50 YEARS OF SCIENTIFIC CONTRIBUTIONS OF THE APO ISLAND EXPERIENCE: A REVIEW

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ABSTRACT

Apo Island, Negros Oriental, has been an informal "natural laboratory" for marine and social scientists for 50 years. It is important to assess the contributions to marine science of studies that have examined the Apo experience in Community-Based Coastal Resource Management. This paper reviews literature on Apo Island from the 1950s to the present. Research emphasis has been on the effects of management on the sustainability of reef fisheries; economic valuation and the benefits of tourism; and, anthropological and sociological studies of coastal fishing communities, particularly the role of women in fishing community dynamics and economics. Much of this research has been ground-breaking, applying novel approaches to issues facing coral reefs over the past three decades. Lessons learned from the Apo experience are discussed in light of current challenges facing reef managers.

Introduction

Apo Island is one of the most thoroughly documented marine reserves in the world. Through the years, this small island and its resident fishing community have provided biologists, social scientists, and students with an opportunity to study topics ranging from local amphibian fauna to tourism impacts to long-term effects of fishery management. It is an unofficial and unplanned "natural laboratory" that has become a globally-recognized example of successful Community-Based Coastal Resources Management (CB-CRM). In this day of scientists and managers eager for examples of community involvement in management and sustainable exploitation, the

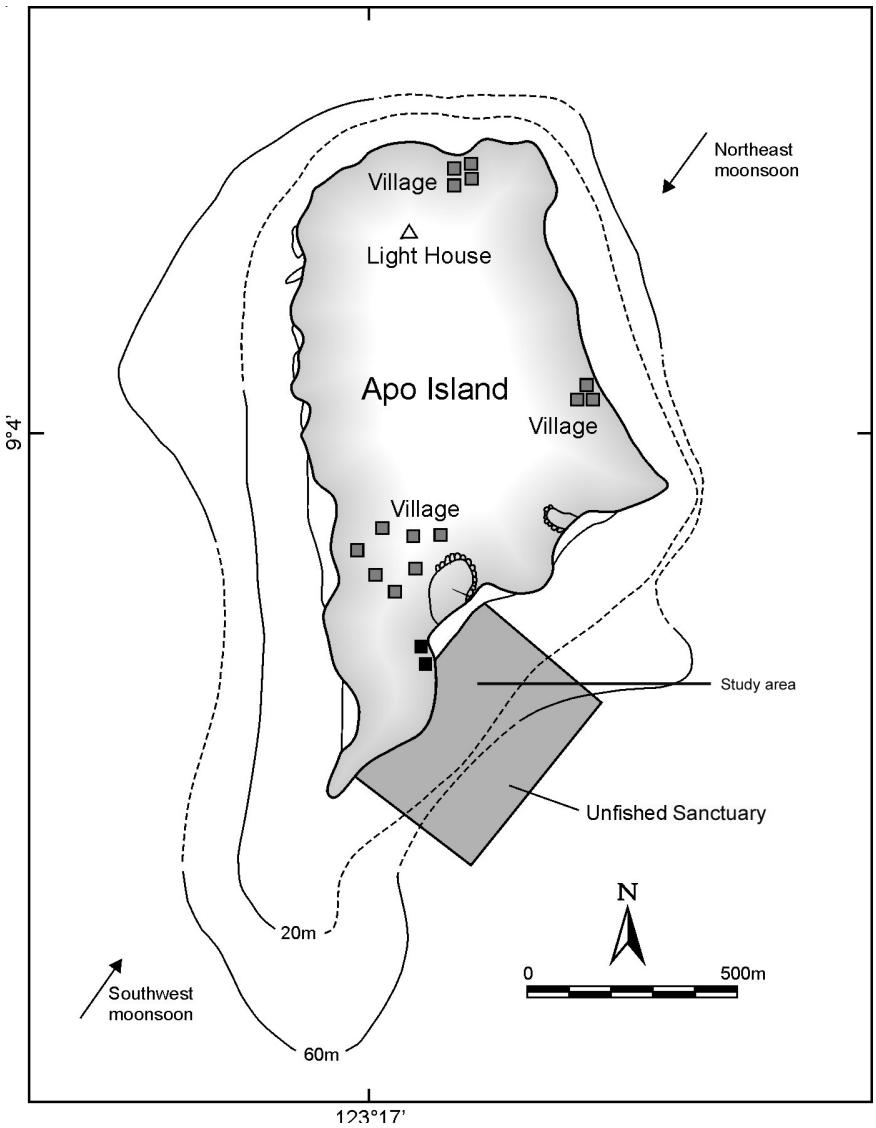
Apo Island experience stands out as a shining success story. Such examples are rare, particularly in overpopulated developing countries such as the Philippines where pressures on natural resources increase daily. The Apo situation is unique in many aspects, and continues to serve as an evolving model on which other management schemes are based. As such, it is useful to take a look at what has been accomplished over the past decades, as well as to examine the issues that continue to pose challenges to sustainability.

