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What Does Your MPA Cost?: Considering the Various Costs of MPAs to Stakeholders and Management

Much discussion on MPAs, and particularly no-take marine reserves, focuses on their benefits: to the marine ecosystem - to research - even to fishermen as insurance against stock collapse, or as a potential source of fish spilling over into fished areas. There are costs from MPAs, too. Some costs, like the potential for foregone catches when no-take areas are placed on fishing grounds, often become a central focus in the planning of new MPAs.

There has been considerable study of the benefits of MPAs: seemingly any MPA-themed conference features multiple papers on fish abundance gains inside reserves. But there has been relatively little examination of the costs. Despite the high profile of foregone-catch arguments, for example, there are few rigorous studies on the actual economic impact of a new reserve on fishing revenue, comparing data from before and after site designation. And studies of the budgetary needs of MPAs, or how those needs can be managed most effectively, seem just as rare. This month, *MPA News* considers the range of costs associated with marine protected areas. We ask, what does it cost to operate an MPA - to resource users, to management, and to the ecosystem?

"Costs matter as much as benefits"

Tony Charles is a professor of Management Science and Environmental Science at Saint Mary's University in Halifax, Nova Scotia, Canada. As an advisor to several fisheries organizations in Atlantic Canada and in his work on fishery and coastal management projects worldwide, Charles has viewed the costs of MPAs as well as their benefits. "Costs matter as much as benefits," he says.

In a September 2007 presentation to the European Symposium on MPAs, Charles said any MPA planning process should consider the distribution of benefits and costs from the proposed site. "Who receives the benefits, who suffers the costs, and when do those benefits and costs occur?" he asked. The "when" aspect can be key: a fundamental tension in MPA planning comes from the fact that benefits from MPAs are often realized in the long term, while costs often arise in the short term. Benefits and costs can also vary geographically or in scale. In terms of the latter aspect, a benefit may be international - such as the existence value of biodiversity in a protected area - whereas the corresponding cost is local in the form of negative impacts on displaced fishers. ("Existence value" reflects the benefit people receive from simply knowing that a particular, cherished environmental resource exists.)

The fact is, designating an MPA often produces winners and losers. Some MPA planning processes take this into account and attempt to minimize the losses for affected stakeholders by adjusting site designs, or provide economic compensation to assist affected parties in adjusting to the new regime. Some take both measures. The Great Barrier Reef Marine Park Authority (GBRMPA) assessed the potential socioeconomic impacts on fishermen from its Representative Areas Program, during which the no-take percentage of the Marine Park increased from 5% to 33% (*MPA News* 5:10). The neighboring state government of Queensland projected the impact of those expanded no-take areas on shore-based businesses, such as fish brokers and businesses dependent on recreational fishing (www.qraa.qld.gov.au/newsitem.jsp?product=305&news=403). Those Queensland findings were incorporated in a "Structural Adjustment Package" developed by the Australian Government that has disbursed tens of millions of dollars to fishermen and fishery-related businesses affected by the rezoning (*MPA News* 7:7).

In terms of costs to fishers from MPAs, there may be both opportunity costs - such as foregone catches due to restrictions in the MPAs - and increased operating costs, such as expenses incurred in having to travel to alternative fishing grounds farther away. For a clear summation of potential costs (and benefits) to fishers, see "Marine Protected Areas: Economic and Social Implications", by James Sanchirico, Kathryn Cochran, and Peter Emerson, at www.rff.org/RFF/Documents/RFF-DP-02-26.pdf. The paper recommends that planners consider under what conditions an MPA's benefits would outweigh its costs. "If reducing potential costs to fishermen is important, then one might look to set aside areas that contribute relatively less to their

livelihood," write the paper's authors. "Why might one potential MPA site contribute less than another? It could be because the species are widely dispersed throughout the fishing grounds, or that the set-aside area is one of the least profitable areas to fish. Another reason could be that the current scale of the MPA is such that it does not make any discernable impact on fishing profits."

Cost of MPAs as a fisheries management tool

Ray Hilborn, a fisheries scientist at the University of Washington (US) who serves as an advisor to several international fisheries commissions, says no-take marine reserves are often an inefficient tool for fisheries management. That is, compared to traditional fisheries management techniques (e.g., restrictions on gear, fishing times, fish size), reserves can confer greater costs with fewer benefits (in the form of reduced catches) depending on a variety of conditions.

