



Case study

Ecosystem response to different management options in Marine Protected Areas (MPA): A case study of intertidal rocky shore communities

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ABSTRACT

Marine Protected Areas (MPA) can be powerful coastal management tools with several specific goals, although there is debate concerning their effectiveness. There is no consensus regarding the ideal size of MPAs, and actually there is some evidence that perhaps size is not as critical as other specific factors in determining their success in terms of populations' protection and ecological functions conservation. On the other hand, depending on the objectives, zones with different classification regimes in terms of rules and uses might enable the maintenance of the intended uses.

At this light, we examined the case of the small (605 002 m²) rocky shore area of Avencas, near Lisbon, on the Atlantic western Coast of Portugal, which was classified as Biophysical Interest Zone (ZIBA) in 1998, due to its exceptional intertidal biodiversity, after what its protection status became controversial, leading to conflicts with the local population and non-compliance with extant regulations. From 2010 efforts were carried out by local authorities to reclassify Avencas as Marine Protected Area, which was achieved in 2016.

Monitoring intertidal communities in a MPA and adjacent areas is an effective and low-cost procedure to evaluate the evolution of the biodiversity of rocky shores. Therefore, antedating the creation of the new MPA, assessments of the ZIBA biodiversity were conducted from January 2013 to December 2015 on a monthly basis. This timeline was selected as a function of a change in visitors' behavior induced from 2013 by several management and outreach initiatives, which increased in a certain extent the user's compliance with regulations.

A positive evolution was expected for density and/or species diversity of the different groups analysed (flora, sessile fauna and mobile fauna) in this three years period. However, a very strong storm occurred in 2014 produced a significant impact and changed large areas of the Avencas rocky shore. As a consequence, results did not display a recognizable recovery pattern of the intertidal communities, and following that extreme event are not even consistent with a hypothesized enhanced recovery capability of the ecosystem in a protected area. This suggests that longer data series are necessary to obtain more robust data regarding natural variability, since alterations caused by extreme events are always likely to occur. Additionally, results illustrate that indeed size matters because it influences the MPA openness, expressed as the ratio of periphery to area, and therefore its susceptibility to external driving forces. Such considerations must be taken into account in any management plan, which in this case should encompass an increase in the intertidal protected area, a new conditioned small-scale fishing regime, and an adequate monitoring programme to evaluate the effectiveness of the new management scheme.

1. Introduction

The Ocean is a living matrix of organisms and nutrients, and small changes in the usages of sensitive coastal areas can degrade its structure and function. Marine Protected Areas (MPAs) constitute coastal management tools that aim to mitigate these threats and can be planned

according to different specific objectives (Halpern, 2003). For some protected areas, the conservation objective is to maintain species biodiversity and not to export biomass for fishing purposes. In this case, several zones with distinct classification regimes, i.e., distinct rules and uses, can enable the maintenance of distinct traditional fishing activities (Horta e Costa et al., 2016). Currently there are 13 674 MPAs,

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