ROLES OF COMMUNITY-BASED FISHERIES MANAGEMENT AND MARINE RESERVES IN COASTAL FISHERIES

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THE PARTICIPATION OF ORGANIZED COMMUNITIES in the management of coastal resources has gained worldwide acceptance as one of the viable strategies in managing dwindling fishery resources (see Scura et al. 1992, Ruddle 1994, Pomeroy 1994). There exist some examples of successful management of coral reefs and mangroves and their fisheries by communities that have been empowered as day-to-day managers of these resources (Alcala and Vande Vusse 1992, Alcala, pers. obs.). But it is not generally known that each of these successful examples incorporates a marine reserve, which is defined as an area of the marine environment protected from all forms of exploitation. This is probably so because the establishment of marine reserves for enhancing fish yields and building large spawning stock biomass is a relatively new development in fishery management. Even though marine reserves were established much earlier for other purposes (Polunin 1983), their use in fishery management is more recent (Alcala 1981, 1988, Alcala and Russ 1990).

This paper discusses the roles of organized and empowered communities and marine reserves in the management of coastal fisheries, with special reference to the Philippines. It will attempt to show the advantages of the community approach and the need for the establishment of marine reserves in the management of coastal fisheries

Community-Based Fisheries Management (CBFM)

Community-based approaches have been used in the management of agricultural and other land natural resources in many parts of the world, but these initiatives were not applied to marine and coastal ecosystems until much later (see Pomeroy 1994). The popularity of CBFM approaches has been brought about by failures of government management arrangements characterized by control, monitoring and surveillance by central authorities, which forced people to seek other solutions to the worsening problems of fishery depletion and natural resource degradation (Williams 1994). This is especially true in Asia and the Pacific region where fisheries provide a source of livelihood for large numbers of people and where community participation is an essential part of traditional fisheries management. Acheson and Wilson (1996) have argued that fishery management practices of tribal and peasant societies are generally successful because they are consistent with fisheries biology and the chaotic nature of marine resources.

There are several features or components of CBFM projects (see for example Ferrer et al. 1996). However, in my view, a highly successful and sustainable fisheries CBFM project may be characterized by the establishment of (1) viable organization or organizations in the community, (2) a working marine reserve protected by the community, (3) sources of livelihood, usually based on coastal resources, (4) networking arrangements with local, national or international organizations and agencies, and (5) a capacity-building program. Based on these criteria, it is estimated that about 50% of the 20-odd community-based coastal or fishery projects in the Philippines can be considered successful. In contrast, projects employing the top-down approach, mostly government-led, were failures.

The relative success of CBFM projects (conducted mostly by the private sector and educational institutions) may be traced to the organized communities whose stakeholder members had developed a sense of being proprietors and claimants of the resources (Walters 1994). As already stated, these communities have been empowered, through the CBFM approach, as the day-to-day managers of their fishery resources. The role of government in the empowerment process is to support the development of effective CBFM regimes by stakeholders of fishery resources (Alcala and Vande Vusse 1994).

Marine Reserves

Marine reserves have been established the world-over for two major reasons insofar as fisheries are concerned, which are (1) to enhance fish yields in fished areas adjacent to the reserves (non-reserves) and (2) to protect a critical spawning stock biomass in order to ensure supply of recruits to fished areas via larval dispersal (see Russ and Alcala 1996 for literature review). Other objectives include protection of biodiversity or the environment (e.g. coral reef) in order to make the area attractive for ecotourism. Alcala and Russ (1990) have argued that control of fishery effort through marine reserves is one of the few viable options for management of shallow-water marine fisheries in countries like the Philippines, where about 10-15% of marine fish production is supplied by coral reefs (Carpenter 1977, Murdy and Ferraris 1980, McManus 1988). Another benefit of marine reserves is the protection of a minimum spawning stock biomass that will guard against recruitment overfishing (e.g. Bohnsack 1990, 1993, Roberts and Polunin 1991, 1993).