Hilborn was asked to compare the costs to industry if traditional management methods were used in one sample area while no-take reserves were used as a fishery management tool in another, otherwise-equivalent area. "If there is well-directed catch regulation in one area and MPAs only in another area, then one would expect a 'good' outcome in the 'traditional' area, with stable stock sizes and economic profitability, as found in our better managed fisheries," says Hilborn. "In contrast, using no-take MPAs only, you would find sedentary species almost exclusively inside the MPAs and severely overfished everywhere else. Highly mobile species of significant economic value would be depleted everywhere." Under this scenario, he suggests, adjacent ecosystems (as well as fishermen) would bear costs of the reserve. In reality, notes Hilborn, almost all Western countries combine MPAs and "traditional" techniques in their fisheries management strategies.

Still, it is possible that long-term benefits to fisheries from a marine reserve can outweigh the short-term costs. Hilborn, who with Raquel Goñi is studying the effects of spillover from Spain's Islas Columbretes Marine Reserve on local lobster catches, confirms this. "It depends primarily on the fishery management system outside the reserves," he says. "The poorer the fishery management system, the more likely it is that the fishery will be better off with the reserves." He also acknowledges that some reserves are designated primarily to protect biodiversity, and not as a tool to help manage fisheries and produce higher fish catches. Deciding what is optimal in terms of costs and benefits therefore depends on your objectives, he says.

Hilborn has partnered with fisheries scientists Carl Walters and Chris Costello to produce modeling work for the Marine Life Protection Act (MLPA) process that is planning a network of marine reserves in the US state of California. "In our MLPA work, we have found win-win circumstances, where you get higher catch, catch-per-unit-effort, and abundance [as well as biodiversity protection]," says Hilborn. "This can occur when you have a source-sink dynamic in the larval dispersal. In those cases you want to protect the larval sources, while fishing in the sinks. The question is whether we know enough about larval dynamics to identify those spots."

Costs of MPA management

The most direct costs imposed by MPAs are those for management: monitoring, enforcement, facilities management, and other budget items, including salaries for staff needed to perform these tasks. Kalli De Meyer, former manager of the Bonaire National Marine Park (BNMP), says she was surprised by a calculation of management costs for protected areas worldwide. "I had been managing the BNMP for 10 years when I attended the World Parks Congress [in 2003] and I remember hearing a keynote speaker expounding how cost-effective it is to set aside and manage protected areas," says De Meyer. "He claimed the global cost of park management, both terrestrial and marine, was in the region of US $1 per hectare. On the back of an envelope I was shocked to realize that BNMP had been running on closer to US $100 per hectare. Explain that to funders!"

De Meyer notes there are "added costs" associated with managing marine protected areas, as opposed to terrestrial ones. "Boots and binoculars are just not enough," she says, listing costs such as keeping boats up and running, mooring maintenance, compressors, diving equipment, and so on. "There is also the ongoing and high repair and replacement cost of equipment that is constantly out on the sea," she adds.

Now De Meyer is executive director of the Dutch Caribbean Nature Alliance (DCNA), an NGO that has led the development of a US $40-million endowment fund for protected areas. According to DCNA calculations, interest generated by that endowment will produce enough annual revenue to cover the basic operational costs of 10 protected areas (five MPAs and five terrestrial parks) in the Dutch Caribbean, which consists of Aruba, Bonaire, Curaçao, Saba, St. Eustatius, and St. Maarten. DCNA's three-volume study of the fund is available at www.dcnanature.org/donations/trustfund.html.

"Now that the Dutch Caribbean has created a regional network, it is fascinating to be able to compare spending across a range of parks," says De Meyer. "One of the things that has struck us is that spending is often a poor reflection of the time and effort that is poured into protected area management." She cites, for example, the budgetary figures reported for law enforcement at

Dutch Caribbean protected areas. These figures are often too low and don't reflect the realities of enforcement, she says. "Law enforcement expenditures, as reported in budgets, sometimes only include things like travel (to go to court), attorney fees (for advice or to write letters), translation costs, and equipment needed only for law enforcement activities, such as calipers to measure net mesh sizes," says De Meyer. "Often the reports don't reflect the huge amount of time spent on patrolling; following up on incident reports; the often long and tedious process of pursuing prosecutions; and overseeing and issuing permits."