The evolution of Community-Based Coastal Resource Management on Apo

Apo Island is a 74-ha hilly, volcanic island 25 km south of Dumaguete City, 9 km from the Negros mainland. It lies within the political jurisdiction of the municipality of Dauin. The island is surrounded by a narrow fringing reef, covering 1.06 km^2 to the 60 m isobath, with a 0.45 km no-take marine sanctuary delineated along its southwest border (see Fig. 1). The present population is about 700, distributed among 110 families (Raymundo, 2001). This is 50% more than the reported population of 460 in 1986 (Savina and White, 1986). The predominant source of income continues to be fishing, although tourism revenue in recent years has helped some families boost financial resources.

D. S. Rabor, then head of the Biology Department, initiated studies on Apo Island as early as the 1950s, followed by A.C. Alcala. These collecting trips surveyed local amphibians, reptiles, and birds (Brown and Alcala, 1978, 1980; Alcala, 2001). At that time, Philippine biologists were simply attempting to find out "what lived where". These forays brought island residents into contact with researchers, and a rapport was developed that paved the way for later collaboration. By the mid-1970s, research interests broadened to include marine resources.

Figure 1. Map of Apo Island, Negros Oriental, Philippines.
Produced by J. Maypa



In the 1970s, establishing marine parks for reef management was gaining attention in the international scientific community, in recognition of increasing rates of reef and marine resource degradation worldwide. The "multiple use concept", applied to a marine park, held that combining scientific, aesthetic, and educational objectives in an area closed to harvesting would allow a reef to recover to a pre-harvested state (Cabanban and White, 1981; Alcala, 1998). This approach was implemented by scientists with little participation by local communities and unclear views of the impacts on fishers affected by closure of a portion of their fishing ground. Biologists from Silliman recognized that little could be accomplished without the support of fishing communities using the reef. In 1976, researchers from the Silliman University Marine Laboratory (SUML) initiated talks on marine conservation with the Apo fishing community. At that time, destructive fishing was practiced, poverty was high, the island population was growing, and non-resident fishers frequented Apo's reefs. Boat anchors, blast fishing, and *muro-ami* were taking their toll on reef health (Savina and White, 1986). Interviews with fishers revealed their perceptions that reef quality had changed (Cabanban and White, 1981). An informal dialogue approach had already been tested on Sumilon Island fishers and local government officials, who endorsed the formation of a reserve after discussions regarding conservation (Cadelìòa, 1976). SUML launched a similar campaign on Apo with the goals of promoting marine conservation and improving fish catch through better management. Slide presentations introduced families to preserving coral reefs as fish habitats, preventing damage to the reef, and avoiding over-fishing and destructive fishing. After four years of discussion and interactions with social workers and biologists, the community selected a 0.45 km stretch of the southwestern reef as a "no-take" sanctuary in 1982. The sanctuary was legalized by Municipal Ordinance in 1986,

