

BIODIVERSITY, CONSERVATION AND MARINE SPATIAL PLANNING

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ABSTRACT

The impacts of human activities, either on land or ocean (e.g., fisheries, tourism) are particularly evident on islands where inland activities have frequently repercussions on the coastal and marine environments.

Ecosystem-based management considers the whole ecosystem as a functional entity where humans play a role, and regards at ecosystem functions' management rather than considering either one issue or resource in isolation. We aim to include this concept in an integrated management strategy, with the application of modelling analyses (coastal and marine ecosystems) together with decision support guidelines in an attempt to achieve an ecosystem conservation strategy.

One of the questions most frequently asked by many naturalists and taxonomists is: "How many species can be found in a particular region or site?" However, it is difficult to record total biodiversity for each site, especially when most information is provided by ancient studies and grey literature.

Based on the information available on the ATLANTIS database for the Azores, biodiversity (specific richness) within several taxonomic groups was determined for littoral areas. Field work provides a database update, improving species spatial distribution patterns resolution and enables identification of the most sensitive and most threatened areas. Integration of biological and socio-economic information on GIS support assists zoning and enables a strong baseline for management decisions. A guideline is established for the definition of coastal and marine priority areas for conservation based on biodiversity evaluation criteria.

Conservation status is not only needed for the protection of globally important areas for species protection or priority areas for preservation action, but also to plan and define what measures are needed to achieve

such aims. An implementation strategy is needed and this is only possible with the integration of all system components (environmental, social and economic) - a biodiversity valuation being one of the steps to achieve any conservation goal.

RESUMO

As actividades humanas e os seus impactos na terra e oceano (e.g. pescas, turismo) são evidentes particularmente em ilhas onde apresentam frequentemente repercussões ao nível dos ambientes costeiros e marinhos.

Na abordagem ecossistémica, o ecossistema é considerado como uma entidade funcional, onde para além do desempenho humano é considerada também a gestão do ecossistema em vez de se reportar apenas a um tema ou recurso. Este conceito encontra-se incluído numa estratégia de gestão integrada, através dos modelos de análise (ecossistemas marinhos e costeiros) e de processos de suporte à decisão, numa tentativa de alcançar uma estratégia de conservação dos ecossistemas.

Uma das questões mais frequentemente utilizadas pelos naturalistas e taxonomistas é: quantas espécies podem ser encontradas numa região ou local em particular? É extremamente difícil efectuar o registo da biodiversidade total para cada local, especialmente quando a maioria da informação provém exclusivamente de estudos antigos e literatura desactualizada.

Tendo por base a informação disponível na base de dados ATLANTIS para os Açores, foi possível determinar, para alguns grupos taxonómicos, a biodiversidade (riqueza específica) existente em algumas áreas litorais.

A realização de trabalho de campo revela-se necessária para a actualização da base de dados, de modo a melhorar a resolução dos padrões de distribuição espacial e facilitar a identificação das áreas mais sensíveis e ameaçadas.

A integração da informação biológica e sócio-económica em SIG apoia o processo de zonamento e permite a obtenção de uma base forte de conhecimento de apoio à decisão em questões de gestão.

Através da valorização da biodiversidade poder-se-á efectuar a selecção das áreas costeiras e marinhas prioritárias para conservação.

O estatuto de conservação não é só necessário para a protecção de

espécies ou áreas prioritárias, como também para planejar e definir quais as medidas necessárias para alcançar esses objetivos.

É necessária uma estratégia de implementação e esta apenas é concretizável através da integração de todas as componentes do sistema (ambientais, sociais e económicas). No entanto, a valorização da biodiversidade é considerada como um dos passos chave que permitirá alcançar os objetivos de conservação.

INTRODUCTION

On 3 July 1881, Charles Darwin wrote a letter to Francisco d'Arruda Furtado, a naturalist from Ponta Delgada (Azores), where he reported:

"You have a splendid field for observation and I do not doubt that your researches will be very valuable".

In fact, in the Azores archipelago several studies had been undertaken focusing on biodiversity and it has been pointed as a "natural laboratory" by many scientists. On the last century, conservation needs have also taken place on their concerns and studies. Conservation implies to know about biodiversity, but also to perform some actions / planning to guarantee preservation. This is more difficult to achieve in the marine environment because of insufficient knowledge about biodiversity and its interaction with the human activities (e.g., fisheries) undertaken in each region.

Biodiversity conservation and its management are envisaged as goals not only at the archipelago level but especially at the island scale. Scientific reasons related to marine biology conservation but mostly the importance of marine biological resources in small islands' economies reinforces the importance of understanding stakeholder issues before the decision making process and the design of management strategies.

