Predicting Coral Gardens habitats in the Southwest coast of Portugal

MESH ATLANTIC

Investing in our common future

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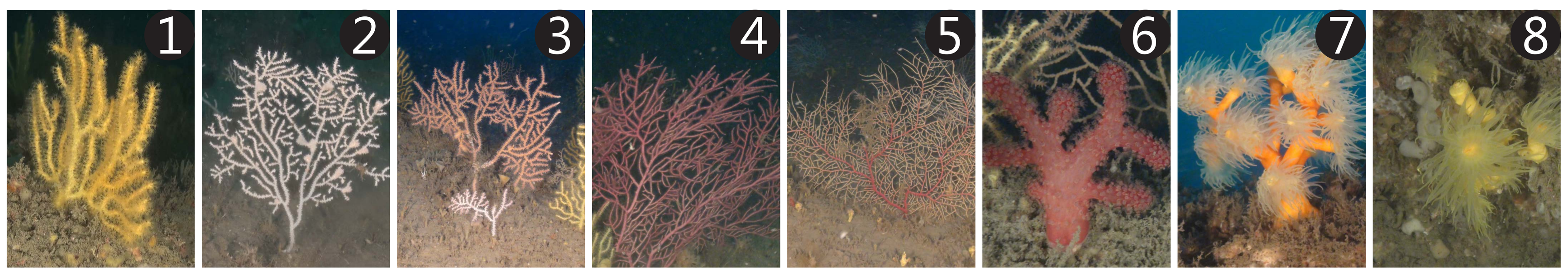
Introduction and objectives

Coral gardens are vulnerable and sensitive habitats protected by the OSPAR Commission. Knowledge on their distribution is essential to provide protection and integration in marine protected areas and also for marine spatial planning actions.
In the southwest coast of Portugal deep water coral gardens (50-80m) are characterized by several gorgonians species such as *Paramuricea clavata*[1] (Risso, 1826), *Eunicella verrucosa*[2] (Pallas, 1766) and *Eunicella labiata*[3] Thomson, 1927, occasionally *Leptogorgia sarmentosa*[4] (Esper, 1789), *Leptogorgia lusitanica*[5] (Stiasny 1937) and *Alcyonium acaule*[6] Marion, 1878. Species of true corals (Scleractinia), *Dendrophyllia ramea*[7] (Linnaeus, 1758) and *Dendrophyllia* cf. *cornigera*[8] (Lamarck, 1816) are less common.



The main purpose of this work is to produce small scale predictions of Coral garden habitats based on remote operated vehicle (ROV) observations.

Study Area and Biological data

Study area was located in the South western coast of Portugal (37°N, 8° 54´W). This area is characterized by rocky, sandy and muddy bottoms with a smooth slope and depths ranging from 50 to 80 meters (Figure 1).
The entire area was fully covered with multibeam sonar providing 5x5m bathymetry grid and geomorphologic interpretation. Two ROV transects were made in the same area with 3000m path and 5h40m duration. All images were georeferenced using the USBL data from the ROV. Video footage was analysed using the video annotation software COVER (Figure 2).

