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Co-management and marine reserves

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co-management strategies

In the marine environment, boundaries are difficult to define and defend. However, traditional fishers and other users may have established and recognized various forms of user rights. Thus, the system of property rights is "strongly defined and deeply integrated in the people's culture and cannot be ignored. Property rights are first and foremost a definition of access, like for example, the rules that decide who is entitled to extract the resources."

When fish are in pens, ponds, and cages, there are usually no conflicts. But when released species are no longer protected by physical means, the "successful application of enhancement techniques raises important questions about management and ownership." An economic impact is involved as cultured organisms coming from a sea ranching project may be harvested by a fishing operation or another sea ranching operation. "At the general level, extensive mariculture will alter production possibilities in traditional marine fisheries, or as seen from the other side, traditional harvesting will affect production possibilities in mariculture."

The law on sea ranching

One way to reduce uncertainty to access is to exclude some forms of extraction. This may be done for single species like salmon by excluding all salmon fishing at sea as in Iceland or in all rivers as in Japan. Both options are related to historical traditions. It is also an option to exclude some forms of organization, where there is a ban on private, for-profit sea ranching.

A law on sea ranching can create management uncertainty and tensions if it proposes that fishing can be regulated outside the recapture area as in regulation of pen farming or wild fish. But if sea ranching would proliferate along the coastline, management battles can burgeon. Again, the Japan experience on salmon can be worth looking into when problems on management such as these emerge because the salmon fishing operations are managed by cooperatives. They implement a rule of equality on profit and cost of operations among the members, and the system has worked well. But if net-set fisheries were managed through individuals or private companies, problems would emerge as to how profit would be distributed.

Stock enhancement in Japan

Discussion of stock enhancement in Southeast Asia would be incomplete without mention of Japan, the pioneer in stock enhancement in Asia. Japan's stock enhancement activities started in 1876 at the initiation of Akekiyo Sekizawa after he studied hatchery techniques in the United States and conducted artificial spawning of chum salmon (*Onchorhynchus keta* Walbaum). Since then, stock enhancement of the chum salmon has subsequently been promoted by the Japan government. In the late 1950s, scallop was also used for stock enhancement in Hokkaido. Using various species (kuruma prawn, sea urchin, swimming crab, abalone, and others) from 1963, stock enhancement continues in Japan until the present time. There are 16 national and 57 local government hatchery facilities distributed throughout the country's coasts. In these facilities, about 90 species are now under technical development for stock release.

For the past 20 years, production techniques have been developing rapidly but a comprehensive review focusing on quantitative surveys regarding the effectiveness of stock enhancement has not been done. Today, Japan's stock enhancement program is focused on the review of stocking effectiveness, the methods of evaluation that are used in the review, and the future prospects of stock enhancement.

In fisheries management, the salmon programs are worth considering because of their organization and salmon is the longest stocked species of great economic importance. At the start of the program, the coastal fishers were integrated through the combined efforts of government, regional authorities, and fishers' cooperatives. The costs of running the operations were divided among all parties. With more than 2000 units, the fishers' associations were important players. The rights system, which traditionally gives exclusive rights to exploit coastal resources to the local fishing community, was included as a basis for seafarming salmon. This takes advantage of a well-established system of rights that requires all marine development activities be approved by local fishers.

Stock enhancement in Taiwan

In Taiwan, stock enhancement activities started in 1982 when the Taiwan Fisheries Research Institute selected prawn fishing grounds along the southwest coast of Taiwan as experimental area. The Institute is now engaged in a series of studies on the community structure, distribution, recruitment, reproduction, food habits, and growth of the commercially important prawns in the area. *Penaeus monodon* subadults were tagged and released along the coast of Tungkang until 1984. To date, life history models based on the above parameters have been established for several commercially important prawns.

