in protected areas, and would like to see more marine areas protected in the same way that I wish more of the terrestrial habitat had been protected in parks.

I do see MPAs having an important role in fisheries management. First, in some places it may be possible to enforce protected areas where other forms of fisheries regulation are not practical. Second, in the US and other intensively managed countries, the vast majority of species are not regulated. Several hundred species are caught in the west coast trawl fishery, yet fewer than 20 are assessed (Hilborn *et al.* in press.). The vast majority of species are generally not of major commercial interest, but conservation concern for all species is currently driving management regulations; the west coast fishery is largely closed at present to protect several species classified as overfished. I see that MPA networks can be established to protect the biodiversity of marine communities, so that exploitation of the commercially important and healthy species can take place outside reserves. Essentially, the reserves would guarantee the protection of overfished or unassessed species. This will probably mean less (not more) yield of the healthy species compared to their potential yield, but it would allow commercial exploitation to continue in some places while providing for protection of a broad range of species.

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Juan Carlos Castilla
Centro de Estudios Avanzados en Ecología & Biodiversidad, Santiago, Chile

Elliot Norse's depiction of MPAs as the saviors of our marine environment does not ring true for the situation here in Chile. Perhaps this is because his ideas were formulated with the US in mind rather than an international perspective. However, even within the context of the US, Norse's views seem too narrow. Most troubling is the unquestioning advocacy of MPAs as "the central management tool" with "full protection necessary". One can come to a different conclusion if one begins with different assumptions, definitions, and goals for conservation. The conclusions reached regarding MPAs depend to a large extent on how we begin with definitions of biodiversity and conservation.

The oceans face serious conservation problems, with the state of the world's fisheries indicating resource overexploitations and a failure of existing management tools (Botsford *et al.* 1997). It follows that a new set of policies needs to be implemented to improve the situation. However, the establishment of marine reserve networks is just one of those tools. We should not fool ourselves into believing that simply via protecting or conserving coastal and open sea sites from "all preventable threats", problems will be solved. The situation is more complex, and the regulation of fishing effort is one critical aspect of it. Furthermore, scientists and agencies cannot agree on the exact meaning of "marine conservation", and the role of MPAs. The US National Research Council (2001) suggested that one of the main priorities for MPAs was to "protect biodiversity". It has been argued that "if society were forced to await the satisfaction of all economic interests before protecting their resources, it is improbable that much protection would ever occur, and the resources supporting the economic concerns would continue their collapse" (Sala *et al.* 2003). On the other hand, Sanchiro *et al.* (2003) have argued that MPA analysis should strive to better represent the complex ecological, sociocultural, and economic dimensions by including variables that are sufficient to capture the range of human activity (O'Connor *et al.* in press). These disagreements can go on forever. There are many possible options and I believe the best one is to first clarify the concept of biodiversity and then invigorate the direct participation of people such as fishermen, users, organizations, and governments. The UN Convention on Biological Biodiversity defines biodiversity as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this include diversity within species, between species and of ecosystems". Clearly, biodiversity includes not just the species that reside in an area, but also functioning ecosystems; biodiversity can be seen as a structural feature of ecosystems. Therefore, I suggest that a comprehensive approach to marine problems should embrace an ecosystem services perspective, rather than center mainly on species richness. Ecosystem services are those conditions and processes through which natural ecosystems, and the species that make them, sustain and fulfill human life; they maintain biodiversity and the production of goods (Daily 1997); and represent the benefits human populations derive, directly or indirectly, from ecosystem functions (Constanza *et al.* 1997). This does not mean that society should await the resolution of all economic concerns before protecting its resources. We must act immediately, using rational, comprehensive, and innovative approaches that include humans as part of the ecosystem. In fact, the first preamble clause of the Convention on Biodiversity refers to "the intrinsic value of Biological Diversity", but also to "the ecological, genetic, social, economic, scientific, educational, cultural, recreational, and aesthetic values". Ecosystem services can be classified into: provisioning (eg food, genetic resources), regulating (eg water, detoxification control), cultural (eg identity,

