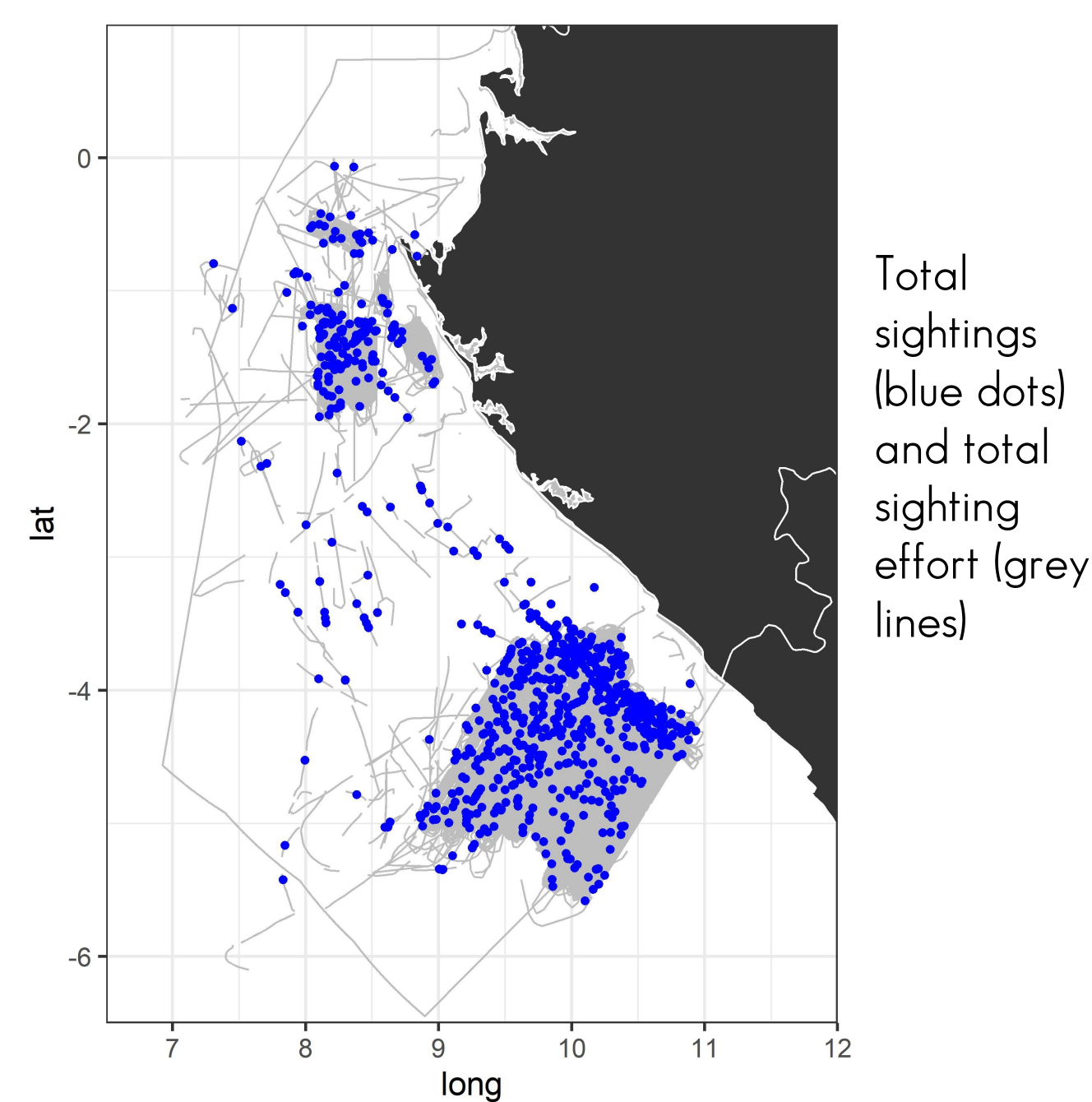
Red box indicates the study area

RESULTS

25 DIFFERENT SPECIES WERE IDENTIFIED

DISTRIBUTION MAPS ARE SHOWN FOR.

