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POLICY BRIEF

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Managing marine protected areas through incentives to local people

The case of Mnazi Bay Ruvuma Estuary Marine Park

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Marine Protected Areas (MPAs) in poor countries typically address the impact of fishing restrictions on rural resource-dependent villagers because of their mandate and because achieving conservation goals requires altering household fishing behavior. Income-generating projects create incentives for local people to reduce their fish harvest if the time spent in the projects produces more value than the time spent in fishing. Patrols and punishment reduce the value fishermen expect to receive from fishing and so can also reduce fishing effort. MPA strategies that consider a village's location relative to agricultural land, markets, and introduced projects are likely to be more effective than non-spatial strategies.

Marine Protected Areas (MPAs) are increasingly popular policy tools that, especially when applied in poor countries, typically have a central goal of protecting livelihoods in addition to protecting marine biodiversity and particular sites for recreation. MPAs often seek to address their negative impact on local households by providing some benefits to induce compliance with the restrictions and defray the burdens of the park. Still, the MPA restrictions on fish harvest can be particularly costly for small-scale fisherfolk who have few alternative livelihood options, particularly in the early stages of MPA implementation, because the combination of degraded fish stocks and new harvest restrictions create difficulties for near-MPA households.

Key Points

- The amount of conservation achieved through a marine park depends on the reaction of fishers to the park policies, viewed as a set of incentives.
- Fisherfolk will continue to fish illegally until the value of using labor in other activities surpasses that of fishing. Enforcement lowers the expected value of fishing and alternative livelihood projects offer other valuable uses of labor.
- Fisherfolk must meet livelihood needs at all times, which means that a moratorium on fishing while stocks recover is impossible. A "big push" of compensation and incentives immediately following park formation can bridge the gap as stocks recover.
- Seemingly similar villages may react differently to policy based on their location.

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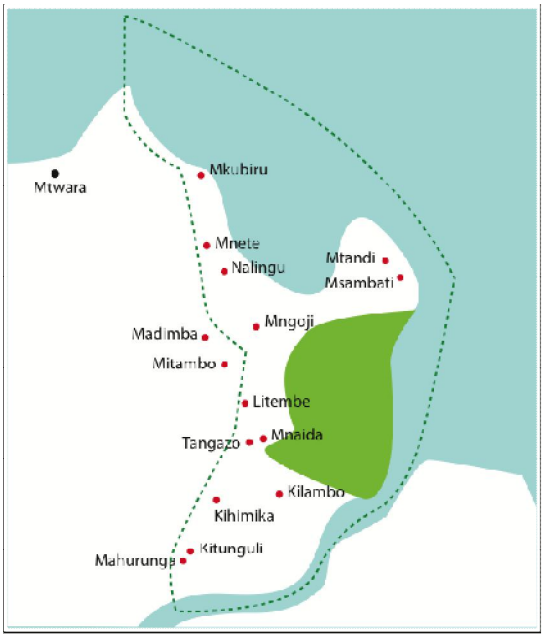
Managing marine protected areas through incentives to local people

Mnazi Bay Ruvuma Estuary Marine Park (MBREMP) in southern Tanzania is a marine park that uses a variety of policies to improve the Bay's fishery health by altering local people's behavior. MBREMP covers 430 km² of bay, ocean, land, and mangrove estuary and includes fifteen villages. Local reliance on fishing varies widely with some villages closer to the coastline almost completely dependent on artisanal fishing and inland villages almost completely agricultural. Since the park was gazetted in 2000, the park managers have phased in a series of harvest technology restrictions and undertaken various education and poverty-alleviation projects in the villages.



Schematic map of MBREMP (villages in red, mangroves in green, park boundaries dashed)

Key Policies in MBREMP

MBREMP's policy for management has several important components but managers emphasize facilitating compliance with, and enforcement via patrols of, regulations against various fishing technologies; mangrove cutting for commercial sale; and the use of nets with mesh size less than 2.5 inches. The regulations include a permit system for fishing within the MBREMP protected area, which is restricted to artisanal fishers who are resident in one of the villages within the MPA. The three primary activities of the park managers are enforcement, gear exchange, and alternative income generating projects.

Enforcement. Instead of basing fishing restrictions on the size of fish caught or on the size of landings, MBREMP managers enforce regulations about the type of fishing gear that fisherfolk can use in the marine park. The regulations prohibit some types of fishing, such as dynamite fishing, and define a minimum mesh size for fishing nets. The marine park confiscates fine mesh nets and other illegal gear wherever found in the marine park. In addition, they can confiscate legal gear, such as boats and legal nets, if they are being used with the illegal gear. The penalty of losing a boat represents a significant cost to any MBREMP villager. Still, the fairly low cost of fine mesh nets and the low patrol rates imply that the expected penalty of using illegal gear is not large and may not create an incentive to use legal gear, especially given the high cost of purchasing the legal gear. In addition, the marine park and village resource councils enforce a permit system for the extraction of trees from mangroves, and that probability of detection appears to be quite high, causing a deterrent to such harvest.

Fishermen with their nets in the mangrove

Gear Exchange. MBREMP offered a program through which villagers could trade in their illegal fine mesh nets in exchange for legal, large mesh nets. Although the number of nets available did not cover all marine park households, those who made the exchange avoided the difficulty of paying for these expensive nets. The incentive to exchange gear relates to the perceived enforcement probability. Disincentives to the gear exchange include difficulties in using the new gear, loss of the fine mesh nets for use elsewhere or for illegal use, and limited fish harvests due to the small size of fish currently in the bay.

