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Modelling the distribution of *Delphinus delphis* in the Eastern Aegean Sea: identifying key variables in their habitat

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INTRODUCTION

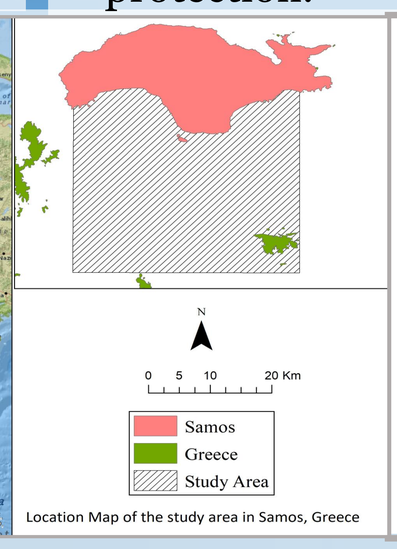
The subpopulation of short-beaked common dolphin (*Delphinus delphis*) in the Mediterranean Sea is classified as Endangered in the IUCN Red List (1). Their decline can affect the functionality and structure of the ecosystem, as they play a role of top predator (2). A conservation plan for this species has started by looking for **habitats of importance** in order to create marine protected areas (3)**. Species distribution modelling** predicts the spatial distribution of species and can be used in the classification of protected areas (4).

AIMS

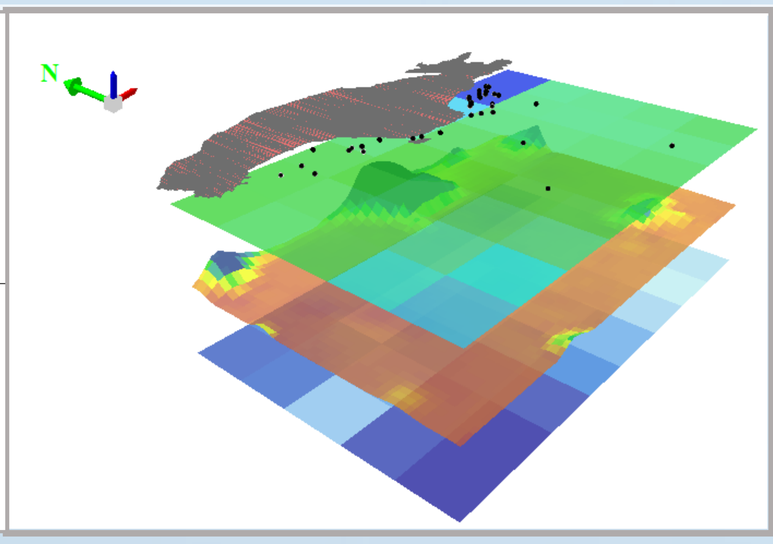
- To determine the **distribution** of *Delphinus delphis* in the waters south of Samos Island (Greece), in the Eastern Aegean Sea
- To create a species distribution model by using maximum entropy (**MaxEnt**) modelling
- To identify the key factors influencing the distribution
- To enhance **conservation plans** by an effective selection of the areas of importance that need protection.

MATERIALS AND METHODS

Sightings + Distance to Shore, Slope, PH, Depth, Chlorophyll-*a*, Sea surface temperature (SST)



Location Map of the study area in Samos, Greece



Pearson correlation coefficient (r <0.7) to reduce multicollinearity between environmental variables.

MaxEnt creates a **Species Distribution Model (SDM)** measured by the area under the curve (AUC). Values of AUC > 0.7 are considered good predictors. The **environmental variables** are studied by a percentage contribution.

RESULTS & ANALYSIS

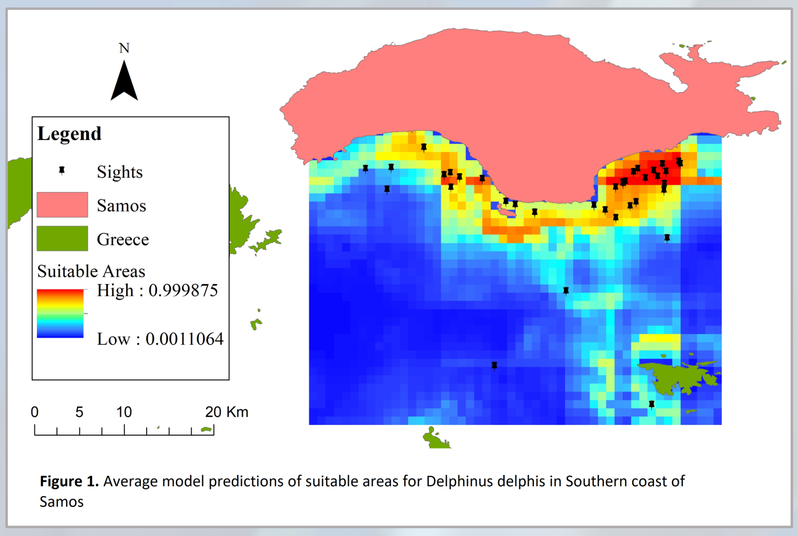


Figure 1. Average model predictions of suitable areas for Delphinus delphis in Southern coast of Samos

The model created has a good predictive value with a mean of AUC=0.86±0.07 (Figure 1). The total suitable area with a value AUC > 0.7 represents a 6.83 % (982.154Km²) of the total study area.