through the assistance of the Marine Conservation and Development Program (MCDP; White and Savina, 1986; Torrequemada-Deguit, 1989; Alcala, 2001). The formation of the Marine Management Committee (MMC) followed, composed of elected Apo community members. Torrequemada-Deguit (1989) reports that the Apo community perceived that community-based management succeeded because of the commitment of the MMC. The Committee laid the groundwork for the widespread acceptance of the no-fishing sanctuary and the ban on destructive fishing. The MCDP was tasked with enhancing management capability and protecting reef resources (White and Savina, 1986; Cabanban and White, 1981; White, 1986a; White, 1989; White and Vogt, 2000). Through the MCDP, community organizers and biologists worked with Apo (and two other Central Visayas communities: Pamilacan and Balicasag, Bohol) to provide management advice and monitoring, and to formalize the process of community involvement in environmental management. Early success was noted in improvements in fish diversity and biomass (White and Savina, 1987a) and coral cover (White, 1986b) one to two years after sanctuary establishment.

On August 1994, the island was declared a Protected Landscape and Seascape by Presidential Proclamation No. 438, and placed under the National Integrated Protected Area System (NIPAS). Management, therefore, was turned over to the Protected Areas Management Board (PAMB; CRMP, 2004) of the national government, chaired by the Regional Executive Director of DENR Region 7. The PAMB created a system of fixed fees for visitors, strengthened enforcement capacity of the community, and funded development projects identified by the community. This move was initiated by A.C. Alcala (then Secretary of the Department of Environment and Natural Resources), who felt that placing the island under national jurisdiction would strengthen management and enforcement capacity and limit

land development (Alcala, 2001). The PAMB continues to manage the island's resources and revenue today, and elected community members comprise a portion of the Board, with other members coming from local government. The effectiveness of PAMB is currently under study, as a number of issues have been raised by community members: transparency and accountability; communication of decisions; involvement of residents in fund allocation based on felt needs; and management that includes all political factions (E. Oracion, pers. comm.; ongoing research).

The prevailing view during the 1970s and early 1980s was that management and conservation should be handled by scientists; lay people, however much affected by management decisions, were thought not qualified to participate. The combined approach that evolved with Apo Island management—stakeholder participation in decision-making, involvement of social scientists in coral reef issues, and linking coastal communities with support institutions—was innovative and untested. The success of this management tool has since been recognized and applied to coastal communities in developing countries worldwide, particularly in light of the failure of centralized attempts that involved little collaboration with local stakeholders. This approach, first applied experimentally to Apo and other Central Visayas communities in the 1970s, was considered key to the success of conservation efforts (White, 1986b) and has evolved into what is currently known as Integrated Coastal Management (ICM; Christie and White, 1997).

Conservation education of Apo fisherfolk was a learning experience for these ground-breaking marine biologists, who had no formal training in social sciences. It was noted that non-formal community leaders were often most effective in convincing the community of a specific course of action. Without the support of such influential individuals, little progress was possible (Torrequemada-Deguit, 1989). In addition, perceptions and attitudes of

people toward their environment could either hinder or help establish a conservation ethic. Most importantly, destruction caused by fishing practices was a touchy subject, one that must be handled objectively, and without blame (Cabanban and White, 1981). These lessons have since been formalized as a CB-CRM process (White *et al.,* 1994). Several aspects are key to the practice of ICM in the Philippines. It begins with empowerment and building a core group of committed community members, requiring a community organizer to live in the community and build capacity. This is accompanied by environmental education – an awakening of the community's awareness of the consequences of various human actions on the environment, and instilling the knowledge that a course of action can be chosen which is conservation-oriented and beneficial. As experience has shown, it is a challenge to request an impoverished fishing community to refrain from harvesting a portion of an established fishing ground, particularly since benefits may not be visible short-term. Therefore, other activities must be identified such as enhancing livelihood options and mobilizing financial resources (White and Savina, 1987a; White *et al.,* 1994; White, 1996; Alcala, 1997, 1998). Health and reproductive issues have more recently been identified as key components to current CB-CRM thrusts (White and Deguit, 2000; White and Chua, 2003), such as the population control program at Apo currently supported by PATH Foundation and Dauin municipality (A.C. Alcala, pers. comm.). Finally, networks are built between communities and institutions, government departments, or non-government organizations (NGOs) to provide long-term support and technical advice.

