Predictive habitat models of bottlenose dolphins (*Tursiops truncatus*) in the Sicilian Channel (Mediterranean Sea)

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INTRODUCTION

- European Habitat Directive requires to select, designate and protect sites that support bottlenose dolphins. To meet this directive, distribution and habitat preference need to be known.
- The studied area is overexploited by fishing activity:
  - → 3 fishery fleets, counting 90 trawler vessels (Trawling and midwater-pair trawling);
  - → strong interaction of dolphins with fisheries (56% of the sightings).

OBJECTIVES

To understand:

- bottlenose dolphins habitat preferences in the Sicilian Channel (Mediterranean Sea);

- the influence of professional fisheries effort in bottlenose dolphin's distribution.

METHODS

The studied area is in the Sicilian Channel (Mediterranean Sea), in front off the coast of Agrigento Province (Italy). **Sightings** of *T. truncatus* were collected during dedicated boat survey on board of a 5.5 m long inflatable boat, following a **random sampling design.** The position of the boat and the location of each sighting were recorded using a Garmin handheld GPS. For the spatial model elaboration, each dolphin sighting was treated as one presence record, regardless of group size. Occurrence data and environmental variables were elaborated with Qgis 3.2.2.

Predictive model (MAXENT)

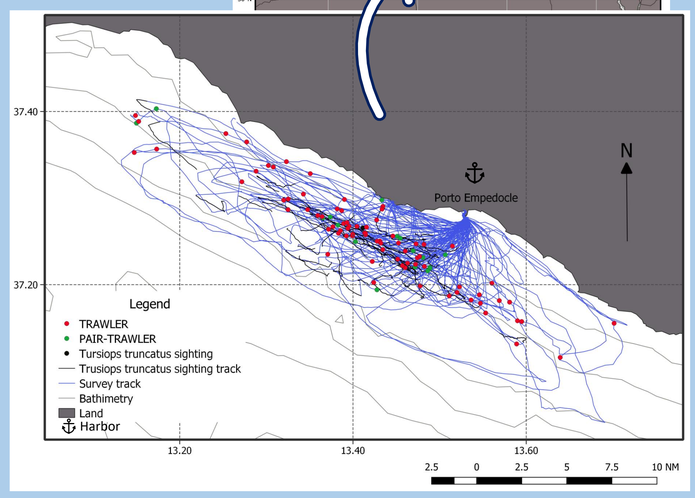
MaxEnt software models distributions from presence-only species records. The model minimizes the relative entropy between two probability densities (one estimated from the presence data and one from the landscape) defined in covariate space. It results in the relative occurrence rate (ROR) of the species into the studied area. Given that an individual was observed, the ROR is the relative probability that a cell is contained in a collection of presence samples.

Average depth, distance from the shoreline and number of professional fishing boats sighted in activity (as index of fishing effort and habitat exploitation) were considered to predict bottlenose dolphins' presence.

RESULTS

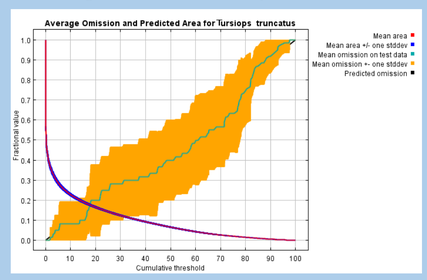
Fig 1. Location of the study area inside the Mediterranean Sea (red dot).

Fig2. Survey tracks (blue lines), bottlenose dolphin sightings (black lines and dot), fishing boats (red dots trawlers, green dots midwater pair-trawlers).



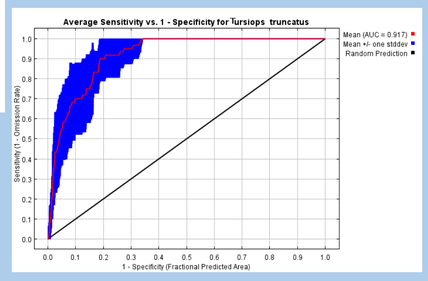
From June to September, between 2016 and 2018, during **67 daily surveys** a total of **60 bottlenose dolphins' sightings** and **181 fishing boats presence** were recorded.

Fig 3. Test omission rate and predicted area as a function of the cumulative threshold, averaged over the replicate runs.



The average test AUC for the replicate runs is 0.917 and the standard deviation is 0.031.