There is evidence, though limited, that populations of fished or target species in reserves replenish those species in areas adjacent to reserves through movements of adult fish, otherwise known as "spillover effect" (see for example reviews of Davis 1989, Roberts and Polunin 1993, Dugan and Davis 1993, Rowley 1994). The first evidence comes from our work at Sumilon Marine Reserve in central Philippines where we demonstrated a significant decline in catch rates and total catch for coral reef fish after the reserve which had been protected for 10 years was heavily fished. This suggests that movements of fish from the reserve to the non-reserve (fished area) enhanced fisheries yield (Alcala 1988, Alcala and Russ 1990). The second evidence consists of a demonstration of increased catch rates for snow crabs in a fished area surrounding a Japanese reserve protected for years (Yamasaki and Kuwahara 1990). The third evidence comes from our observations in another marine reserve on Apo Island, central Philippines, where we found significant positive correlations of both mean density and species richness of large predatory coral reef fish during the period of reserve protection in both reserve and non-reserve areas (Russ and Alcala 1996). During the period of nine to eleven years of protection, there was a significantly higher density of these fish in the area closest to the reserve (200-300 m). Movement of fish from marine reserves to adjacent non-reserves is the subject of study by several investigators (see Russ and Alcala 1996 for literature citations).

The second objective of establishing marine reserves, that is, protecting a critical stock biomass to ensure supply of recruits to fished areas away from reserves via larval dispersal, has not been confirmed by our studies. However, it is known that larvae of coral reef fishes from protected areas may be transported by ocean currents over distances of tens or hundreds of kilometers (Frith et al. 1986, Doherty and Williams 1988). Such effects of marine reserves would be true over a long term.

The Sumilon Marine Reserve, occupying about 25% of the 50-hectare coral reef of Sumilon Island in central Philippines was established in 1974. Fish yields from fish traps, hooks and lines, gill nets, and spears were monitored for six separate years during the period 1976-1983/84 in the fished area (non-reserve). There was evidence of yields gradually increasing, especially from traps. The annual yields in tons per km^2 increased from 9.7 in 1976 to 14.0 in 1977, 15.0 in 1978, 16.8 in 1979, 14.4 in 1980 and 16.8 in 1983/84 (Alcala 1981, Alcala and Russ 1990). In 1984, the reserve lost its protection and was heavily fished, resulting in the decline of those species constituting the majority of fish yield, mostly caesionids (Russ and Alcala 1989), Alcala and Russ 1990). The result was a reduction in catch rates of 57% for hooks and lines, 58% for gill nets, and 33% for traps, and a 54% decline in total catch (from 36.9 tons/km^2 in 1983/84 to 19.87 tons/km^2 in 1985/86) (Alcala and Russ 1990). Alcala and Russ (1990) suggested that these results were due to migration of adult fish from the reserve to the non-reserve (fished area).

The finding that fishers caught more fish from 75% of the reef area during period of protection than from 100% of the area when there was no protection would seem contrary to common sense. But Beverton and Holt (1957) provides a theoretical explanation for the higher yield during time of protection: at high levels of fishing mortality, as in the case of Sumilon, closing certain areas to fishing as a regulative measure can enhance yield per recruit. However, preliminary modeling of effects on yield per recruit by Russ et al. (1992) indicated that the maximum yield enhancement, assuming random dispersion, was only about 10% and that there is a strong possibility of other mechanisms operating to produce the large enhancement effects reported by Alcala and Russ (1990).

Marine Reserves as a Management Tool

In order to be effective in fisheries management, communities need assistance in such areas as capability building, finance, legislation, and technical arrangements (Scura et al. 1992, Williams 1994). In addition, one technical tool that has been shown to be effective in convincing communities to protect their marine resources and sustaining community effort at management of coral reef fishery is the marine reserve. Marine reserves can be part of the management strategy (e.g. Munro 1995). As illustrations we shall cite the CBFM experience in the Philippines.

