CONSERVATION PLANNING IN SPATIALLY AND TEMPORALLY DYNAMIC MARINE ECOSYSTEMS

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Abstract:
Pelagic ecosystems provide a significant and vital component of the ocean's productivity and biodiversity. They are also heavily exploited and are currently the focus of numerous ecosystem-based management exercises. Over the past ten years there has been increasing enthusiasm for marine protected areas (MPAs) as a tool for pelagic conservation. However, there remains almost a complete absence of systematic conservation planning in the pelagic realm, both within exclusive economic zones and the high seas. Here we demonstrate the use of a decision support system to guide the implementation of MPAs that consider the physical and biological dynamics typical of the pelagic realm, and propose a method for integrative planning for pelagic and benthic conservation in the Southern Benguela ecosystem. Our approach was to maximize the representation of threatened species and key fisheries species within MPAs closed to fishing. In addition to representation, we consider MPA design to address the dynamics of the system using time series data of key oceanographic characteristics and abundance of small pelagic fish. We also discuss problems associated with offshore conservation, where the features of interest are ephemeral and dynamic. Our approach explicitly involves stakeholders and we incorporate socio-economic data into decision support tools.

There has been a significant decline in the diversity and abundance of pelagic species worldwide In particular, overfishing has resulted in the collapse of numerous fisheries, the decline of many species, and in some instances, changes in the structure and function of entire ecosystems. This has been, at least in part, due to management objectives focusing on maximizing the catch of particular target species while overlooking the inter-connections of ecosystems. In response, a body of theory has been developed on Ecosystem-Based Management (EBM) where ecosystems are managed holistically and management actions planned synergistically across all user sectors. One management approach that has become an increasingly popular tool for EBM is Marine Protected Areas (MPAs); spatially managed areas where human activities are regulated.

The science of designing MPAs emphasize the development of specific objectives and the application of decision support systems that help identify when, where and how objectives can be achieved. Developing specific objectives involves understanding the components of the ecosystem that require the most urgent attention, and the likely consequences of implementing these actions on pertinent ecological, social, political, cultural and economic systems. The Southern Benguela is a globally significant marine region renowned for its prosperous fisheries and unique biodiversity. It is part of the Benguela Current Large Marine Ecosystem, one of the four major upwelling zones of the world. Our aim was to develop a decision support system to demonstrate how to design a system of MPAs that might contribute to fisheries sustainability and the conservation of pelagic biodiversity in the Southern Benguela. Our approach was to set specific quantitative objectives, which included representational targets for key fisheries species and species of conservation concern. In addition to representation, we considered MPA design to address the dynamics of the system using time series data of key oceanographic characteristics and abundance of small pelagic fish.

One of the goals in the design of the MPA system was for it to contribute to sustainable fisheries management. No-take MPAs can potentially increase sustainability by insuring against overfishing, and in some cases, increase yields. Our approach was to stop fishing within a portion of each fisheries species distribution. Fisheries were also a major threat to several coastal seabirds in the region, particularly Gannets, African penguins and Cormorants, due to a lack of prey in their foraging areas. We identified areas important for protecting prey using estimated foraging ranges of breeding seabirds and variables such as primary productivity, likely to predict the more favorable feeding areas. The other major threat to biodiversity was by-catch from long line fisheries. For this we identified MPAs based on both fisheries and oceanographic data. While many of these species are highly mobile they tend to aggregate in areas of high productivity, such as eddies

We provided a novel approach to conservation planning in pelagic ecosystems. Our intention was not to provide a conservation plan for the Southern Benguela but an approach for the technical-assessment on where to locate no-take MPAs. It has been increasingly recognized that consultation with stakeholders is critical for successful implementation of MPA networks. While no consultation with stakeholders was made during this study, there is currently a process of establishing a network of offshore MPAs in South Africa to fulfill national and international legal obligations. We suggest for effective implementation, constraints and opportunities should be considered during planning and our approach is adaptable to this.