
GLOBAL TRENDS IN MARINE PROTECTED AREAS

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Introduction

Marine protected areas are increasingly being used to protect biologically rich habitats, resolve user conflicts, and help restore over-exploited stocks and degraded areas. The upsurge in the use of the tool is in part due to the fact that fisheries managers are now looking to reserves to complement conventional fisheries management techniques. In the United States, the legislative requirement to identify and protect essential fish habitat for managed fisheries species has contributed to the debate over and use of marine protected areas in all their various forms. Similarly, fisheries managers and government agencies abroad are now realizing that marine protected areas can serve to enhance sustainable resource utilization in addition to promoting conservation. We are thus witnessing an increase in the designation and management of marine protected areas that is occurring on two tracks: 1) the establishment of reserves to safeguard representative habitats or particularly rich and diverse areas, and 2) the use of protected areas to complement both fisheries and coastal management. Many will claim the new wave of marine protected areas is characterized by a strong reliance on marine sciences—scientific knowledge that has at long last matured to the point that it has become useful to marine resource managers. It should be noted, however, that protected area placement, design, and operation all relate to the scope and nature of the goals being targeted—i.e. the specific objectives the protected area is meant to achieve. The identification of these objectives is ultimately societal, not scientific. Subsequent to the elaboration of specific objectives, conservation biology and other sciences can be harnessed to help identify what needs to be protected and in what manner, leading to optimally effective marine protected areas. A few good examples of such well-planned protected areas have now emerged around the world, but unfortunately this number is small compared to the vast number of ill-designed “paper parks” around the world.

Global Trends in Marine Protected Areas

The designation “marine protected area” encompasses everything from small marine parks established to protect an endangered or threatened

species, a unique habitat, or a site of historical or cultural interest, to vast reserves that target a range of conservation, economic, and social objectives and encompass different types of protection. The use of marine protected areas has enjoyed a sudden upsurge in popularity as marine reserves

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are being invoked to complement and strengthen traditional fisheries management. In the United States this has been driven by the revision of the Magnuson-Stevens Fishery Conservation and Management Act, now mandating fisheries managers to identify and protect essential fish habitat. Paralleling this new push for the use of protected areas in fisheries management regimes has been an upsurge in multiple objective protected areas. Indeed, many of the newest marine protected areas are more ambitious than conventional marine protected areas, resulting in multiple use reserves that try to accommodate many different users groups, each with their own needs and objectives. Administrators are finding different uses can indeed be fostered without adverse impacts on ecosystem function, as long as planning is based on ecological realities, relies on specific objectives from the outset, and balances established objectives (Agardy, 1993). These protected areas can provide a footing for integrated coastal management and better ocean governance

overall. Whatever the scope of the protected area, the science of conservation biology has contributed important theories, perspectives, and tools, many of which await critical testing (Allison et al., 1998).

The terms marine protected area, marine reserve, closed area, harvest refugium, marine park, and sanctuary may cause semantic difficulty since they are often used interchangeably and without definition. The spectrum in size, design, and management objectives that comprise marine protected areas is vast—ranging from the small and focused harvest refugium (a place where harvest of one or more species, usually of fish or shellfish, is restricted) to the large and ambitious sanctuary. Closed area and harvest refugium are sometimes synonymous, but closed areas can also be closed to entry in general, or can be used to restrict non-living resource extraction such as oil and gas. Reserve is the term that most closely approximates a synonym of marine protected area in some countries though “reserve” can refer to a particular type of protected area such as a biosphere reserve, or, as in Britain, to an area closed to all fishing (in other words, a harvest refugium) (Gubbay, 1995). Lastly, there is that problematic term “marine park,” which outlived its usefulness when protected areas shifted away from being places of recreation. The term “marine protected area,” and only that term, encompasses all of the other terms, and is thus the term used herein.

Arguments abound about the nature of marine protected areas and how they relate to conventional land parks; the fact remains that marine protected areas do significantly differ from protected areas on land. The greatest single factor underlying this difference is the nebulous nature of boundaries in the fluid environment of the sea (Steele, 1974). It is notoriously difficult to attach boundary conditions to marine ecological processes, just as it is difficult to bound the impacts that affect those processes. While this is also true for inland freshwater systems, these ecosystems usually have distinct horizontal layers and outer bounds. In essence, it is impossible to “fence in” living marine resources or the critical ecological processes that support them, just as it is impossible to “fence out” the degradation of ocean environments caused by land-based sources of pollution, changes in hydrology, or ecological disruptions occurring in areas adjacent or linked to a protected area. This holds true not only for open ocean pelagic environments but for the coastal zones as well, where functional linkages between habitats are so geographically widespread. The vastness of linkages between species and between critical

habitats in a coastal area requires comprehensive management of all its parts (Caddy and Sharp, 1986).