The enhanced fish yield in fished areas as a result of the Sumilon reserve natural experiment, already discussed, has convinced several organized communities engaged in CBFM in various parts of the country to include a provision of reserve establishment in their management plans. To my knowledge, many CBFM projects established and maintained reserves for the purpose of increasing fishery yields. But another reason for reserve establishment is to prevent pollution, as exemplified by the rejection of a pullutive industry by the Bolinao, Pangasinan community. Marine reserves are also utilized by organized communities to attract tourists.

This enhancement of fishery yields through marine reserves would encourage subsistence-level fishers to adopt management schemes directed at long-run productivity. It would also convince people of the relevance of coastal resource management (Newkirk and Rivera 1996). Some examples may be cited. The Apo Island Marine Reserve was established in 1982, following the Sumilon model. The community believes that their fish catches doubled after ten years of protective management, and Russ and Alcala's observations (1996) tend to confirm this assessment. Furthermore, the community earns from the use by tourists of the protected area.

Heinin and Laranjo (1996) reported that the establishment of a marine reserve was the rationale for a CBFM project in Danao Bay, Baliangao, on Mindanao Island. this is also true of several CBFM projects in Eastern and Western Visayas (pers. obs.). The continued effort at coral reef protection by the organized community at San Salvador Island, off Masinloc, Zambales, Luzon Island revolves around the marine reserve it established earlier (Dizon and Miranda (1996). In brief, marine reserves play an important role in the community management of coastal fisheries. All successful CBFM projects incorporate marine reserves (pers.obs.).

Sustainability of CBFM Projects

Of all issues in CBFM, that of sustainability stands out prominently. Pomeroy (1994) expressed his fear that subsistence-level fishers would not accept management schemes with long-run objectives. Sorensen and McCreary (1990) argue that local governments and local communities usually cannot adequately manage coastal ecosystems because of their limited area jurisdiction, limited research capacity, budget constraints, and dominance of parochial interests in local politics. The consequences of these limitations are that either management projects cannot take off at all or they cannot be sustained in the long term.

It is a widely established fact, and one that my own personal experience has confirmed, that parochial or even selfish interests on the part of local politicians have been a major reason for failure of some CBFM projects. Under conditions of unresolved political conflicts, community workers had to abort projects and leave the project areas. Fortunately this does not happen frequently.

The limitations in research capacity and in area jurisdiction, though real, are not unsolvable. These problems have been overcome by training, capacity building, and linking with non-government organizations and academic institutions in a number of cases, resulting in relatively successful CBFM projects.

What matters most in my experience is budget limitation. Generally, partner organizations in CBFM undertakings are prepared to provide financial and technical support for only two or three years, whereas four to five years are usually required for a community to form viable organizations that are capable of formulating and implementing development plans. It also takes about the same length of time to place communities on a solid footing in terms of provision of livelihood opportunities. By coincidence, four to five years are needed for plankton-feeding fish (but eight to eleven years for carnivores) to spill over from coral reef reserves to fished areas, thereby increasing fish catches of fishers (Russ and Alcala 1994, 1996; Alcala and Russ 1990). These time frames are important guides to partner organizations involved in demonstrating the impact of protected areas (reserves) on the fish catches of fisher communities. As Newkirk and Rivera (1996) state "... concrete gains in a project are the most effective mechanism to convince people about the relevance of CRM." (CRM stands for coastal Resource Management.)