The Azorean coastal zone represents a significant proportion of the archipelago (a coastline 943 km long and a total area of 2322 km²). The increasing pressures on coastal and marine systems reinforce the need to find a framework based on social, economic and environmental values, to support sustainable decisions. Efforts should be made to improve policies and instruments for marine and coastal planning and management, in relevant areas. The marine com-

ponent of an archipelago, such as the Azorean, is an omnipresent feature in the decision making process. However, its inclusion into planning tools and integrated management is a new practice. Whereas spatial planning is widely applied to terrestrial systems its transposition to the marine realm is still in its early experiences.

Marine spatial planning (MSP) is a strategic tool for regulating, managing and protecting the marine environment that is combined with multiple, cumulative and potentially conflicting uses of the sea (Tyldesley, 2004). This definition appears to assume that MSP includes the “management” of either ongoing uses or activities. Other definitions address the potential scope of MSP as “marine spatial planning and management” (e.g., Birdlife International 2003). Some observers advocate that Marine Spatial Planning could improve the ability to assess and make decisions about cumulative effects in the marine environment (Gilliland *et al.*, 2004). In sum, it can be stated that Marine spatial planning aims at the integration and implementation of successful management strategies for coastal and marine

areas based on scientific knowledge, inputted into the decision-making process that has been, until now, based solely upon empirical fundamentals.

In the present study, we aim to contribute to coastal zone management in the Azores by inclusion of marine spatial planning in the process. With this goal in mind, the zoning of Marine Areas is attempted, based on the potential and sustainable use of marine resources without jeopardizing biodiversity conservation. A marine spatial planning process (geographically represented), based on the hierarchical categorization of usages and restrictions derived from an integrated and sustainable use of biodiversity in the Azores is the ultimate goal of this study. Here we present the strategy and the on-going work in process necessary to achieve this objective.

LEGAL FRAMEWORK AND DEMANDS ON MARINE ENVIRONMENTS – AZORES CASE STUDY

International conservation policies, together with the extensive use of coastal land for industry, housing and tourism

have strengthened the need to develop coastal and marine planning and management.

Until now, the marine environment was never seen as a trans-disciplinary scenario with a need for the integration of its diverse components to be undertaken within the framework of a planning study. The present project aims to overcome this issue and apply marine spatial planning to marine areas in the Azores. Therefore, this first approach to MSP is attempted in the Azores, as a contribution to the development of coastal zone and marine management in the Archipelago.

A general awareness of the need for coastal and marine conservation only arose as a result of European policies and demands regarding protection and management of naturally sensitive areas, namely with the Bird Directive (79/409/EEC of 2 April) and Habitat Directive (92/43/EEC of 21 May). This resulted, in the Azores, in the establishment of 13 Special Protected Areas (SPAs) and 17 Special Areas of Conservation (SACs) - all protected and classified components of the local coastal and marine environment under the Natura 2000 network.

In the Azores Archipelago, protected areas include several coastal and marine sites. These required different regional legal frameworks as they were established as a consequence of local scientific lobbying and display several designations corresponding to diverse and confusing aims for protection and management. Until the beginning of 2009, there were 24 protected areas in the Azores (12 Regional Natural Reserves; 4 protected Landscapes of Regional Interest; 7 Regional Natural Monuments; 1 Natural Park), but only 11 either are or include Marine Protected Areas. The first protected area that included a marine area was the Monte da Guia Protected Landscape (Faial Island) established in 1980.

Recognition of the necessity to maintain biodiversity amidst growing human pressures culminated at the World Summit (Rio de Janeiro, Brazil in 1992), where the Convention on Biological Diversity (CBD) was first opened for adoption by national governments. By ratifying that convention, all members committed themselves to implement national and international measures to achieve three objectives: (1), the conservation of biologi-

cal diversity; (2), the sustainable use of its components and (3), sharing the benefits derived from the use of genetic resources. By committing to a Global Programme of Work on Protected Areas, over 180 countries adopted the goal of establishing comprehensive, ecologically representative and effectively managed national and regional systems of protected terrestrial areas by 2010 and of protected marine areas by 2012.

A Marine Protected Area network (2012 MPA network) will only be fully accomplished when four key conservation questions are answered: what to conserve? what are the key threats to biodiversity? how much to conserve? where are the priority areas for conservation?