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P. monodon subadults (4-5 month old) were tagged and released in varying numbers on 16 separate occasions from 1983 to 1984. A modified streamer tag, made of vinyl sheeting was inserted laterally through the first abdominal segment using a sewing needle. The recapture rate of tagged prawns was 15% for those raised in saltwater ponds and 5% for those from commercial brackishwater ponds. Average growth rate was 2.97 g per week for females and 1.67 g per week for males. In addition, to evaluate the efficacy of seed release, a study on marking *P. monodo*n using an automated microwire tagging system was conducted. Prawns with an initial mean total length of 27.5 mm were injected with microwire tags at the cephalothorax, the first or the sixth segment. No significant difference was observed in the growth and survival among treatments. No tag loss was found in prawns tagged at the first segment, which shows that the coded microwire tags can be used for tagging juvenile prawns.

In the rapid development of the prawn industry, supply of spawners in the waters surrounding Taiwan has been depleted. Thus, the release of pond-reared subadults of this species is expected to increase the stock in coastal waters. Assuming that subadults favor the environmental conditions and food in the spawning grounds, it is recommended that the subadults be released near spawning grounds in October to December for *P. monodon* because they may become spawners and can be harvested in the following spring.

The recapture rate of prawns released from saltwater ponds was much better than that from brackish ponds. This indicates that the physiological condition of released prawns influences the recapture rate. Based on tagging and recapture data, the growth potential was 9.37 g per week for female subadults and 3.52 g per week for male subadults. The prawns also grow faster in sea than in culture ponds. Clearly in Taiwan, restocking of subadults for cultivating broodstock is very promising. But only specific pathogen-free prawns should be released.

SEAFDEC/AQD's experience in coastal resource management

In 1991, SEAFDEC/AQD started a coastal resource management project in Malalison Island, an island off the west coast of Panay in the Philippines. Within five years, several components of CRM were successfully implemented in the island. Such components were the organization of the fishers into an association, institutionalization of initiatives in the local government level, and the granting of Territorial Use Rights in Fisheries (TURF) resulting in the establishment of a marine sanctuary deployed with concrete artificial reefs. The TURF concept was translated into policy through Municipal Ordinance No. 5-90 designating one square kilometer area for the exclusive use of of the Fisherman's Association of Malalison Island.

After years of maintaining protected areas, testimonies of increased catch, and a perceivable economic progress in the island, nearby municiplities off the island adopted the Malalison way. The municipalities of Libertad, Pandan, Sebaste and Culasi, all bordering Pandan Bay grouped together to manage their coastal resources, known as the LIPASECU Baywide Management Council Inc. LIPASECU has several projects, all related to coastal management such as resource conservation and utilization, livelihood enhancement, waste management, law enforcement and sea patrol, and research and data banking. Considered the most important component of the project is the institutionalization of initiatives in the local government level. Officers of the project believe that it is the most meaningful component of the project because any change in elective officials or pull out of funding agencies would not spell immediate change in the the legal policies or ordinances. One such initiative is the adoption of an ordinance which is spelled out in the Comprehensive Unified Ordinance Regulating the Fishing Industry, Fisheries, and Aquatic Resources.

The unified fishery ordinance would be enacted by the four member municipalities. Enforcement would cover all of Pandan Bay in conjunction with existing laws, decrees, orders, issuances, and regulations on fishing and fisheries.

The ordinance basically upholds the preferential rights of marginal municipal fisherfolks enunciated in the Philippine Fisheries Code of 1998. The general provisions start with the coverage of Pandan Bay, issuance of licenses and permits, limited entry into overfished areas, and end with the penalties of each offense cited. Other provisions provide for a Manual of Operations that governs the operations and effective implementation of the ordinance, source of fund (from municipal contribution P5000), and specific monetary and non-monetary penalties.

Conclusion

Co-management is an accepted tool in coastal management, as implemented in the SEAFDEC/AQD project. It recognizes the importance of involving user groups in the development and implementation of management policies. The creation of the Fisheries and Aquatic Resources Management Councils in every coastal barangay, municipality or city has provided the institutional setting for the emergence and enhancement of fisheries co-management at the village level.