It is important that, before outside financial and technical support to communities is terminated, all arrangements be made that would allow the organized community to engage in productive livelihood activities on a sustainable basis. This is true of one of the most successful CBFM projects in the Philippines - Apo Island Marine Conservation Project in Central Visayas. The project began in 1981 and its marine reserve established in 1982; community organizing intensified in 1985-86 (Tiempo and Delfin 1991, White 1989, Russ and Alcala 1996). The organized community of 500 people have successfully managed and protected the reserve with little help from their partner agency (Silliman University) for nine years (since 1987). The fishers now report enhanced fishery catches from the non-reserve, and they attribute this increase to the establishment of the reserve. They are happy that the reserve now brings more income to them through perceived increased fishery yield and tourism. We might say that our objective is to establish more successful CBRM projects like Apo Island Marine Reserve. ❖

Literature Cited

Acheson, J. M. and Wilson, J. A. 1996. Order out of chaos, the case for parametric fisheries management. American Anthropologist 98, 579-594.

Alcala, A. C. 1981. Fish yields of coral reefs of Sumilon Island, central Philippines. Nat. Res. Counc. Philipp. Res. Bull. 36, 1-7.

Alcala, A. C. 1988. Effects of protective management of marine reserves on fish abundances and fish yields in the Philippines. Ambio 17, 194-199.

Alcala. A. C. and Russ, G. R. 1990. A direct test of the effects of protective management on abundance and yield of tropical marine resources. J. Cons. int. Explor. Mer. 46, 40-47.

Alcala, A. C. and Vande Vusse, F. J. 1994. The role of government in coastal resource management, pp. 12-19. In Pomeroy, R.S. (ed.) Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences. ICLARM Conf. Proc. 45, 189 pp.

Beverton, R. J. H. and Holt, S. J. 1957. On the dynamics of exploited fish population. Fisheries Investment Series 2, vol 19. U.K.

Bohnsack, J. A. 1990. The potential of marine fishery reserves for reef fish management in the U.S., South Atlantic. NOAA Tech. Memo. NMFS-SEFC 261, 1-40.

Bohnsack, J. A. 1993. Marine reserves: they enhance fisheries, reduce conflicts, and protect resources. Oceanus 36, 63-71.

Carpenter, K. E. 1977. Philippine coral reef fisheries resources. Philipp. J. Fish. 15, 95-126.

Davis, G. E. 1989. Designated harvest refugia: the next stage of marine fishery management in California. Calif. Coop. Ocean Fish. Inv. Rep. 30, 53-58.

Dizon, J. C. A. M. and Miranda, G. C. 1996. The coastal resource management experience in San Salvador Island, pp. 129-155. In Ferrer, E. M. et al. (eds.) Seeds of Hope. College of Social Work and Community Development, University of the Philippines, Quezon City, Philippines, 223 pp.

Doherty, P. J. and Williams, D. McB. 1988. The replenishment of coral reef populations. Oceanogr. Mar. Biol. Ann. Rev. 26, 487-551.

Dugan, J. E. and Davis, G. E. 1993. Applications of marine refugia to coastal fisheries management. Can. J. Fish. Aquat. Sci. 50, 2029-2042.

Ferrer, E. M., dela Cruz, L. P., and Domingo, M. A. (eds.) 1996. Seeds of Hope. College of Social Work and Community Development, University of the Philippines, Quezon City, Philippines. 223 pp.

Frith, C. A., Leis, J. M. and Goldman, B. 1986. Currents in the Lizard. Island region of the Great Barrier Reef Lagoon and their relevance to potential movements of larvae. Coral Reefs 5, 81-93.

Heinen, A. and Laranjo, A. 1996. Marine sanctuary establishment: the case of Baliangao Wetland Park in Danao Bay, pp. 3-20. In Ferrer, E. M. et al. (eds.). Seeds of Hope. College of Social Work and Community Development, University of the Philippines, Quezon City, Philippines, 223 pp.

McManus, J. W. 1988. Coral reefs of the ASEAN region: status and management. Ambio 17, 189-193.

Munro, J. L. 1995. Alternative strategies for coastal fisheries rehabilitation, pp. 42-51. In Munro, J.L. and Balgos, M.C. (eds.). Artificial Reefs in the Philippines. ICLARM Conf. Proc. 49, 56 pp.