The open nature of coastal and ocean areas exists as a spectrum ranging from relatively fixed and “land-like” systems to highly dynamic and complex systems. Coral reef ecosystems, for instance, harbor organisms that are largely confined in their movements to the specific habitats of reef, surrounding soft or hard benthos, and coastal wetlands. The structural framework for reef systems is fixed in place and can be mapped, much like a tropical forest provides a relatively fixed framework for the interactions of the forest community. The functional links between the water column in reef areas and the benthos are strong, so one can treat the ocean space together with reef structures themselves. In contrast, temperate open ocean systems such as estuarine/gulf/banks complexes are highly dynamic and in no way “fixed.” Here, living marine resources move in space and time according to physically dominated, largely non-deterministic patterns. The ecology of the benthos is not strongly linked to that of the water column, and physical reference points for the system cannot easily be mapped. This wide array of system types thus presents a challenge to conservationists and resource managers, requiring that protected area measures be appropriate to the system in question. The random application of terrestrial models to the marine environment will not result in a viable means of protecting resources and the underlying ecology that gives rise to them. New paradigms are needed—and the newest generation of marine protected areas reflects this new way of thinking.

Modern marine protected areas serve a wide variety of functions. However, there is no single “model” marine protected area. The size, shape, and means of implementation in any single marine protected area will be a function of the primary objectives that protected area sets out to achieve. If the goal of a protected area is, for instance, the protection of a single vulnerable habitat type from a specific type of use (e.g. protection of a fringing reef system from prospective shipping accidents), the resulting protected area can be simple in both design and management. If, however, the conservation goal targets a wide range of habitats/resources, the protected area will have to be necessarily more complex. Where a functional approach is adopted, in other words where the object of conservation is not a single stock of resources or a single species but the ecosystem and its processes, marine protected areas will tend to be large and encompass many types of linked habitats (Lauck et al., 1998). These large, multiple-use

protected areas can be thought of as demonstrating the concept of ecosystem-based management, where the limits of protection in a geographical sense are based on the extent to which movements of organisms and physically-linked processes (Hatcher et al., 1989; Dayton et al., 1995). The underlying ecology thus defines the outer boundaries for the area of protection, or management unit. In recognizing these linkages, marine protected area planners can work towards conserving ecosystem integrity, not just individual resources or ecosystem structures.

Globally, marine protected areas are being designated according to at least two major approaches: 1) preservation of ocean or coastal “wilderness” areas (the term wilderness is in quotation marks because no part of the world’s oceans, inland seas, or coastlines is pristine) and 2) resolution of conflicts among users (current or in the future). Most existing national marine protected area networks follow the first strategy. For instance, Parks Canada is currently designing a network of Marine National Conservation Areas to represent each of the 29 distinct ecoregions (based on large-scale biophysical units) of Canada’s Atlantic, Great Lakes, Pacific, and Arctic coasts. The long-term goal of this program is to establish a protected area in each region. Similarly, the federal government of Australia is developing a strategy for establishing a National Representative System within Australian Coastal and Marine Environments. In designing such a system, site selection will be guided by representativeness, opportunity, and redundancy (meaning that the government’s policy is to designate more than one protected area per representative habitat type). Other national efforts are currently underway. In fact, the 1995 publication of the Great Barrier Reef Marine Park Authority, the World Bank, and IUCN, which is the most comprehensive overview of existing marine protected areas and gaps in coverage, strongly urges all countries to establish such representative networks (Kelleher et al., 1995).

Conflict resolution is the other major driving force behind the establishment of networks or systems of reserves or protected areas. Virtually all the world’s coasts and nearshore areas are characterized by conflict between and among user groups or jurisdictional agencies, or at a minimum a serious lack of communication between these factions. Shipping and mineral extraction, for instance, often conflict with recreational use of coastal areas. Fishing, both commercial and subsistence, conflicts with skin and scuba diving and nature-based tourism. In such cases of conflict, zoning can be used to accommodate

a wide variety of user groups in relative harmony, and can be a tool for dispute resolution where conflicting uses clash (Reynard, 1994; Valdez-Pizzini 1995).

