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Editorial

The future of fisheries – marine protected areas – a new way forward or another management glitch?

Although retired from NOAA/NMFS since 1995, I have remained involved with the several issues which bear upon the marine fisheries: (1) declining yields worldwide, (2) too many fishers pursuing too few fish and shellfish, (3) an ever growing market for seafoods, and (4) a seeming inability for scientists, managers, and politicians to do much to stop several downward trends. Concerns about these issues are no longer expressed solely in agency management memoranda and local newspapers; national journals of science, such as Science, regularly have articles expressing concern and outrage about the situation. Jackson et al. (2001) recently wrote extensively on "historical overfishing and the recent collapse of coastal ecosystems". A few weeks later one of the nation's leading ecologists, Pimm et al. (2000), and colleagues wrote "Can we Defy Nature's End?", in which they consider local and global extinctions, including damage to marine fish, which arise because of overfishing and other insults. They suggested that marine protected areas (MPAs) enhance biodiversity and fish stocks. This year (2001) I was asked by the American Institute of Fisheries Research Biologists (AIFRB) to report on the MPAs during its Annual Board Meeting in Phoenix.

It is almost a decade ago (1992) when I was invited to chair a special session on "marine habitats and their protection from degradation". This session became part of the proceedings of the annual meeting of the Natural Areas Association, held at the University of Maine, Bangor (Pearce, 1995). During the session, papers were given by state and Federal scientists which dealt with MPAs, marine reserves, and refuges. This was the first time that many, if not most, of the attendees had heard about MPAs. It was not to be the last! One presenter strongly believed that "his" reserves would protect a fishery, or marine mammals, or an entire habitat (Crosby and Beck, 1995). More recently, however, Lackey (2001) suggested that many biologists he interviewed doubted that the wild Columbia River salmon could ever be saved, largely because of habitat failures, and managerial ineptitude.

Subsequently, there have been scores of journal and popularized articles about MPAs (see Dodd, 2001), all of which culminated in a recent volume entitled "Marine Protected Areas: Tools for Sustaining Ocean Ecosystems"(NRC, 2001). Written by the Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States, the book concludes that, relative to conventional management, "MPAs show promise". At the same time, limitations and controversies were recognized.

So, what is it that MPAs do? Basically, areas of varying sizes are set aside and closed to fishing or harvesting of other Living Marine Resources (LMRs). The MPAs then provide opportunities for reproduction, spawning, and recruitment of various LMRs. Moreover, the habitat of an MPA is not subjected to physical damages by fishing gear, or the noise, movements, and shadows resulting from docks, piers, vessel traffic, or transects. The MPAs in estuaries and coastal zones can preclude dredging, filling, dock construction, pollution, ocean mining, and other physical damages so common in many coastal areas. Such areas may then develop more robust stocks, capable of dissemination to other, unprotected, areas. Forage species, essential to fishes, other LMRs, and marine mammals, may grow and occur in far greater numbers, augmenting the diets of LMRs, and thus their growth and biomass. In many cases, the MPAs are designed to protect diversity and endangered species (Dodd, 2001).

The volume by the NRC (2001) provides abundant evidence that MPAs do provide for more robust populations of LMRs; certainly, photographs showing the differences in sea floors fished and not fished indicated conclusively that benthic forage species are much more robust and healthy in protected areas. These are often more diverse, populated by a greater range of taxa, than the areas fished. Evidence is increasing beyond mere intuition that wetlands and coastal aquatic habitats subject to ecosystem planning and protection, i.e., the Multispecies Recovery Plan (MSRP), are more robust, and characterized by greater species diversity, sometimes including endangered species (Kloor, 1999).

