5º Simpósio sobre a Margem Ibérica Atlântica
5º Simposio sobre el Margen Ibérico Atlántico
5ih Symposium on the Atlantic Iberian Margin

2-4 • Novembro • 2006
Aveiro • Portugal

Livro de Resumos
Libro de Resúmenes
Abstract Book
INTRODUCTION
Coastal areas present valuable biodiversity and provide the means for the establishment and development of human activities (Bellan & Bellan-Santini, 2001). The pressure driven by those activities mitigates the ecosystems' ability to recover, thus highlighting the need for proper coastal management (Lacerda, 2003). Environmental management puts increasing demand on spatial surveys of marine ecosystems that support a wide array of habitats with diverse associated biotic assemblages. If these are to be protected then identification of their variety and delineation of their spatial extent and boundaries are required. Modelling patterns of community distribution suggested by Zacharias & Roff (2001) and Zacharias et al. (1999) propose models for predicting spatial distribution of intertidal communities based on biological and environmental data. In addition, the wide use of Geographic Information Systems (GIS) for graphic representation of habitats and biotic communities highlights the need for scientifically accurate maps for integrating environmental management processes (Johnson, 1990; Minonga, 2004). Recent coastal community classifications have been developed based on biotic and abiotic associations - biotopes - with management concerns (Titley Neto, 2000; Wallenstein & Neto, 2006, Wallenstein et al., in press) though not focusing on mapping these with environmental planning purposes. Legal protection areas of the Azores consist of Natura 2000 sites and Protected Areas, both created to protect the natural patrimony. In this context, based on a recent study by Wallenstein et al. (unpublished data) on algal-based biotopes for three substrate categories (cobbles, boulders and bedrock) of Santa Maria and São Miguel islands (Fig. 1), the present study intends to create a tool to predict intertidal algal communities' geographic occurrence on Azorean coasts. The overlap of such information with further ecological information and environmental legislation is intended to be used in further studies on the ecology of intertidal communities of the Azores and for management purposes.

METHODS
Bio-geo-morphological data used for the present study was collected using a balanced sampling design regarding substrate type (cobbles, boulders and bedrock), and a total of 15 study sites were surveyed. At each site transect lines were used for recording the starting and ending points of selected ecological categories used for biotope definition: green algae; calcareous turf; non-calcareous turf; Stypocaulon scoparium / Halopteris filicina; Laurencia spp.; Osmundea spp.; erect calcareous; calcareous crusts. For each ecological category's shore height distribution calculations were made for: maximum average height (MH), minimum average height (mH) and respective standard deviations (SDM and SDm). For generalization purposes it was assumed that the probability of finding each category on the shore is 100% between its respective MH and mH, decreasing proportionately to 0% from MH to (MH-SDM), and from mH to (mH-SDm) (Fig. 2).

![Fig. 2 - Scheme for the probability distribution of ecological categories along the shores of Santa Maria.](image-url)

Additionally, the average percentage cover of each ecological category [Wallenstein et al. (unpublished data)] was considered constant within 3 shore levels of the same amplitude [max. MH+SDM]. Consequently, the distribution of biotopes on the shores of Santa Maria results from the conjunction of two distribution criteria: (i) probability of occurrence; and (ii) average % coverage. On each of the 3 substrate shore coverage of each ecological category varies with shore height according to the following formula:

\[ P_A = P_O \times A\% C_i \]

- \( P_O \) - probability of occurrence
- \( A\% C \) - average percentage coverage
- \( i \) - shore height
- \( L_i \) - shore height level (L1 to L5)
  - \( 0 \leq L_i \leq (\text{max MH+SDM}) \)
  - \( (\text{max MH+SDM}) \leq 2 \)
  - \( (\text{max MH+SDM}) \leq 3 \)
  - \( (\text{max MH+SDM}) \leq 4 \)
  - \( (\text{max MH+SDM}) \leq 5 \)

This model was combined with substratum distribution charts and shore altimetry data by using a Geographical...
Information System for predicting each ecological category's shore coverage around the island of Santa Maria. Biotope maps were then created using ArcGIS 9.1® and biotope distribution was overlaid to geographic representation of legally protected areas to assess the level of protection of the defined biotopes.

RESULTS
Spatial distribution of intertidal communities shows a higher density in bedrock sites than on boulders, followed by cobbles. Cobbles present a higher occurrence of "green algae", while boulders and bedrock have a greater incidence of turf (Fig. 3).

Intertidal biotopes are distributed along the rocky shores of Santa Maria and cover 85.64% of the total intertidal mapped area for this island (Fig. 4). The island's protected sites cover approximately 50.11% of the total intertidal biotope predicted area (Fig. 5).

DISCUSSION
Modelling distribution patterns of intertidal communities has proved to reflect previous biotope description (Wallenstein & Neto, 2006), as well as substratum influence on intertidal communities described in Macedo (2002). As such, the proposed model proved useful and accurate to the extent needed for representing biotopes on Azorean shores. Cartography process allowed determining that intertidal biotopes cover a significant percentage of the total mapped area on Santa Maria. Santa Maria's biotopes are covered by protection sites to a great extent, and might thus be indicative of an excessive protection of the coast on that island. Protected Areas, although representing a strong protective tool, might also have a negative impact on traditional implemented activities such as tourism and fisheries, consequently mitigating economical development. Consequently, it might be worth considering the reduction of such protected areas to levels that are acceptable from both points of view – conservationism and economic development. However, these levels have never been defined for intertidal algae communities. The definition of minimum areas that assure maximum effectiveness in protecting intertidal communities would help greatly as a guideline for the definition of intertidal protection areas.

REFERENCES