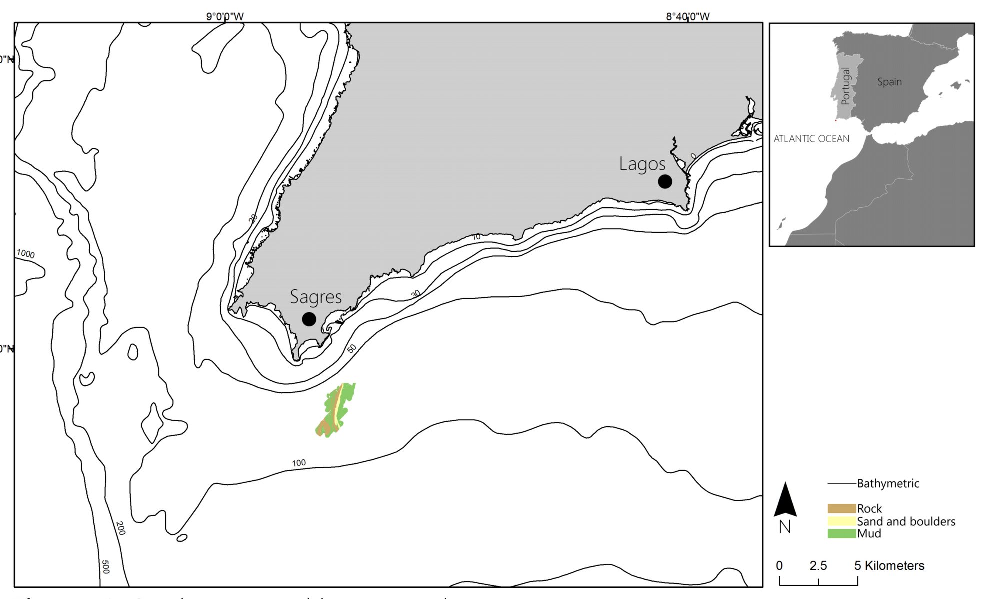


Figure 1. Study area and bottom substrates.

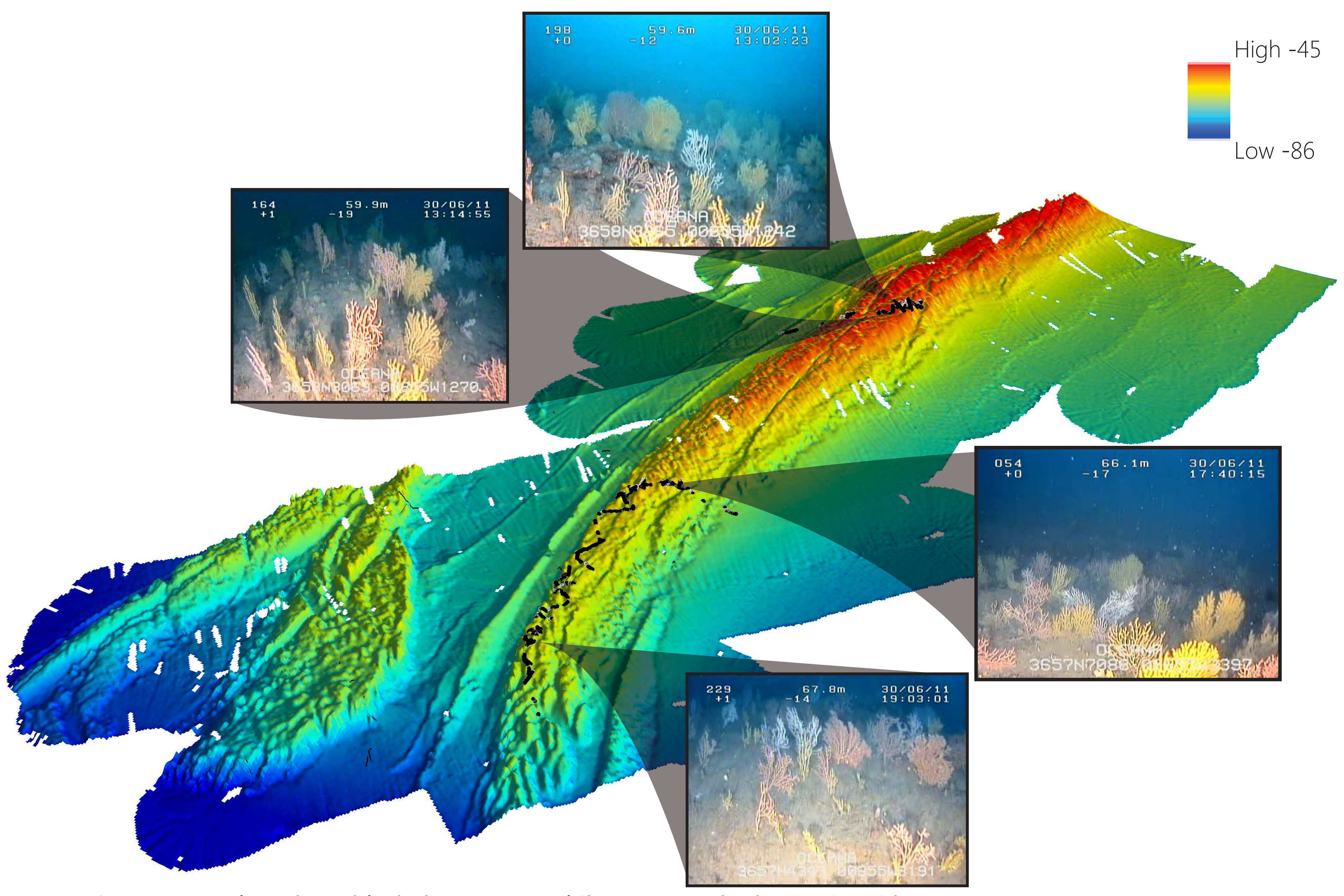


Figure 2. Coral gardens (black dots) over multibeam sonar bathymetric grid (meters).