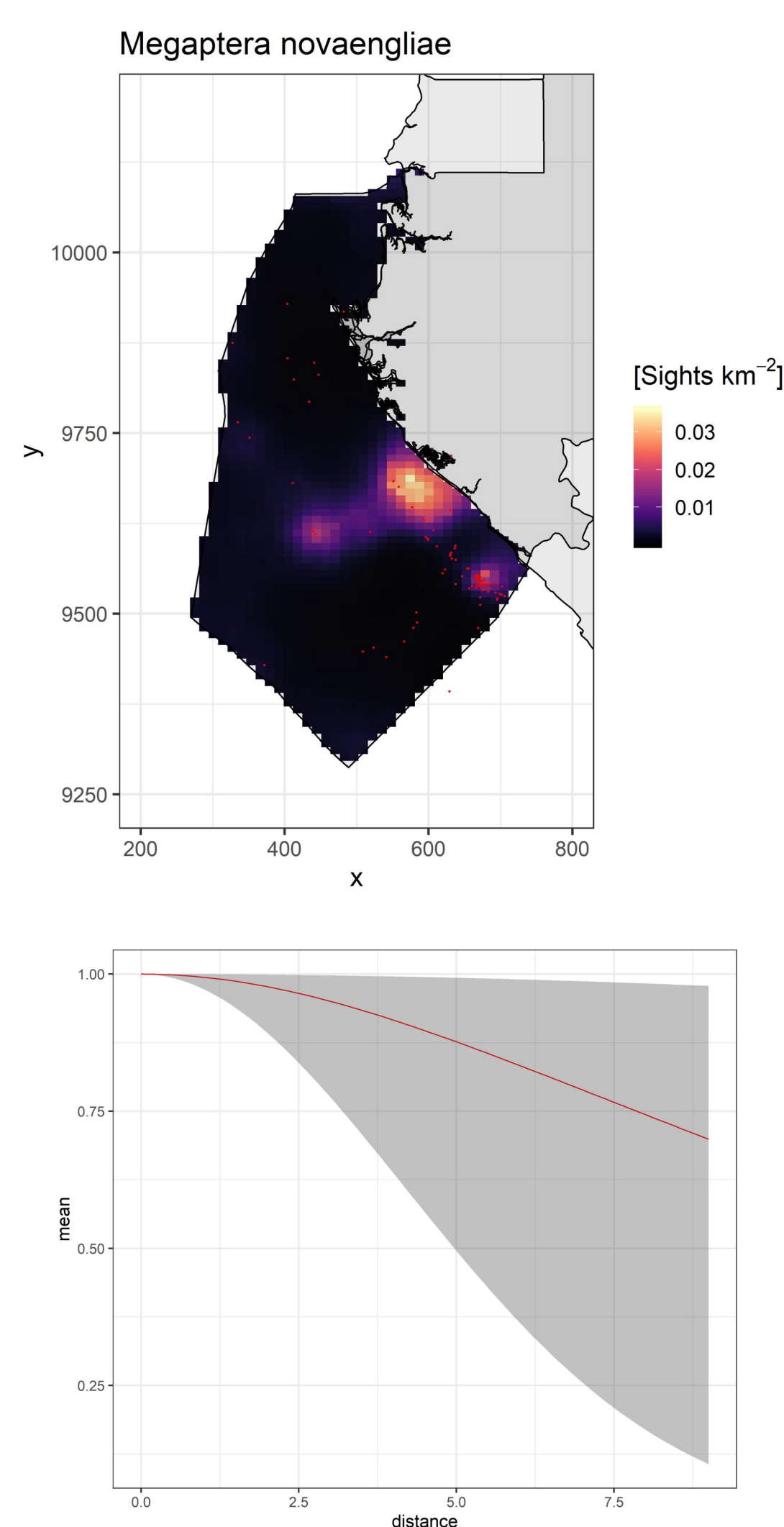
- HUMPBACK WHALE (*Megaptera novaeangliae*)
- SPERM WHALE (*Physeter macrocephalus*)
- STENELLAS (*Stenella* sp.)
- BLACKFISH (*O. orca*, *P. crassidens*, *P. electra*, *Globicephala* sp. And *G. griseus*)



Total sightings (blue dots) and total sighting effort (grey lines)