Despite enabling legislation, documentations of projects on co-management on coastal areas are not without described difficulties, foremost of which is the expectation of fisherfolks for immediate benefits and the conflict between organizers and concerned agencies. No matter how laborious the job is, the emerging promise of the project as perceived in the empowered members' attitude towards resource rehabilitation and conservation is well worth their effort.

Except for the part on AQD experience, this story is summarized from Suchi Kitada, Effectiveness of Japan's stock enhancement programmes: current perspectives, p 103; Koji Imamura, The organization and development of sea farming in Japan, p 91; Shuichi Kitada, Effectiveness of Japan's stock enhancement programmes: current perspectives, p 103; Research and development of prawn stock enhancement in Taiwan, p 379, all from Stock enhancement and sea ranching, edited by: Bari Howell, Erlend Moksness, Terje Svasand. Fishing News Books, 1999 -- **MBS**

marine reserves

Marine reserves are areas protected from various forms of human or extractive exploitation, especially fishing. These were initially established for marine conservation but recent scientific evidence indicated that these also provide much needed support for fisheries.

Establishment of marine reserves is one of the management strategies relevant to marine stock enhancement. There is evidence that protecting areas from fishing leads to rapid increases in abundance, average body size and biomass of exploited stocks. Even non-target or non-fishery species benefited from protection of the area. Once an area is declared protected, fishes are safe from getting caught, live longer and grow larger. Bigger animals produce much more eggs than smaller ones. For example, a 10-kg red snapper can produce over 20 times more eggs at a single spawning compared to ten 1-kg snappers. Thus, a few very large animals are more valuable as egg producers than many smaller ones.

In addition, reserves often increase population densities. This is of great importance especially to animals that can only reproduce successfully at high population densities, such as bottom dwellers and slow moving animals like oysters, clams or abalones. As animals get further apart, fertilization rates decrease and fewer viable offspring are produced. Many of the eggs and larvae produced by fish in marine reserves will drift into adjacent fishing grounds and therefore help restock the fishery, the so-called spillover or movement of juvenile or adult fish out of reserves.

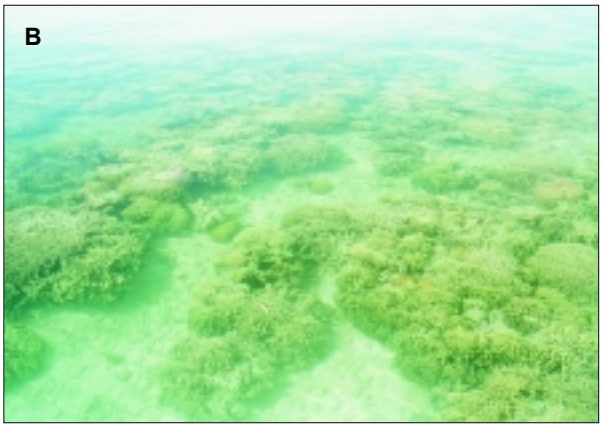
Indeed, marine reserves have a great role in fishery enhancement. Reserves can provide a refuge from fishing for vulnerable species, prevent habitat damage and promote habitat recovery, maintain biodiversity by promoting development of natural biological communities that are different from those in fishing grounds and finally, facilitate ecosystem recovery after major human or natural disturbances. These are just some of the most visible contributions marine reserves offer.

We visited two marine reserves in Misamis Occidental in northern Mindanao and in Sagay, Negros Occidental and looked at how these marine reserves were implemented.

CASE 1: BALIANGAO WETLAND PARK MISAMIS OCCIDENTAL

Danao Bay is situated in Misamis Occidental in northern Mindanao. It is shallow with a large intertidal zone dotted by mangroves, mudflats, seagrass beds and coral reefs. About 90% of the bay is located in the municipality of Baliangao while the remaining belongs to Plaridel.