Murdy, E. O. and Ferraris, C. J. 1980. The contribution of coral reef fisheries to Philippine fisheries production. ICLARM Newslett. 3, 21-22.

Newkirk, G. F. and Rivera, R. A. 1996. Synthesis, pp. 195-202. In Ferrer, E.M. et al. (eds.). Seeds of Hope. College of Social Work and Community Development, University of the Philippines, Quezon City, Philippines, 223 pp.

Polunin, N. V. C. 1983. Marine 'genetic resources' and the potential role of protected areas in conserving them. Environmental Conserv. 10, 31-41.

Pomeroy, R. S. 1994. Introduction, pp 1-11. In Pomeroy, R. S. (ed.) Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences. ICLARM Conf. Proc. 45, 189 pp.

Roberts, C. M. and Polunin, N. V. C. 1993. Marine reserves: simple solutions to managing complex fisheries? Ambio 22, 363-368.

Rowley, R.J. 1994. Marine reserves and fisheries management. Aquat. Conserv. 4, 233-254.

Ruddle, K. 1994. Changing the focus of coastal fisheries management, pp. 63-86. In Pomeroy, R.S. (ed.) Community Management and Common Property of Coastal Fisheries in Asia and the Pacific:

Concepts, Methods and Experiences. ICLARM Conf. Proc. 45, 189 pp.

Russ, G. R. and Alcala, A. C. 1989. Effects of intense fishing pressure on an assemblage of coral reef fishes. Mar. Ecol. Prog. Ser. 56, 13-27.

Russ, G. R. , Alcala, A. C. and Cabanban, A. S. 1992. Marine reserves and fisheries management on coral reefs with preliminary modeling of the effects on yield per recruit. Proc. 7th int. Symp. Coral Reefs 2, 988-995.

Russ, G. R. and Alcala, A. C. 1996. Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. Mar. Ecol. Progr. Ser. 132, 1-9.

Scura, L. F., Chua, T. E. Pido, M. D., and Paw, J. N. 1992. Lessons for integrated coastal zone management: the ASEAN experience pp. 63-86. In Chua, T.E. and Scura, L.F. (eds.) Integrative Framework and Methods for Coastal Area Management in ASEAN: Lessons Learned, Bandar Seri Begawan, Brunei Darussalam, 28-30 April 1992.

Sorensen, J. and McCreary, S. 1990. Institutional arrangements for managing coastal resources and environments. Rev. 2nd ed. COAST. Renewable Resources Information Series. Coastal Management Publication No. 1 National Park Service, U.S. Department of the Interior and USAID.

Tiempo, F. A. and Delfin, E. C. 1991. Background and status of three community-managed marine reserves established I 1985-86 in the Central Visayas, Philippines, pp. 80-89. In Alcala, A. C. and Balgos, M. C. (eds.) PCAMRD. Management of Nearshore Fishery Resources. Proc. Seminar-Workshop on Management of Nearshore Fishery Resources. Cebu City. 23-25 January 1990, 218 pp.

Walters, J. S. 1994. Property rights and participatory coastal management in the Philippines and Indonesia. Coastal Management in Tropical Asia 1994, 20-24.

White, A. 1989. The marine conservation and development program of Silliman University as an example for Lingayen Gulf, pp. 119-123. In Silvestre, G. et al. (eds.) Towards Sustainable Development of the Coastal Resources of Lingayen Gulf, Philippines. ICLARM Conf. Proc. 17, 200 pp.

Williams, M. J. 1994. Foreword, p.v. In Pomeroy R. S. (ed.) Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences. ICLARM Conf. Proc. 45, 189 pp.

Yamasaki, A. and Kuwahara, A. 1990. Preserved area to effect recovery of overfished Zuwai crab stocks off Kyoto Prefecture. In Proc. Int. Symp. on King and Tanner Crabs. Alaska Sea Grant College Program. Univ. of Alaska, Fairbanks, pp. 575-578.