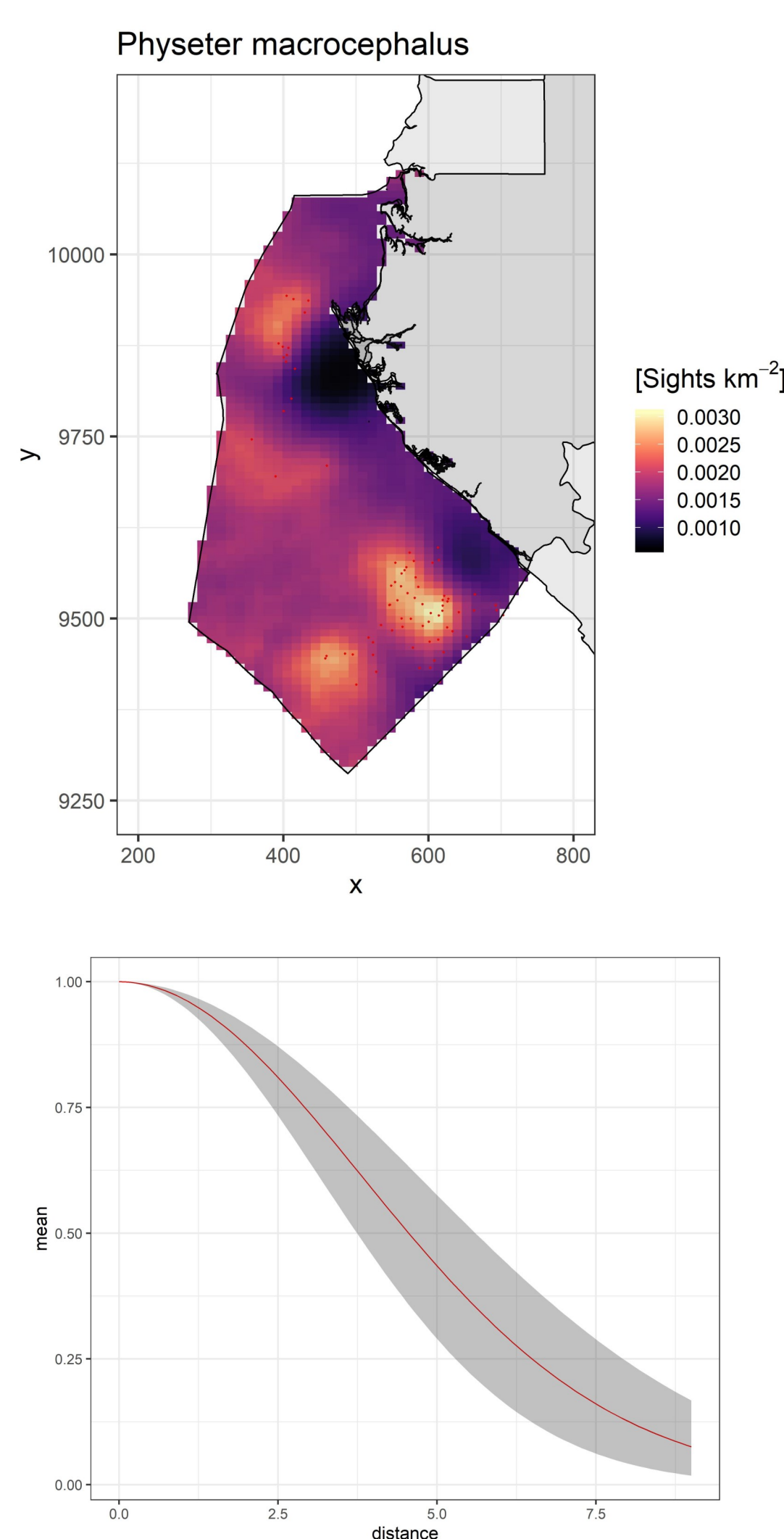
M. Novaeangliae

96 SIGHTINGS



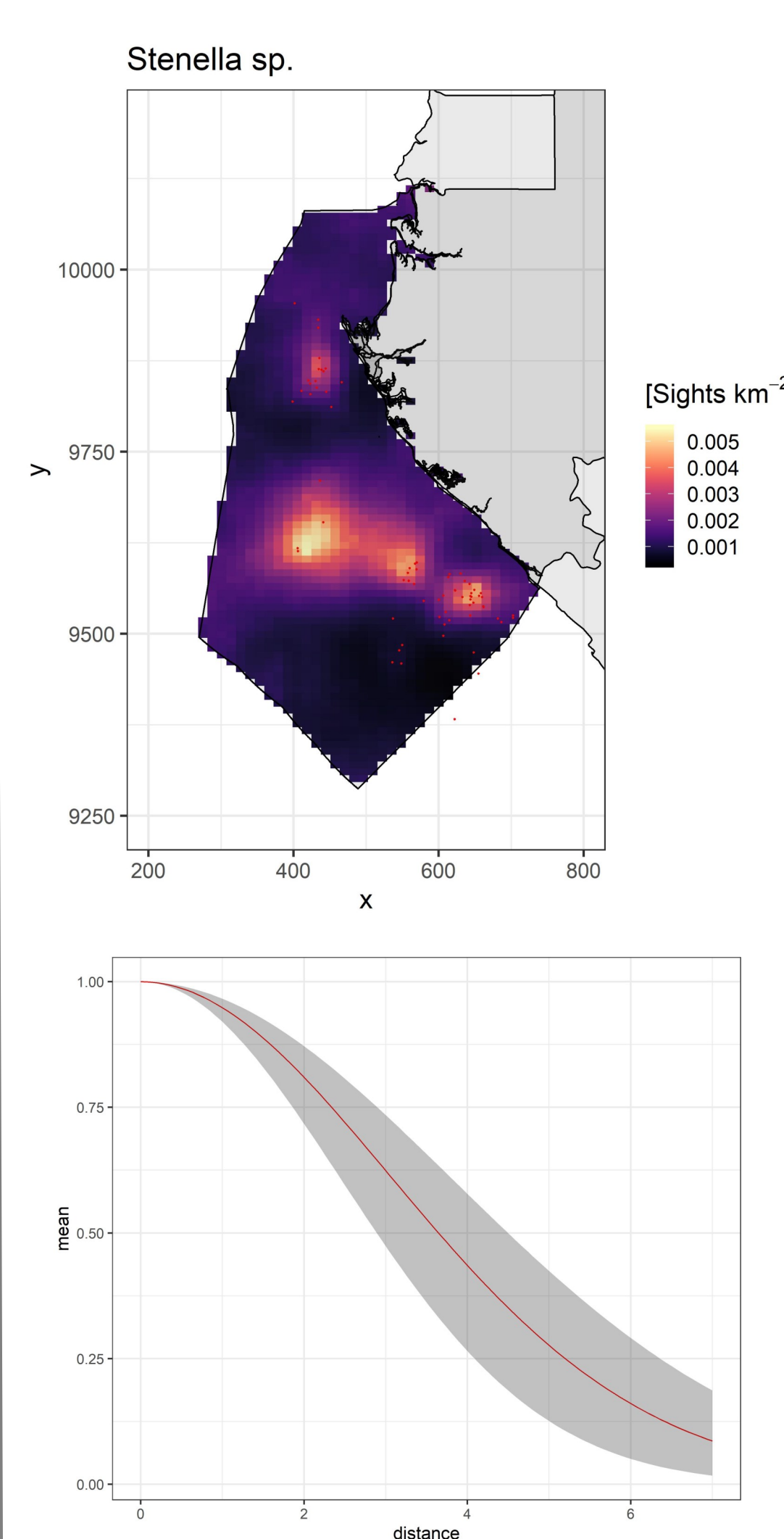
P. Macrocephalus

79 SIGHTINGS



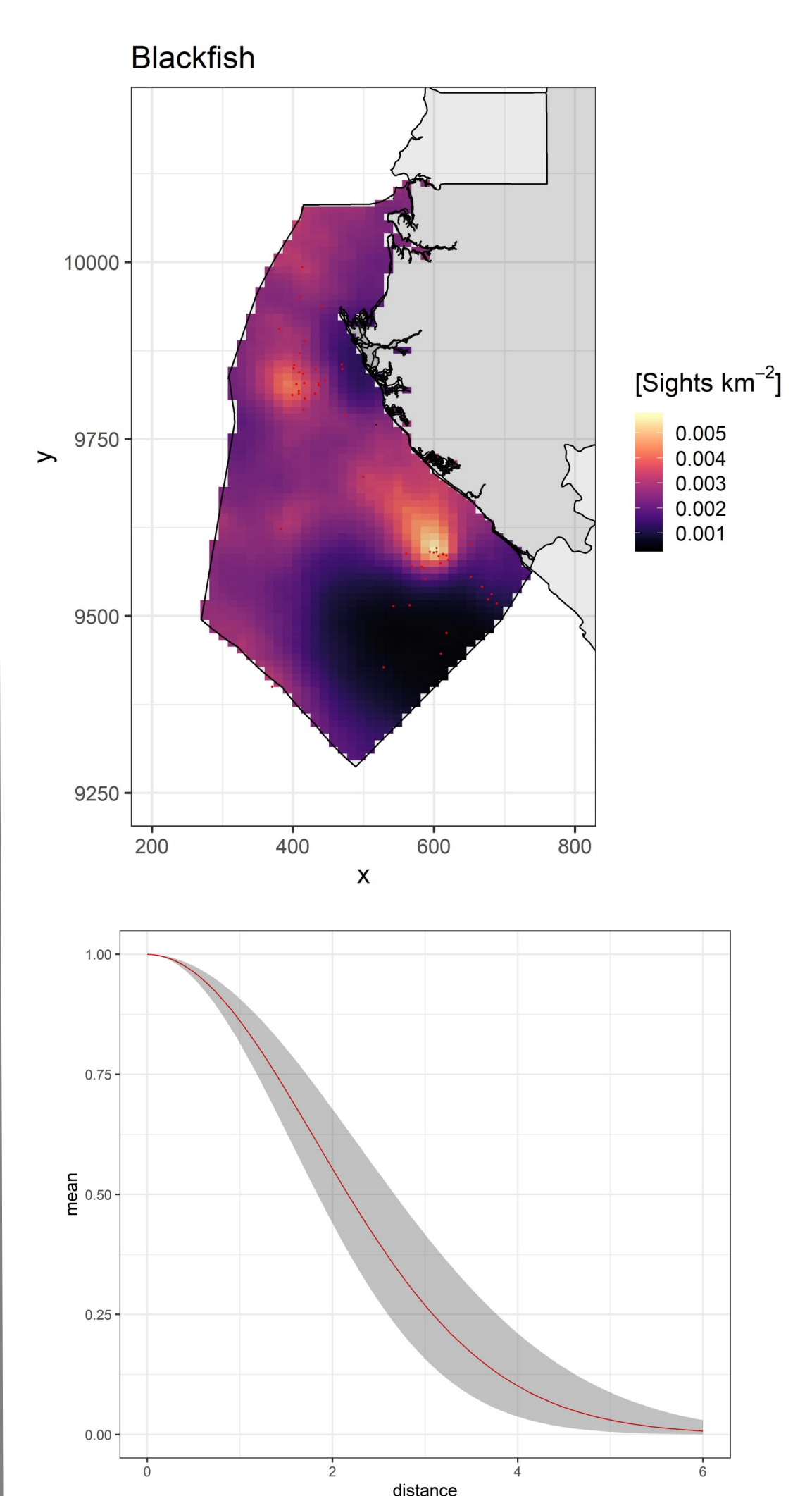
Stenella sp.

73 SIGHTINGS



Blackfish

55 SIGHTINGS



PREDICTED DENSITY [SIGHTINGS/km²]
Red dots indicate sighting locations

DISTANCE FUNCTION



REFS: [1] <https://www.nationalgeographic.com/news/2017/06/gabon-marine-protected-area-ocean-conservation/>; [2] DE BOER, Marijke N. Cetacean distribution and relative abundance in offshore Gabonese waters. *Journal of the Marine Biological Association of the United Kingdom*, 2010, vol. 90, no 8, p. 1613-1621. [3] WEIR, Caroline R. A review of cetacean occurrence in West African waters from the Gulf of Guinea to Angola. *Mammal Review*, 2010, vol. 40, no 1, p. 2-39. [4] RUE, H., MARTINO, S. & CHOPIN, N. 2009. Approximate Bayesian inference for latent Gaussian models by using integrated nested Laplace approximations. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 71:319-392. [5] LINDGREN, F., RUE, H. & LINDSTRÖM, J. 2011. An explicit link between Gaussian fields and Gaussian Markov random fields: the stochastic partial differential equation approach: Link between Gaussian Fields and Gaussian Markov Random Fields. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 73:423-498 [6] YUAN, Yuan, et al. Point process models for spatio-temporal distance sampling data from a large-scale survey of blue whales. *The Annals of Applied Statistics*, 2017, vol. 11, no 4, p. 2270-2297. [7] R CORE TEAM. 2019. A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. [8] BACHL, F. E., LINDGREN, F., BORCHERS, D. L. & ILLIAN, J. B. 2019. inlabru: an R package for Bayesian spatial modelling from ecological survey data. *Methods in Ecology and Evolution* 10:760-766.