Alternative Income Generating Projects. MBREMP has offered villages a variety of projects including beekeeping and fish ponds. Although several of these projects have generated incomes for the people involved, many have been located in villages with little or no dependence on fishing, which limits the project's ability to induce further reductions in fishing, encourage legal fishing gear, or compensate fisherfolk for lost resource access.

Fish pond introduced as alternative income generating project

Ongoing Problems and Considerations

Mesh size too large for fishing in the bay. Villagers and park managers agree that the early gear exchanges with 5 or 6 inch mesh nets produced problems because the fish remaining in the Bay were not large enough to be caught with those nets. Few fisherfolk have access to motor boats to fish beyond the bay where larger fish could be caught with the large mesh nets. Park managers have responded with gear exchanges involving 2-3 inch mesh nets but even those may not be able to generate good catches with the degraded fish stock. Early frustration with the large mesh nets has caused lingering dissent and the park has limited funds for gear exchange now.

Low levels of patrolling and enforcement. The inability of MPA managers to patrol often, even with guards from villlage resource management councils, generates low probabilities of detection for use of illegal gear. In keeping with the economics literature's concept of pairing low detection probabilities with high penalties to achieve deterrence, MBREMP confiscate the boats in addition to the nets when someone fishes with illegal gear. That level of penalty strikes many locals as unfair.

Unequal cost burdens across villages with equal projects. The park-sponsored projects all offer similar levels of value despite the diversity of the cost burdens the MPA imposes on villages, at least in the short run while fish stocks recover. Villages most dependent on the marine resources, typically those located on the bay and distant from agricultural land, face the highest costs associated with complying with the MBREMP regulations, yet all villages were offered similar projects. If projects provide compensation for the costs imposed by the park, fishery-dependent villages should receive larger projects. Similarly, fishery-dependent villages require larger projects to create incentives for cooperation with fishing restrictions. Providing uniform projects across villages appears equitable on the surface but does not address unequal cost burdens across villages and does not induce the largest possible reductions in fish harvest.

Within village project benefit disparities. Most of the projects offer significant benefits to a relatively small group of villagers within each project village. The projects do not address the costs of complying with the MPA regulations for the remaining individual fishers and intra-village equity. Similarly, those projects do not create incentives to reduce fish harvests for the villagers who do not capture the project benefits.

Park managers aren't development experts. Conservation managers recognize the impact of protection policy on resource-dependent people and, in some cases, that livelihood projects can provide incentives for conservation. In Tanzania and elsewhere, MPA managers face both conservation and rural development goals. MBREMP officials report some

frustration with this dual role because, although they see the importance and necessity of the livelihood projects, they are not trained as development experts. Yet, the rural poverty aspects of the MPA management loom large in MBREMP. One fisherman states that he undertook gear exchange but now uses his mosquito net to catch fish because he "can't protect against malaria when hungry." Conservation policy requires an understanding of the setting in which resource-dependent people make decisions, which involves a significant component of rural development expertise in order to define and locate interventions to create conservation incentives without undermining rural welfare.

Conclusion: changing behavior through incentives

MPAs can only protect resources when they implement policies that change the behavior of resource users to reduce or eliminate their impact on the ecosystem. In MBREMP this change is primarily through alternate fishing gear. This gear adoption and the related reduction in fish harvest is trickiest to achieve in the early years of an MPA when villagers see no benefits from a recovered fish stock and, instead, bear the costs of limited harvesting to permit such recovery. Rural fishing households who produce a few subsistence crops but rely exclusively on fishing for their income may change their behavior in different ways from fishers in a more developed market setting. For example, enforcement of fishing regulations, that could be access or gear restrictions through patrols and punishment, creates incentives for a household to allocate less labor to illegal fishing only if there are alternative labor opportunities. Enforcement is likely to have the smallest impact on behavior within the villages located closest to the fish resource who depend most on that resource -- at low levels, enforcement may induce no changes in fishing in these villages.

Many protected areas in developing countries aim to offset the burdens of proximity to a park, or to create additional incentives to cooperate, by offering villagers livelihood projects that limit the labor available to fishing or compensation for lost access to fish resources. Although these projects can improve rural welfare, they only reduce fishing pressure if households reduce their labor time spent in fishing activities, which occurs only when the value of labor in those projects outweighs its value in fishing. As with enforcement, the reaction to livelihood projects varies across villages and again has the least impact on villages that focus on fishing. In high-valued fishing settings such as for villages in MBREMP close to the coastline, enforcement's "push" combined with a livelihood project's "pull" of labor may not generate strong enough incentives to limit fishing labor allocations.

Offering all villages the same package of gear exchange and livelihood projects might appear equitable, but that practice has caused conflict in MBREMP. Villages where fishing is least important have benefited from livelihood projects that improve villager incomes whilst shouldering few costs caused by marine enforcement or gear exchange programs. Villages for which fishing is particularly important often find that the livelihood projects do not come close to compensating them for the loss of legal access to the fishery. Meanwhile, non-fishing villages bear few of the costs of marine park restrictions while capturing benefits from projects. Marine protected areas such as that in Mnazi Bay can increase their impact on fish stocks by examining the spatial heterogeneity of costs imposed by the park and tailoring their incentives and programs to each village's opportunity costs.

ABOUT THIS BRIEF

This brief is based on Robinson, Elizabeth J. Z., Albers, Heidi J., and Kirama, S. L. The role of incentives for sustainable implementation of Marine Protected Areas: An Example from Tanzania, *International Journal of Sustainable Society* (forthcoming).

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