Seasonal and interannual variation of common dolphin's densities in Portuguese waters

Miguel P. Martins[1,2], Marc Fernandez[3] , Ana Marçalo[4], Nuno Oliveira[5], Tiago Marques[6,7]

Miguel P. **Martins**
miguelpintomartis@gmail.com

(1) CEAUL - Centro de Estatística e Aplicações da Universidade de Lisboa, Lisboa, Portugal
(2) AIMM – Marine Environment Research Association, Lisboa, Portugal
(3) MARE - Marine and Environmental Sciences Centre, ARNET – Aquatic Research Network, Regional Agency for the Development of Research, Technology and Innovation (ARDITI), Funchal, Madeira, Portugal
(4) CCMAR – Centre of Marine Sciences, University of the Algarve, Faro, Portugal
(5) SPEA – Sociedade Portuguesa para o Estudo das Aves – Marine Conservation Department, Lisboa, Portugal
(6) Departamento de Biologia Animal, Centro de Estatística e Aplicações, Faculdade de Ciências da Universidade de Lisboa, Portugal
(7) CREEM - Centre for Research into Ecological and Environmental Modelling, The Observatory, University of St Andrews, St Andrews, KY16 9LZ, Scotland

Introduction

Estimating abundance, trends, and species distributions is paramount conservation and management. Despite this, there are still significant knowledge gaps in cetacean densities, with only about 25% of the global ocean having been surveyed[(1)]. Coastal waters in the Eastern North Atlantic have been regularly surveyed [(2,3)], with significantly less effort in offshore waters, particularly in mainland Portugal. **Here, we model common dolphin *(Delphinus delphis)* (Figure 1) densities from an opportunistic line transect dataset, through habitat-based Density Surface Models (DSMs), exploring potential impacts from climate change and overfishing.**

Figure 1 – Scientific illustration of an adult common dolphin (*Delphinus delphis*), © Miguel P. Martins.

Methodology

Line transects with two observers using distance sampling were employed by SPEA from December 2004 to December 2020, for marine bird data collection. In total, 62,392.6 km were covered in both coastal and offshore waters (**Figure 2).** Distance to the transect line was binned into five categories: i) 0-50 m; ii) 50-100 m; iii) 100-200 m; iv) 200-300 m and v) >300 m. When the distance was greater than 300 m, the sighting was considered out of sampling effort and was removed from the analysis. Two-phase DSMs were employed in R, via Generalized Additive Models (GAMs) using the *Distance* and *dsm* packages[(4,5)]. Seafloor depth, slope, Distance to the coast, 200 m isobath, 1000 m isobath, SST, chlorophyll-a concentration with and without a time lag, salinity, zooplankton concentration and yearly sardine biomass were considered as potential variables for modelling common dolphin densities. The model was projected in space for the environmental conditions in 2020 and in a hypothetical climate change and overfishing scenario.

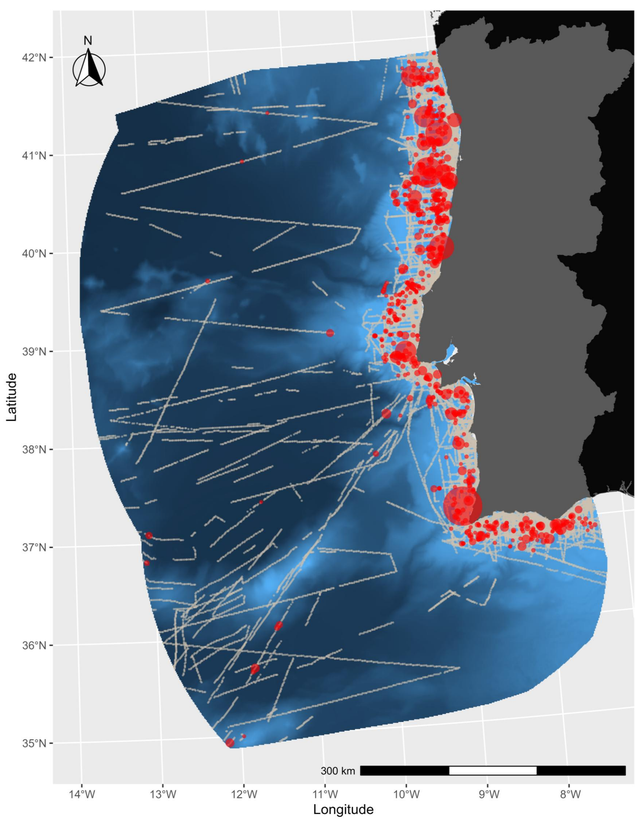

Figure 2 – Transect effort (grey) recorded in Portugal EEZ from 2004 to 2020. Common dolphin sighting point size (red) is proportional to the group size.