Accordingly, fisheries in Baliangao were abundant in the early '40s. In fact, the name Baliangao was derived from the Cebuano phrase *balay sa langaw* which means house of flies. Folk tales



A *Bamboo stakes serve as fence for the Baliangao sanctuary's core area to keep fishing boats from getting inside*

B *Corals and seagrasses are starting to grow back, as well as the populations of sea urchin and sea cucumber*

C *Members of the Danao Bay resource management team give testimonies about how the establishment of the sanctuary changed their outlook on the environment*

D *More than 165 ha of mangroves have been reforested since 1991*

relate that the place was once literally teeming with flies living off decomposing fishes which lay on the shore. The place also has a dense mangrove forest.

Most of the people were solely dependent on the bay for their livelihood then. They were engaged in capture, processing or selling of fishery products. Exploited resources included fish, shells, sea urchins, and crabs. These activities, along with massive mangrove cutting and extensive use of illegal fishing gears, eventually resulted in the downfall of fisheries in the area.

According to a local fisher Dodong Agodolo, they noticed a decline in their fish catches by the early '80s. "Before, our catch was enough to provide for our daily needs; then came a time when we barely brought home a catch. We also noticed that several of the high-value species started to disappear," he explains.

Two resource management measures were implemented in response to this growing problem. The cutting of mangroves was prohibited and a ban period for rabbitfish was implemented. However, these regulations were not strictly enforced and the situation, in fact, became worse.

In 1991, the PIPULI Foundation Inc, a non-government organization chose Danao Bay as the site for a marine ecosystem protection program. Through the efforts of the foundation, some local fishers, the church and the local government, a 74-hectare sanctuary was established in Misom, Baliangao. This was named Misom Sea Sanctuary and later renamed Baliangao Wetland Park.

"The sanctuary was fenced off with bamboo stakes and watched over by a guard round the clock. No fishing was allowed inside the sanctuary and destructive, illegal fishing was strictly banned around the area," said Ms. Estrelita Bulatete, executive director of PIPULI.

The fishers identified and created a core area or a *lumlumay* within the sanctuary. This serves as spawning ground and a hiding place for fishes during low tide.

A fishing ban on the once thriving rabbitfish was re-enacted but strictly enforced this time. Before, rabbitfish constituted half of the catch of the fishers of Danao Bay. Local fishers' knowledge of lunar spawning rhythm of rabbitfish occurring on the 5th day after the new moon at 3- 4 am reinforced the fishing ban to protect rabbitfish during spawning. A typical 48-hour ban period starts at 8 am of the 3rd day after new moon and ends 8 am of the 5th day.

Daily monitoring of catches of rabbitfish validated the period of the ban. Fish caught before the ban period had ripe gonads having eggs ready to be released. After the ban period, no ripe gonads were observed.

Sea cucumbers also thrived in the waters of Danao Bay before. Abundant on the reef in the mid '80s, the sea cucumber eventually became almost extinct in the area. Following the establishment of the sanctuary, fishers now attest to an increase in its population and individual body sizes. In fact, its abundance enticed poaching in the sanctuary.

Massive reforestation of the once dense mangrove forest of Baliangao was also implemented. The joint efforts of the people's organizations, local government units, DENR and the community are evident in the 165 hectares of planted mangroves. Seventeen (17) mangrove species consisting mostly of the genus *Rhizophora, Avicennia, Combreta* and *Sonneratia* now grow in the area.

Bulatete explained that after the establishment of the sanctuary, PIPULI focused on organizing and educating the fishers about coastal resource management.

A participatory management group of stakeholders/fishers representatives proved effective and successful in this activity. Aside from assigning among themselves a guard to watch over the sanctuary, the organized fishers also took charge of ecotourism. A mangrove tour, coral reef and sanctuary sight seeing activities and overnight cottages are available to visitors for a minimal fee.