educational values) and supporting eg primary production, provision of habitats) (Millennium Ecosystem Assessment, in press). Thus we need to integrate into the concept of "marine reserve networking" a richer set of objectives than simply sequestering species in no-take areas. I suggest that marine management and marine conservation be melted into one enterprise. For example, artisanal fisheries are important components of coastal ecosystems throughout South America; marine conservation must include these fishing communities and the economic and production services they rely on, as well as species richness. In Chile, a mix of local, community-based management units and marine protected areas (Castilla 2000) promises the greatest hope for the marine environment. In general, we cannot expect any approach or solution to work in all countries. Adaptive and multi-approach plans will be needed, in which strategies ought to be adapted to countries, states, regions, governance, and idiosyncrasies.

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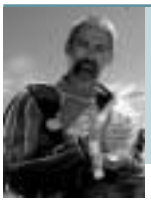

Stephen R. Palumbi
Dept. Biological Sciences, Stanford University, Hopkins Marine Station, Pacific Grove, CA, USA

Suppose there was no overfishing – that all fished species were perfectly managed to yield a sustained take – would there still be a need for any fully protected marine reserves? On the surface, this seems, perhaps, a foolish question, because reserves protect against the local damage caused by overfishing. But even in an imaginary world where fished species were not disappearing, there would still be powerful reasons to create reserves.

Impacts from exploitation can be felt even in the absence of overfishing. Fisheries species can be considered healthy even though they persist at only one-third of their former abundance, and many important fishing species are far rarer, at about 10% of historic levels. Reducing species to these levels can still yield sustainable fisheries, but such reductions in abundance can have dramatic impacts on marine ecosystems. Reserves can help to buffer these impacts.

Three aspects of fishing can generate impacts, even if fished species are sustainable. First, sustainable mechanized fishing can disturb bottom habitats, removing biological architecture species such as oyster reefs (Brooks 1891), dredging seabed structures that provide juvenile protection, or disturbing spawning grounds. Because even low intensity dredging can dramatically alter the seafloor for years (Peterson and Estes 2001), reserves play a key role by creating areas free of this impact.

Second, removal of a large part of a population – even when no physical habitat is disturbed – can result in extreme disruption of an ecosystem. This disruption is called ecological overfishing (Palumbi 2003) and an example is found in lobster harvesting. Low numbers of lobsters result in sea urchin booms and loss of kelp beds in New Zealand and California (Babcock *et al.* 1999; Laferty unpublished). Ecological overfishing of cod in New England led to the rise of dogfish communities. Removal of oysters in the Chesapeake Bay has helped muddy the US's largest estuary (Brooks 1891). Lessons like these show that even heavily managed fisheries can deplete species so dramatically that their normal ecological role is lost. As a result, the ecosystems left may be nothing like their natural state.

Third, fishing is now a diverse enterprise in which many species are exploited; there are few parts of the US where fishing concentrates on just one species. When we fish entire ecosystems, removing two-thirds to nine-tenths of the biomass of many different species, we can end up with a situation in which no species is technically overfished, but the whole ecosystem is depleted and non-functional.

When exploitation reaches every corner of the sea, these fisheries impacts become universal. Managers in previous centuries did not face this problem because there were always places in the sea where the technology of fishing could not reach (Bohnsack 1996). However, dredges can now navigate rocky seabeds that would previously have shredded nets, and the hunger of a populous world leaves few corners of the ocean untouched.

It is crucial to leave some parts of the sea unperturbed by these activities, so that in some places natural marine communities can thrive, grow, and persist. A strategy to establish reserves in every major marine habitat solves the problem of pervasive impacts of exploitation, at least in local protected areas. Reserve science has shown that many components of marine communities respond strongly to reserve protection, so this management device can help promote crucial conservation goals that are otherwise unattainable.

Naturally, these fully protected areas do not serve all conservation or management goals, and it is imperative that they be joined by other types of marine management schemes that allow access to the sea and its resources by