MPAs (large quadrants, $> 2\ km^2$) formerly subject to heavy scallop dredging, then protected, show

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reestablishment of benthic fauna, with increased scallop populations (Veale et al., 2000). Such findings have led the US Fish and Wildlife Service (USFWS) to initiate planning for widely varying habitats, from the Petit Manan National Wildlife Refuge Complex off the Maine coast (USFWS, 2001) to the Dry Tortugas off Key West, Florida, the latter a 150 square mile MPA with no fishing. As such planning has proceeded, however, there has been evermore criticism of MPAs. Fisheries oriented Internet "newsletters" now carry articles from newspapers as diverse as the Sacramento Bee and Bangor Daily News. Many are critical that the Federal agencies do not pinpoint where MPAs are to be located, but, rather, leave this to the states. Another concern is the establishment of "yet another bureaucracy"! Because MPAs may range from protecting a sunken transport or fishing vessel to precluding overfishing or increasing diversity, sometimes over thousands of square kilometers, the goals of an MPA are often misunderstood.

The NRC's summary (NRC, 2001) says it best: "MPAs seem to some to be a tool to fence in the sea, closing out former users of the sea's resources (My paraphrase)"! This is not an exaggeration; numerous articles in the aforementioned newsletters and magazines, oriented towards fishers and other resource users, are blatant in their hyperbole and dislike of the scientist, manager, and environmentalist. One magazine title read, "Zoned to Extinction: Overzealous regulation may soon render commercial fishermen a dying breed." (Paige, 2001).

Such antagonisms have made, and will make it near impossible to implement new techniques to manage LMRs, mineral extraction, and other uses of the seas. For instance, in the same issue of the magazine carrying Paige's article, the title "Reef madness: How Alabama fishermen are repopulating the sea" (Bailey, 2001) appears. This article stresses how artificial reefs have increased the productivity of coastal seas. But, however, it also emphasized how Alabama's fishers keep the location of "their" reefs secret. A concluding remark says: "We've learned that the creation of artificial reefs increases the fish population but they too will be overfished unless we take the next step of creating some form of ownership of these resources", probably through an individual fishery quota system. I have always envisioned a public resource as just that, public. Fishers may be awarded a temporary individual quota, and users of the sea floor may be given permission to fish or mine, but not with a carte blanche permit, and without proper monitoring to ensure compliance with those guidelines which ensure stability of the resource in perpetuity.

Use of the protected marine area is, without doubt, the only way to preserve certain reefs, coral heads, and associated fauna and these must be preserved. Reserves have been shown clearly to aid in the preservation of many tropical aquatic species; the Great Barrier Reefs of Australia come to mind in these regards, as well as the fringing reefs of Bermuda (see BBSR, 2001).

Areas closed to the harvesting of several marine species have been demonstrated to "grow" new spawning stock, and thus MPAs can be "rotated", as are many agrarian fields, grazing areas, and forests. One must, however, be cognizant of when to turn on a use or turn off another use. Working scientists I have spoken with state that some four decades of resource assessments and research on individual species have yielded sufficient information and data to allow management by areas to begin.

It is not a lack of science and scientific data that prevents the first step; rather it is a lack of political will and, perhaps, timid souls at the management helm. We live in times when one's neck must be extended if ever we are to manage effectively, the largesse of the World's oceans. The MPAs have been demonstrated in many ways to work and their use must be initiated if we are to conserve groundfish stocks, as well as endangered species and diversity and habitat stability.

Finally, the MPAs may ultimately be linked to other schemes such as "corridors" (see Kaiser, 2001; Hale et al., 2001) and artificial reefs or islands, new tools and pathways to provide "bridges" so that stock progeny and genes may disseminate or flow from one MPA to another, or from an MPA to an unmanaged area. Again, while controversial, these methods have been tested and found functional in breaking down barriers, natural and man made, to the dispersal of stocks and their progeny.

As for future research, the larger MPAs protected for long, sometimes very long, periods will allow us to assess change as it occurs with long-term cycles (millennia) and shorter-term, man-induced change. Recent research using mitochondrial and nuclear sequence data allows us to evolve hypotheses as to how common marine species (*Asterias forbesi* and *A. rubens*) evolved, sometimes in close juxtaposition (Wares, 2001). MPAs will be another "island tool" to aid in the verification of evolutionary change. They may also be the one best way to deal with marine pollution and physical degradation.

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