"One surprising and very good outcome of the establishment of the sanctuary is the change of attitude of fishers towards fishery resources and sustainable development. Illegal fishers turned their backs on destructive practices and became active advocates of resource protection," said Lilia Jumarito, PIPULI Danao Bay Program Coordinator.

"Most of us here used destructive fishing gears before. We were against the introduction of the sanctuary because it reduced our fishing area. But upon knowing and understanding the purpose of the sanctuary, we gave up our destructive practices. I am proud and happy to say that I am now militant on protecting our fishery resources," testifies Gregorio Gayola, chair of the Danao Bay Resource Management Organization (DB-REMO).

Over time, the fishing communities have become very open to the idea of improving the management of the resource through their own active involvement.

The fishers realized that if they do not take action now, their catches will continue to decline, thus worsening their livelihood. They agreed to implement the following measures to answer this growing problem: total ban on illegal or destructive fishing techniques; ban on fishing gears like drive-in nets, 3-ply trammel nets, beach seines and compressor fishing; and the change in gears to reduce the by-catch of immature fish. Moreover, only residents from Baliangao and Plaridel are allowed to fish in Danao Bay; all other resource users need to be registered.

A fish stock assessment survey conducted by PIPULI marine biologist Jade Fraser in 1997 showed higher species diversity (93 species under 25 family), abundance, and importance value (biomass and economic value) inside than outside the sanctuary. Rabbitfish, milkfish, mullet, surgeonfish, snapper, sea urchins among other species now thrive in the sanctuary.

The Marine Laboratory of Silliman University also assessed the resources of Baliangao Wetland Park in 1990s, and showed that the sanctuary has been effective in restoring degraded coastal habitats in the area.

For the fishers, the sanctuary has indeed brought good things to the entire community. They have observed a gradual increase in their fish catch, fish sizes, and fish species, which disappeared before and have now returned.

But for them, the most important contribution that the sanctuary gave is empowering the people to manage their resources well. That, in itself, will secure the future of their children. -- **RIYA**

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CASE 2: SAGAY MARINE RESERVE NEGROS OCCIDENTAL

The Sagay Marine Reserve constitutes 32,000 km^2 of land and seascape on the northeastern tip of Negros Island in western Visayas. Sagay's coastline and coral islets blend natural beauty with high productivity. These have supported the fishing industry of Sagay and its neighboring towns for generations. Mangroves protected the coast and islets. Likewise, seagrass meadows also covered shorelines.

But just like any other Third World setting, population pressure threatened these beautiful and rich marine ecosystems. They were exploited at a rate exceeding their carrying capacity.

Fortunately for Sagay, they have a man with a vision, strong political will and a quiet resolve to realize the need for environmental concerns. That man is erstwhile Mayor and now Congressman Alfredo Marañon Jr.

According to Congressman Marañon, even as a young man, he already dreamed of making Sagay's marine resources last for many generations. And the opportunity came to make a difference. In the late '70s, as elected mayor of Sagay, he initiated a marine conservation program with help and encouragement of Dr. Angel Alcala, then president of Silliman University in Dumaguete City. In 1983, Municipal Ordinance No. 2 formally proclaimed Carbin Reef as a fish sanctuary. Later, it extended to include Panal, Macahulom, and the fringing reefs of Molocaboc.

Law enforcement was further strengthened through the installation of a watchtower in Carbin and Macahulom, and the organization of the Bantay Dagat Program. Technical assistance was provided by Silliman University, while financial assistance came from the Philippine Council for Aquatic and Marine Research and Development.

Rehabilitation, including restocking of giant clams and mangrove reforestation was done. It was fully supported by civic groups and the national government's coastal environment program. Preliminary assessments of reef fish standing stock and marine flora and fauna were also conducted. Alternatively livelihood projects were introduced to displaced fisherfolk.