When applying terrestrial-based assessments to marine areas, as was attempted, problems arose as demonstrated by the difficulties experienced in implementing the Habitats Directive (92/43/EEC) in the marine environment. The tri-dimensionality of the marine environment increases the difficulty of its management. "How to do it?" and "Where and at what level of protection should be applied?" are some of the most frequent ques-

tions asked. Criteria developed for identifying terrestrial species and habitats for conservation cannot be easily applied to the marine environment (Derous *et al.*, 2007).

The selection of protected areas was often based on an *ad-hoc*, opportunistic, or even arbitrary choice. The chance of selecting the areas with the highest intrinsic biological and ecological value through these methods is small (Ray, 1999; Roberts *et al.*, 2003). In the Azores, the awareness and concern of the scientific community, led to the proposal for conservation of some marine areas by Santos *et al.* (1995). But, an increasing awareness that a more objective valuation procedure was needed, resulted from the limitations of the existing methods for assessing the value of the marine ecosystem.

In 2005, the European Commission developed a Marine Strategy Directive that recognized the need for a global strategy that would achieve the protection and conservation of the European marine environment with the overall aim of promoting the sustainable use of the seas and the conservation of marine ecosystems. The zoning of terrestrial areas in the Azores is

already common practice in the planning and management process, but zoning in marine protected areas is still uncertain.

BIODIVERSITY HOT SPOTS AND MARINE SPATIAL PLANNING IN THE AZORES

In a recently developed Coastal Zone Management Plans for the Azores project, an effort was made to articulate coastal zoning with marine planning (e.g., SRAM/CIGPT, 2008). However, this is a very fragile and simple zoning process.

To attain the purposes established for the application of MSP in the Azores it is necessary to define an intervention area. Selection of protected areas defined by the Natura 2000 network included a marine area and areas defined by the recent development of new local legislation – the Regional Network of Azores Protected Areas was the first step. Biodiversity evaluation of each area is one of the first steps necessary to achieve a conservation goal. Information can be retrieved from Atlântico (2003-2005) and Bionatura (2007-2008) (INTERREG III B Azores, Madeira and Canarias) projects that developed a first

detailed account of the distribution of species in the Azores Archipelago, based on literature and published studies (e.g. Morton *et al.*, 1998; DRA, 2004; Borges *et al.*, 2010). The resulting biodiversity database provides information on which areas (spatial 500m units) species were observed (recorded). The aim of these projects was to improve knowledge about Macaronesian biodiversity and its spatial distribution patterns in order to contribute to management and the conservation sustainability of natural values. Based on the data available on the ATLANTIS database, specific biodiversities (richness map) for several groups was determined for the areas under study.

In the example presented in Figure 1 (ATLANTIS database), species richness is determined for each spatial unit (500 metres). Within each spatial unit, or cell, can be found the number of species present and which species are resident in the area, enabling the elucidation of biodiversity hot spots. Protected and classified areas delimitations can also be integrated into the system.

Species richness will be represented in GIS support, together with information about species'

distributions as well as sensitive and activities areas. Integration on GIS can reveal areas that have an information deficit and those where higher biodiversity is observed. Such information can be grouped and/or regrouped using environmental laws and regulations and this will assist zoning and create a strong baseline upon which management decisions can be based creating a new interactive legislative framework.

Considering that most available information on biodiversity derives from scattered, often grey, publications and that there is a lack of quantitative data, some field work is still needed with regard to, for example, the identification of species and activities with direct or indirect impacts on the area, – rare/vulnerable species and species with economic values. Field work provides database updates and improves the resolution of species' spatial distribution patterns. Direct observations (e.g., SCUBA diving) enable registration of the presence and/or absence of vulnerable, rare or threatened species, species with economic values and gathers information about regionally important habitats.

The enquiries of local people, specifically those of local fisher communities, will help to draw use maps for marine protected areas. Habitat mapping, identification of the most sensitive and threatened areas, integration of physical, biological and socio-economic information on GIS, and multi-criteria analyses (economic-ecological trade-offs) are some of the further developments that can be developed by the project (Figure 2) to promote a stronger baseline for management and the user-sensitive zoning of Marine Protected Areas.

DISCUSSION

Threats to coastal zone integrity are expected to increase with the pressures caused by developers and increasing population densities, with adverse consequences for coastal and marine biodiversity.