Coral garden features were characterized by assemblages of Alcyonacea species mainly composed by *Paramuricea clavata*, *Eunicella verrucosa* and *Eunicella labiata* and occasionally complemented by *Alcyonium acaule*, *Leptogorgia lusitanica*, *Leptogorgia sarmentosa* and the more rare *Ellisella paraplexauroides*. This habitat is also characterized by the abundance of *Parazoanthus axinellae* and by the conspicuous and branched species of true corals (Scleractinia), *Dendrophyllia ramea* and *Dendrophyllia* cf. *cornigera*.

Data analysis

Maximum entropy approach using occurrence locations was calculated using MaxEnt software. The assessment of the probability of coral garden distributions was elaborated with the multibeam bathymetry and derivate layers, aspect (Categorical), slope, small and broad scale bathymetric position index (BPI), curvature and bottom type (Categorical). Highest value of AUC was used to choose the best model and select the best prediction variables. Original data was splitted in two dataset, training (75%) and test (25%). The True Skill Statistic (TSS) value was also used to assess accuracy and performance of the model.

Results

Coral Gardens

Coral gardens observations were abundant along the path of the ROV and covered the majority of the video transect. However, these Coral gardens were not continuous and occasional gaps were encountered, particularly in rock covered with a deep layer of sediment, sediment pits or over soft substrates (sand or mud).

MaxEnt

For the final model prediction, small scale bathymetric position index was rejected since it showed high correlation (0.81) with the broad scale bathymetric position index. The later index reveals a higher contribution for this model.
The final model has a mean AUC of 0.93 and a narrow confidence (one standard deviation) which indicates a good model. True Skill Statistic (TSS) of 0.75 also confirmed a fit model (Figure 3).
The relative contribution of each variable is given in Table I, indicating that the variables that contributed the most for this model were depth and sediment type.

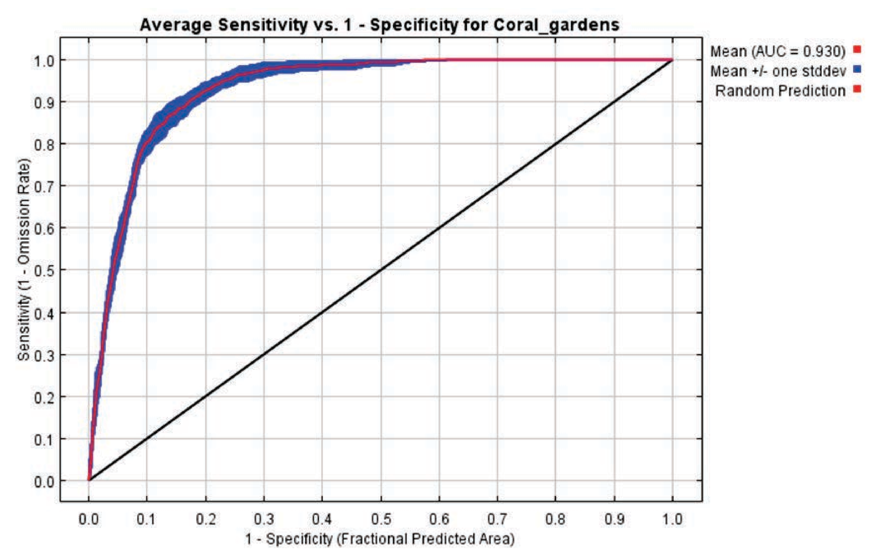


Figure 3. Study area and bottom substrates.

Table I. Model variables contribution.

Variable	Percent Contribution	Permutation importance
depth	66.2	72.5
sediment	31.8	25.7
aspect	1.2	0.8
curvature	0.4	0.4
slope	0.2	0.4
b_bpi	0.1	0.2

Applying the average value of the 10% training presence logistic threshold for the 10 replicates of 0.2133, the predicted Coral Garden Habitats are illustrated in Figure 4.