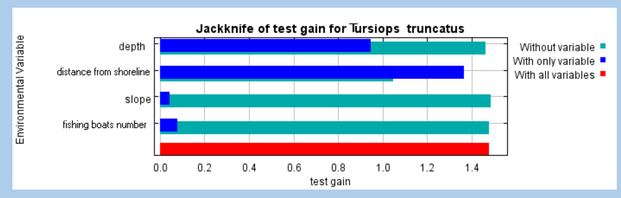
Fig 4. The receiver operating characteristic (ROC) curve for the data, again averaged over the replicate runs. The specificity is defined using predicted area, rather than true commission.

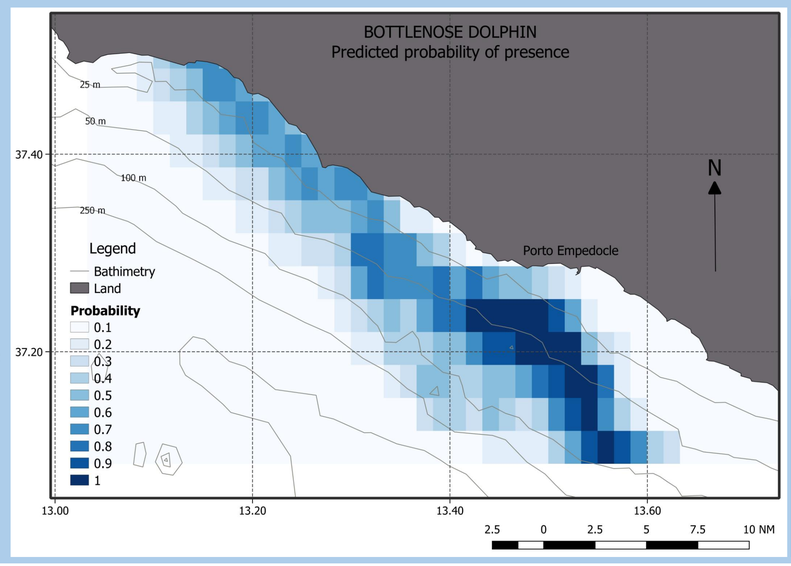


Tab.1 Estimates of relative contributions of the environmental variables to the Maxent model.

Variable	Percent contribution	Permutation importance
Distance from the shoreline (m)	79.4	90.5
Depth (m)	15.4	7.4
Slope (m)	5.1	1.5
N° of fishing boats	0.1	0.5

Fig 5. Jackknife test of variable importance. *Distance from the shoreline* results the environmental variable with highest gain when used in isolation, which therefore appears to have the most useful information by itself and the ones that decreases the gain the most when it is omitted.





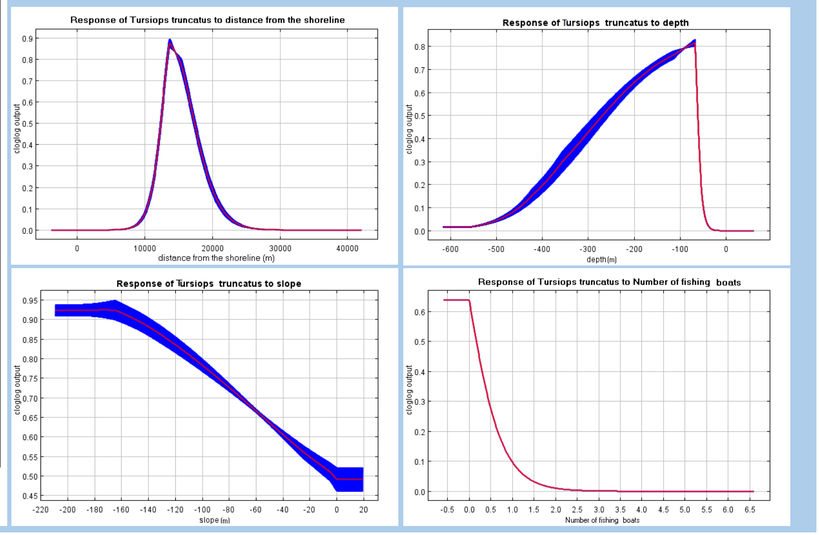


Fig 6. MAXENT MODEL. MAP illustrates the probability of bottlenose dolphin presence. PLOTS (right side of the map) reflect the dependence of predicted suitability both on the selected variable and on dependencies induced by correlations between the selected variable and other variables.

DISCUSSION

Distance from the shoreline is the variable with the greatest influence in predict dolphin's presence, while where fishing effort is greater decrease the probability of dolphins' presence, this could be due to: increased noise disturbance; competition and over-exploitation of marine resources; degradation of marine habitats. → MORE STUDIES ARE NECESSARY TO UNDERSTAND IT. **In this work were gained crucial information to the planning and management of the bottlenose dolphin conservation under the Environmental Directives worldwide.**

SCAN ME

This work is part of OCEAN ACTION HUB