Topographic variables (distances to the shore and slope) play a main role in the species distribution (Table 1). Distances to the coast from 625m to 4000m showed to be the critical areas for the species (Figure 2).

Table 1. Percent contribution of each variable by presenting the mean result from the repetitions from the Maxent model for 2016 and 2017.

Variable	Percent Contribution
Distance to Shore	44.5
Slope	22.1
pH	16
SST	13.1
Depth	2.2
Chlorophyll-a	2.1

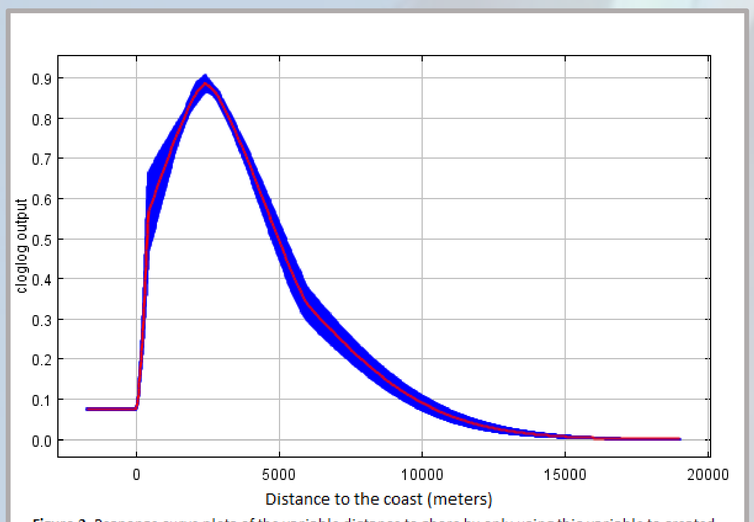


Figure 2. Response curve plots of the variable distance to shore by only using this variable to created predictive models. In red is shown the mean response from the 10 replicates and, in blue the standard deviations.

DISCUSSION & CONCLUSION

The model distribution of *Delphinus delphis* matches the sightings recorded in which the species is found close to the coast. The MaxEnt model shows that topographic variables contributed more than 50% of the prediction. These results are similar to Moura *et al.* (5) in which it is clear that areas close to the shore need conservation action to reduce the habitat disturbance, and thus the decline of the species.

The species distribution model has shown a well defined habitat, **identifying priority areas close to the shore**. Moreover, the oceanographic parameters influence the distribution and give information about the ecology of this endangered species.

PERSPECTIVES

Seasonal studies are required in order to understand how temporal changes in oceanographic parameters affect the distribution of the species as seen in Tobeña *et al.*(6), thereby, increasing knowledge of their ecology. This model can be applied for the conservation of the species by **identifying effective marine areas** to be protected and thus increasing the knowledge of their ecology.

(1) Bearzi, G. 2003. *Delphinus delphis (Mediterranean subpopulation).* The IUCN Red List of Threatened Species 2003: e.T41762A10557372. http://dx.doi.org/10.2305/IUCN.UK.2003.RLTS.T41762A10557372.en. [Accessed 14 August 2017] **(2)** Kiszka, J., Heithaus, M. and Wirsing, A., 2015. Behavioural drivers of the ecological roles and importance of marine mammals. *Marine Ecology Progress Series,* 523, 267-281 **(3)** Cañadas, A and Hammond, P., 2008. Abundance and habitat preferences of the short-beaked common dolphin *Delphinus delphis*in the southwestern Mediterranean: implications for conservation. *Endangered Species Research,* 4, 309-331 **(4)** Guisan, A. and Zimmermann, N. E., 2000. Predictive habitat distribution models in ecology. *Ecological Modelling,* 135, 147-186 **(5)** Moura, A., Sillero, N. and Rodrigues, A., 2012. Common dolphin (*Delphinus delphis)* habitat preferences using data from two platforms of opportunity. *Acta Oecologica,* 38, 24-32 **(6)** Tobeña, M., Prieto, R., Machete, M., Silva, M., 2016. Modeling the Potential Distribution and Richness of Cetaceans in the Azores from Fisheries Observer Program Data. *Frontiers in Marine Science,* 3, 2002.