Recognizing the potential of Sagay's coast to contribute to the preservation of the nation's biodiversity, the Department of Environment and Natural Resources, through then Secretary Alcala recommended its inclusion in the National Integrated Area System (NIPAS). Finally, on 10 June 1995, Sagay's coastal waters was proclaimed a protected seascape by Presidential Proclamation 592. Republic Act No. 9106, dated 14 April 2001, improved it to the Sagay Marine Reserve Law.

The reserve has three component sections: resource management, social development and law enforcement.

The first conducts biological research and monitoring activities to evaluate the impact of management strategies; and initiates development projects through sustainable use of resources to improve economic conditions while enhancing environmental protection.

The second links effectively to community organizations and introduces livelihood projects that will discourage illegal fishing practices and decrease dependence on marine resources for sustenance.

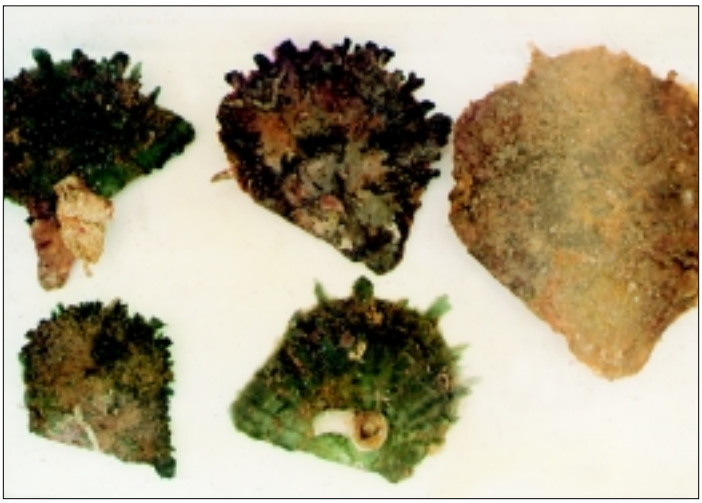
The last implements laws and regulations through surveillance and monitoring of the protected areas.

See also the back cover story. -- **APS**

▶ *Congressman Marañon points to the boundaries of the reserve in a map*

▼ *Lush mangroves along the coasts of 3 municipalities*

Pearl oysters can be found in the whole reserve; there is a ban on their harvest



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strategies) to control the effects of enhancement. Essentially, adaptive management is the continued use of the above nine key components, to ensure an efficient and wise use of natural resource. ###

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The results suggest that (a) there was a significant genetic differentiation among the wild *P. monodon* populations in the Philippines, and (b) the cultured populations were significantly differentiated from the natural populations. More replicate samples from each of the geographic regions are needed to conclusively determine the possibility of an association between genetic differentiation and the status of mangroves and/or intensity of shrimp culture systems. ###

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veloped monitoring and assessment techniques, especially the use of an effective tag for sub-adult and a coded microwire tag for juvenile prawns. It appears that the prospects for restocking with sub-adults to augment prawn broodstocks in nature are promising. Taiwan's prawns have joined a growing list of successful stock enhancement programs (Table 2).

In addition to prawns, TFRI has experimentally released fingerlings, sub-adults and adults of seven fishes, six crustaceans, and one mollusc from 1976 to 1995 (Table 3). Most released animals were fingerlings except for the Japanese eel (*Anguila japonica* Temminck and Schlegel) and grass prawn (*P. monodon* Fabricius).

Taiwan considers the provision of artificial reefs an effective approach to building a good habitat for fishery resources. Since 1973, both the central and prefectural governments have put more emphasis on constructing artificial reefs to provide fish habitats or substrates.

In addition, a total of 25 fisheries resource protective zones have been set up for fish (anchovy), crustaceans (lobster, kuruma prawn, redtail prawn, grass prawn), molluscs (small abalone, hard clam, *Tapes* spp., purple clam, blood cockle, top shell, pearl shell), echinoderm (sea urchin) and seaweeds (*Porphyra, Gelidium, Meristotheca*). **-- RIYA**

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