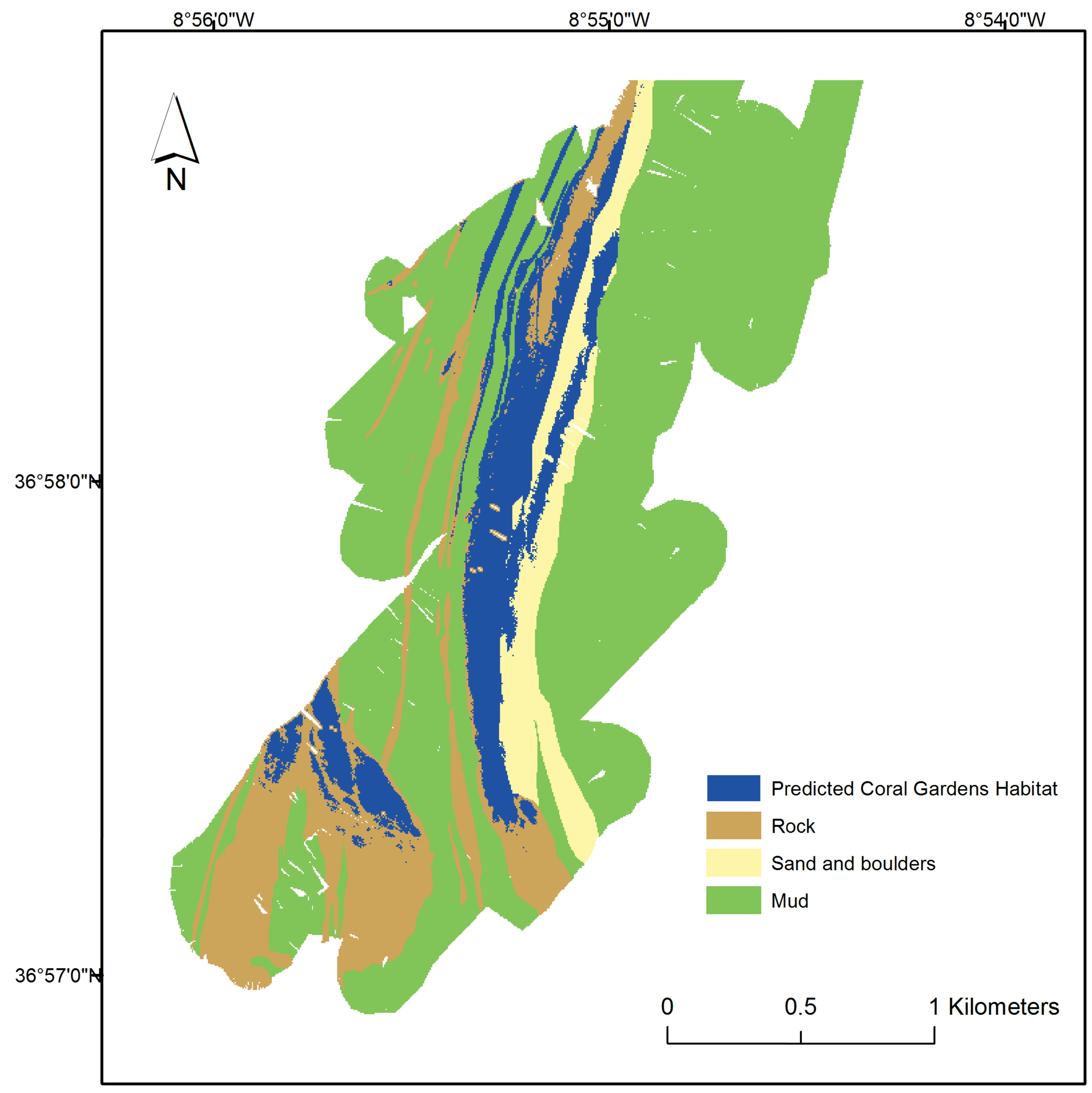


Figure 4. Predicted Coral Garden Habitats for the study area.

Discussion

The AUC and the TSS values obtained indicate good performance for the model, with depth and bottom type variables contributing the most for the model prediction.

The predicted distribution and the observed value suggest that this approach could be a valid contribution to predict coral garden habitats in wide surrounding areas with the same range of depth and geomorphologic features.