The human element in marine protected areas cannot be understated. The success of any protected area is closely related to how well user groups and stakeholders are identified and brought into the planning and management processes for the protected area. Marine protected areas cannot afford to be elitist, nor can they be exclusionary—again underscoring the difference between terrestrial and marine protected areas. Wilderness is not a concept easily applied to ocean areas—nor does it provide a particularly useful perspective for marine conservation. Humans and their needs are the driving force for marine protected area work, and humans stand most to benefit from their effective implementation. The designation of a marine protected area can provide local communities, decision-makers, and other stakeholders with a defined arena in which to promote effective management—a sense of place, as it were.

Table 1. Relationship between marine protected area objectives, size, and design complexity.

Specific MPA Objective	Relative Size	Complexity
Protecting an Endangered Species	Small to Medium	Simple
Protecting a Migratory Species	Large (or Network)	Simple to Complex
Protecting Habitat from Single Threat	Medium	Simple
Protecting Habitat from Multiple Threats	Medium to Large	Complex
Preventing Overfishing	Small	Simple
Enhancing Stocks	Small to Medium	Simple
Protecting an Area of Historic or Cultural Interest	Small	Simple
Providing a CZM Model or Empowering Local People	Small to Medium	Somewhat Complex
Promoting Marine Ecotourism	Small	Simple
Providing Site(s) for Scientific Research	Small	Simple
Conserving Biodiversity	Large (or Network)	Simple to Complex

Scientific information on biomass, dispersal patterns, recruitment dynamics, trophic interactions, and critical habitat are all needed for designing the size, shape, and management of marine protected areas. But what is needed first and foremost, and what is most often overlooked when the process of establishing a marine protected area is initiated, is information on what the protected area is being established to achieve. This goal-setting or objective elaboration

is critical in order to determine expectations, effectively design the reserve, and have in place targets and benchmarks against which progress towards the objectives can be measured. Thus, the most crucial information for protected areas is inherently societal, and not scientific. Table 1 suggests how reserve design and management can be a function of the specific objectives that the protected area is trying to target.

We now know that marine protected areas can be designed to help make fisheries and coastal management more effective. In the last 5 years, new, rigorous, and defensible evidence has emerged to show that marine protected areas do indeed improve fish yields while conserving biological diversity more generally. These benefits have included increased fish stock size inside the reserve as well as spillover effects in which fish populations have also increased outside the reserve (Roberts, 1995). One of the most cited examples of this spillover effect has been the work of Russ and Alcala (1996; 1997) in the Philippines, where a small protected area in Apo Island was shown to increase fish yields well outside the boundaries of the reserve less than a decade after its establishment. Other marine protected areas that appear successful in helping manage fisheries include Kenyan refuges (McClanahan and Kaunda-Arara, 1996; McClanahan and Shafir, 1990); New Zealand fishery reserves (Ballantine, 1991, 1995; McCormick and Choat, 1987); several Mediterranean reserves (Dugan and Davis, 1993); invertebrate reserves in Chile (Castilla and Duran, 1985); coral reef reserves throughout the Caribbean (Rakitin and Kramer, 1996; Reynard, 1994; Roberts and Polunin, 1991); Red Sea reserves (Roberts and Polunin, 1992); and fisheries zones in Florida (Bohnsack, 1996a, 1996b), inter alia.

A summary of published literature and anecdotal information shows that marine protected areas have yielded the following quantifiable benefits (Ruckelhaus, in Florida Forum Report #1, 1997): 1) increase in abundance of reef fish and invertebrates; 2) increase in individual size/age; 3) increase in reproductive output; 4) increase in species diversity; 5) increase in spillover; 6) increase in replenishment; 7) increase in preservation of genetic and demographic diversity; and 8) increase in habitat quality and diversity. All of these factors increase the potential for fisheries production and yields (Roberts and Polunin, 1993). There are even more examples of successful marine protected areas that have enhanced fish stocks through broader conservation measures aimed at protecting habitat and biological diversity

more generally (e.g. Agardy, 1997). An ideal situation seems to be the establishment of harvest refugia within the context of a larger multiple-use protected area such as a coastal biosphere reserve, marine sanctuary, or other large-scale marine protected area.

Fishers, nations, and indeed the entire biosphere can benefit from the establishment of marine protected areas at all scales and in all coastal environments. As noted above, the rationale for marine protected area establishment is no longer lacking—but the courage to go forward is often hard to summon. Despite incomplete knowledge and imprecise science, steps must be taken to establish protected areas now—and use the additional information we gain as time goes on to alter these reserves, remove superfluous ones, and add new reserves. By clearly defining objectives and using science to design the best possible plans for meeting those objectives, we can improve our management of marine activities before the health of the seas is compromised and with it the ability of marine systems to provide us with the resources and services upon which we increasingly depend.

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