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Mediterranean marine protected areas

Francis Juanes

A collection of five recent papers assesses the role and effectiveness of marine protected areas (MPAs) in the Mediterranean. The papers provide a broad perspective of MPAs and include social, economic, cultural, biological and statistical components.

Fishing has an ancient history in the Mediterranean and much of that history and artisanal character can be seen in many Mediterranean coastal communities today. However, as is observed in many fisheries around the world, the growth of the human population has led to a decline in near-shore fish stocks, necessitating harvest of stocks further from the coast. In turn, this has led to technological developments that increase fishing efficiency, followed by increased market demands and eventually overfishing of target populations coupled with habitat degradation. Marine research and fisheries management in the Mediterranean are relatively recent events. Although early ecological marine work can be traced back to Aristotle, marine research only started to produce detailed descriptions of many of the exploited species about 100 years ago, with the creation of coastal marine laboratories.

Marine protected areas

Marine conservation in the Mediterranean, as is true for most global marine environments, is an even more recent subject than is marine research. Mediterranean countries have implemented a series of measures to conserve stocks and habitats; among them is the creation of marine protected areas (MPAs). There are presently 33 Mediterranean MPAs in the European Union (EU) (Ref. 1; Fig. 1), covering a total 477 453 ha. Five are in France, 11 in Spain, 16 in Italy and one in Greece, although this is by far the largest. There has, however, been no evaluation of the role and effectiveness of MPAs in the Mediterranean. Now, thanks in part to a collaborative research project funded by the EU, an international group of researchers has been organized to review the ecological impacts and socio-economic implications of MPAs. The first product of the ECOMARE project is a series of five papers and four short commentaries in a special issue of *Environmental Conservation* (2000, Vol. 27, no. 2). These papers are unique and of potential interest for several reasons, and are written primarily by scientists from France, Greece, Italy, Spain and the UK. They focus on the Mediterranean, a marine system that has been reviewed rarely in prominent ecological journals and, as a consequence, remains poorly understood by nonsouthern European ecologists. The papers provide a broad perspective on MPAs and include social, economic, cultural, biological and statistical components. The topic of MPAs is of broad ecological interest and has grown in the past decade as the field of marine conservation has itself matured. There is increasing evidence for the effectiveness of marine reserves as a management tool, and more political pressure to create marine protected areas (e.g. last May, President Clinton signed an executive order to strengthen and expand the system of MPAs in the USA).

MPAs and socioeconomic factors

Perhaps the most unique contribution is that by Badalamenti *et al.*[1], which outlines the cultural and socioeconomic impacts of Mediterranean MPAs. Interestingly, many of the EU MPAs are found in areas of their respective countries that are defined as economically depressed. These areas usually depend on tourism as an

Fig. 1. European Union marine protected areas in the Mediterranean. Locations taken Ref. 1.

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important source of income and, therefore, MPAs are often seen as tourist attractions and an impetus for economic development. Increased tourism, however, also leads to excessive growth and a direct impact on the environment being protected. These areas probably contain fishers who depend on fishing as their only source of income. In wealthier areas, however, fishers probably have more than one occupation and their secondary activities will allow them to gain benefits from MPAs. Unfortunately, there has been little research conducted to examine the social, cultural and economic aspects of EU MPAs. Socioeconomic studies performed outside the Mediterranean suggest that future development of Mediterranean MPAs will require multidisciplinary planning and management, which might be site-specific.

MPAS and species and habitat protection

Many studies worldwide have demonstrated conclusively the effectiveness of MPAs with respect to protection of overexploited species and habitats. MPAs generally increase species diversity, and the abundance and average size of exploited species. But, are there longer-term and more indirect effects that have not been studied as carefully? For MPAs to benefit local fisheries, protection must lead to increased species recruitment and/or emigration to nonprotected areas. The paper by Planes *et al.*[2] focuses on recruitment processes; few studies have addressed the effectiveness of MPAs in enhancing species recruitment in the Mediterranean because of the great difficulty involved in such research. The location and size of MPAs will ultimately define their effectiveness with respect to reproduction and larval ecology. For example, if the early life stages are to be protected, then nursery habitats must be located within the MPA. Near-shore zones are critical nursery habitats for Mediterranean shallow water species. Studies conducted in the northwest Mediterranean have, however, shown no differences between survival of early life stages of littoral fish in MPAs and in areas outside them. More puzzling, perhaps, is the finding that, for older recruits, mortality was higher inside MPAs. This might be because of increased predation within MPAs due to the protection afforded large predators. The indirect effects of protection and potential for negative feedback are subjects explored by two other contributions[3,4]. Sánchez Lizaso *et al.*[3] suggest that, if fish populations are controlled by density-dependent factors, then increases in abundance in protected areas could have implications for vital life-history characteristics, such as growth, survival and migration. Because there is still debate as to the relative importance of density-dependent versus independent processes in controlling recruitment, the establishment of MPAs could serve as a tool for testing competing hypotheses. Similarly, Pinnegar *et al.*[4] conclude that protection can lead to the development of trophic cascades with implications for trophic levels below (and above) the one at which the targeted species is found.

Responses of populations and communities in MPAs

García Charton *et al.*[5] examine our ability to detect and predict the responses of populations and communities in MPAs. To have some detection power, we must be able to distinguish clearly between effects of management and the natural variability in the system owing to factors other than protection. To ensure explanatory and predictive power of results, long-term data sets collected at relevant temporal and spatial scales are necessary.

Conclusion

These papers address a series of questions that have been asked rarely in relation to MPAs anywhere, let alone the Mediterranean. Although there are few data for predicting the biological, social or economic consequences of large-scale and long-term protection of habitats and species from harvesting, these papers emphasize the potential of MPAs for reversing Mediterranean degradation and produce a scientific basis for future research needs.

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