MPA cost vs. MPA value

In 2002, environmental consultant Pippa Gravestock conducted a global survey of incomes and expenses for MPAs, including the minimal and ideal levels of funding necessary to manage an MPA effectively. Her survey of 79 MPAs found that a large majority of sites reported shortfalls in the funding necessary to meet their management needs ("The cost of operating an MPA", *MPA News* 5:5).

Gravestock's analysis of the survey findings looked for correlations between cost of management and various MPA characteristics. She found that MPA funding needs were positively correlated with visitor numbers and MPA surface area. In general, the more visitors an MPA had and the larger it was in size, the greater its management costs were. Thus, on a cost-per-hectare basis, large, highly visited MPAs were no more efficient than smaller, less-visited sites.

"At the most basic level, you would think that economies of scale should be present within any organizational structure," she says. In other words, you might expect larger MPAs to have more efficient cost structures than smaller MPAs - somewhat similar to how a larger factory is generally able to produce goods more efficiently than a small factory. "But my findings were actually that MPAs come in so many different shapes and sizes, with differing objectives and differing circumstances (proximity to population centers, accessibility, habitats etc.) that no clear evidence could be found for economies of scale," says Gravestock.

"Policing a very large and inaccessible offshore MPA may look like good value in terms of dollars per hectare, but protecting an unusual and unique habitat at a far higher cost per hectare may be money better spent," says Gravestock. "To turn one's budgetary firepower exclusively on 'big and efficient' (though perhaps rarely visited) MPAs may neglect the 'small and beautiful' MPAs where 'beauty' may equate to 'effectiveness in moving public opinion' or 'critical contribution to ecosystem services'. Indeed, if there was one over-riding finding in my survey, it was that MPAs cross so many orders of magnitude in their key metrics that modeling based on any one factor is generally a poor guide to their actual financial needs.

"I suppose what we need is a measure of 'value per hectare' to weigh against 'cost per hectare'," says Gravestock, who is now studying costs associated with MPAs on the high seas. "I needn't tell you, though, that calculating 'value per hectare' would be the hardest part."

For more information

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BOX: MPA Tip - On decreasing your MPA's overhead costs

These suggestions for decreasing your MPA's overhead costs are from remarks by Sibylle Riedmiller in the April 2002 issue of *MPA News* ("Stretching Your MPA Budget: How to Do More with Less Funding", *MPA News* 3:9). Riedmiller is project director for the Chumbe Island Coral Park, located 13 km southwest from Zanzibar, Tanzania. She credited these strategies in frugal management with helping the MPA survive through lean financial periods:

- Encourage help from volunteers;
- Keep some staff on seasonal schedules;
- Outsource monitoring to university students;
- Conduct marketing for your MPA primarily via the Web; and
- Choose technologies and technical equipment that are simple, appropriate, and low-cost to maintain.

Riedmiller said the last point was particularly important in developing countries. "Expensive, state-of-the-art equipment often breaks down in an environment characterized by tropical climates, power fluctuations, unskilled users, and lack of specialized spare parts," she said. In contrast, old computers and reconditioned vehicles can often be maintained locally and at low cost.

BOX: Benefits of MPAs

The preceding article discusses various costs that MPAs impose. There are benefits from MPAs, too - both to humans and the environment. The IUCN book *Guidelines for Marine Protected Areas* (available atwww.iucn.org/dbtw-wpd/edocs/PAG-003.pdf) provides the following list of potential MPA benefits:

A. Conservation of biodiversity, especially critical habitats of threatened species;

B. Refuge for heavily exploited species;

C. Protection of attractive habitats/species on which sustainable tourism can be based;

D. Increased productivity of fisheries by:

- Insurance against stock collapse;
- Buffer against recruitment failure;
- Increase in densities and average sizes of individuals;
- Increase in reproductive output;
- Provision of dispersal centers for propagules and adults (spillover);
- Maintenance of more natural species composition, age structure, spawning potential, and genetic variability;

E. Contribution to increased knowledge of marine science through:

- Information on functional linkages;
- Implementation of the precautionary principle;
- Provision of ecological benchmarks and control sites for research;
- Potential as nodes in monitoring networks; and

F. Protection of cultural diversity, such as sacred places, wrecks and lighthouses.