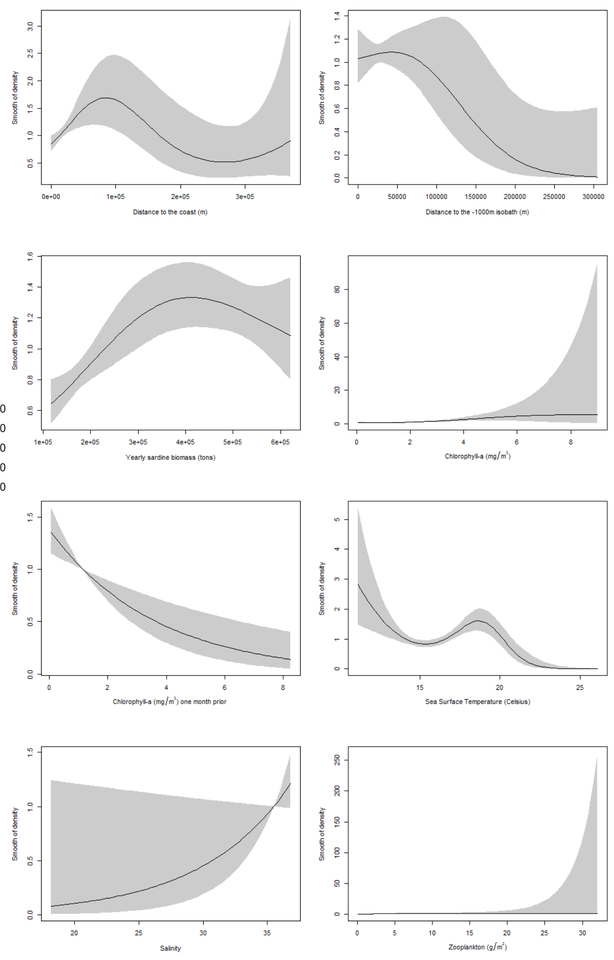

Figure 3 – Smoothed fit plots for each covariate.

Results

In total, 737 common dolphin sightings were used for modelling. The selected model included smooths of distance to the coast, distance to the 1000 m isobath, SST, chlorophyll-a concentration with and without a time lag, salinity, zooplankton concentration and sardine biomass **(Figure 3)**. Higher densities were predicted in shelf waters, particularly during the summer, with slightly higher densities offshore in the other seasons **(Figure 4)**. Climate change and overfishing scenario predictions show a reduction in abundance, with an estimated population drop as low as 57% (CV = 0.27) during the Spring and as high as 99% (CV = 0.23) during the summer. For a more comprehensive look into the results, please refer to the QR code in the end of the poster.

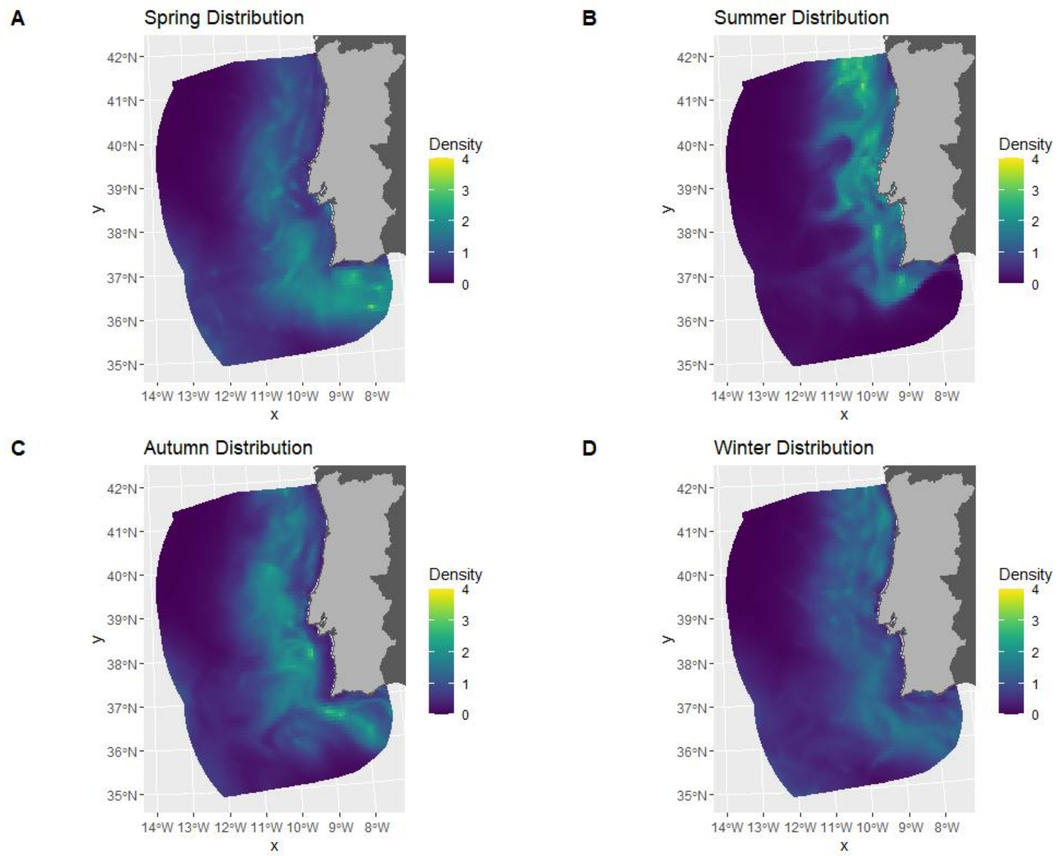

Figure 4 – Predicted common dolphin density (individuals/km²) distribution in mainland Portugal EEZ in 2020.

Discussion and Conclusion

This study shows how dynamic variables correlate to common dolphin densities in mainland Portugal, bringing important insights into the species seasonality. **Our results also support that climate change and sardine depletion may lead to a significant drop in common dolphin abundance in mainland Portugal (see the QR code below).**

References

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Acknowledgements

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