The study under development seeks the implementation of guidelines, in order to achieve protection and attain conservation with the ultimate goal of improving the value of natural resources based on environmental and social-economic safeguards. Marine Spatial Planning is a dynamic tool useful to, possibly

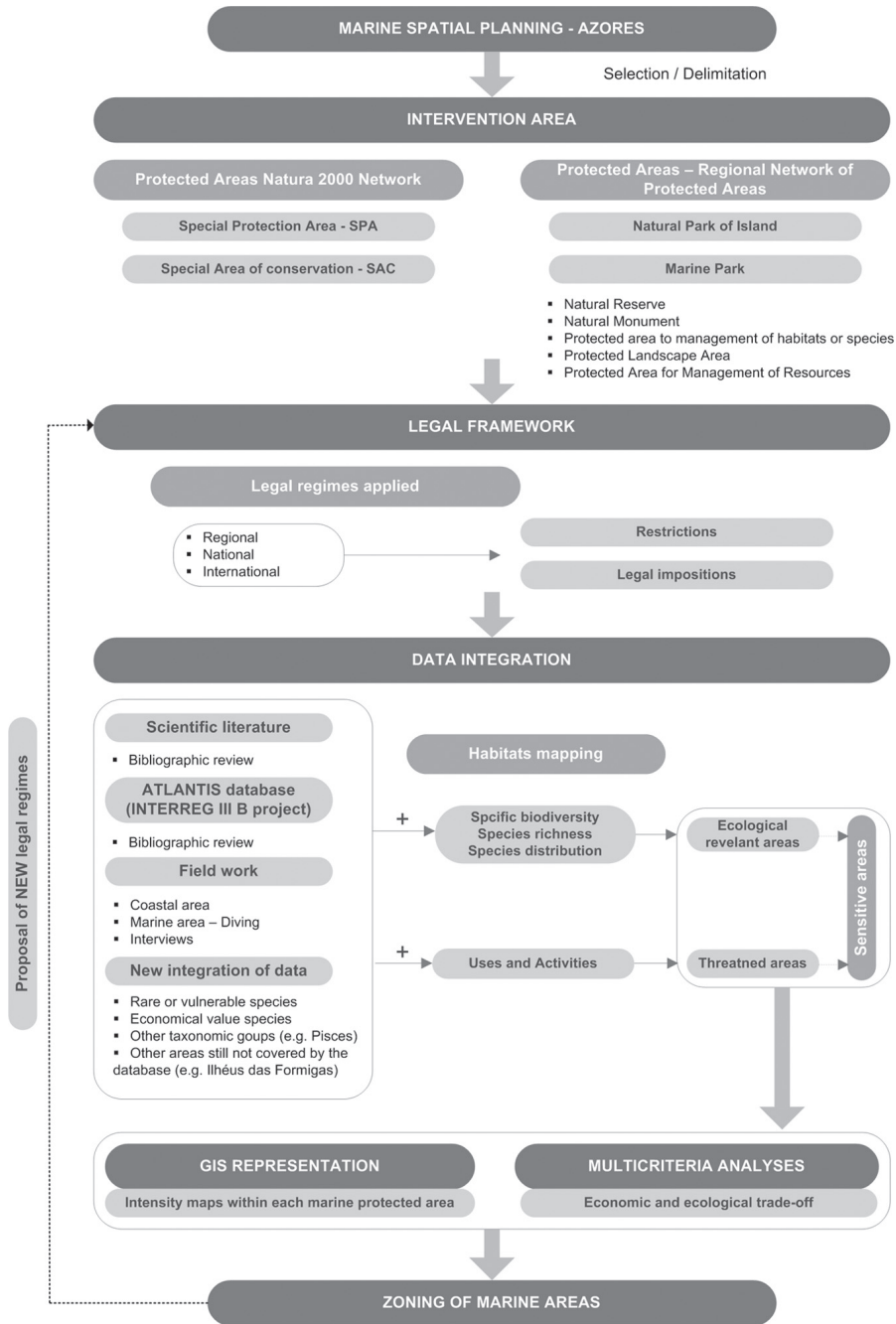


FIGURE 2. A conceptual framework of Marine Spatial Planning for the Azores.

essential for, local coastal zone management.

Although the state of knowledge about the Azorean coastal and marine environment has grown significantly over the past decade, there is still a recognized need for further information. Some gaps found, such as a recurrent lack of information about ecologically important places under study, should be urgently addressed so that better management over the temporal scale (as well as the spatial) can be achieved. However, some steps have already been taken with the information available, such as the identification of biodiversity hot spots, species' distribution and the elaboration of species richness maps.

The development of a monitoring plan applicable to protected areas is one of the tasks that we aim to achieve. Regular regional assessments would contribute not only to the validation process necessary for the establishment of the proposed conservation measures, but would also give insights necessary for the creation of new protected areas and other conservation actions.

In order to protect and conserve biodiversity, and to sustain the "splendid field for observa-

tion" as proclaimed by Darwin, it is necessary to propose, for each marine protected area, a suite of protection levels based on usage and conservation needs and demands.

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