Contributions to fisheries research

By far, the largest contribution of research on Apo has been an expanded knowledge of the effects of protection on coral reef fish communities. The Apo fishery has been

studied since the early 1980s, prior to the creation of its marine reserve in 1982, and such long-term data sets are notoriously rare. Today, marine sanctuaries are frequently established to address the linked problems of reef degradation and over-fishing, but the concept was relatively untested when first applied in the 1970s. Though theoretically sound, little data supported the hypothesis that sanctuaries stimulated reef recovery and produced excess fish and/or larvae to be exported into adjacent fishing grounds, thereby increasing catch outside the reserve (the "spillover" and "recruitment" concepts; see Russ and Alcala, 1996a, 1996b; Russ *et al.,* 2003; Russ *et al.,* 2004). Long-term annual monitoring and short-term, intensive studies of the Apo fishery have created an extensive database. This database has provided some of the first empirical evidence of sustained fisheries enhancement effects of management, controlled exploitation, and small, no-take sanctuaries.

The first Apo fishery status assessment was conducted by Alcala and Luchavez (1981). The authors described catch composition (mainly reef fish), fishing gear (traditional, non-destructive methods), yield (a mean of 11.4 mt km^{-2} yr^{-1}), and average income (PhP5.83-PhP9.41), and concluded that fishery management and alternative livelihood options were needed, as the reef was over-fished. At this point, the marine sanctuary had not yet been delineated, though destructive fishing (*muro-ami* and blast fishing) had stopped. Alcala and Gomez (1985) and Alcala (1988) concluded that it was not reasonable to expect an effect of protection on fish catch at such an early management stage. By 1986, a second assessment was undertaken using a different method of evaluating catch, but results suggested a higher yield (31.8 mt km^{-2} yr^{-1}; White and Savina, 1987b). Again, catch composition reflected the fisher's preference for the more accessible reef fish; the pelagic fishery represented a small proportion of total catch. Reef quality was described as high, with little evidence of damage to coral, and yield was higher than was currently predicted with moderately

heavy exploitation. It was concluded that the effects of eliminating destructive fishing and the presence of the sanctuary may have begun to influence the fishery. Though these two papers (Alcala and Luchavez, 1981 and White and Savina, 1987b) came to different conclusions (low yield suggesting an over-fished state vs. higher yield than predicted with current exploitation levels), the data suggested that over a ten year period following the ban of destructive fishing methods (1976-1986), fish catch was sustained. During the same period, Russ (1985) compared yields from fishing grounds of three managed reserves, Sumilon I., Balicasag I., and Apo I. and showed that Sumilon, with the longest history of successful protection at that time (10 yr), had significantly higher fish yields than the other two. This type of study marked the first efforts to document the effects of protection on fishery resource recovery.

A number of recent publications report analyses of long-term data sets supporting the hypothesis that sustained, managed exploitation is possible without severe impacts to reef communities, and evidence of spillover is slowly accumulating. Such evidence is urgently needed: the MPA concept is often "sold" to fishers by convincing them that protection will eventually lead to greater catch—an approach that remains controversial due to the lack of hard evidence. Russ and Alcala (1996a) provided the first circumstantial evidence suggesting spillover from the Apo reserve into surrounding fishing grounds: significantly higher densities of target species were found closest to the reserve boundary, with decreasing densities farther from the reserve. This effect was seen only after several years of protection. A recent effort to examine long-term fishery trends in Apo was presented by Maypa *et al.* (2001). Compiling data for a twenty-year period, from 1980-81 to 2000-2001, the authors found that annual yield remained stable over this period, though fishing effort declined. These findings demonstrated a long-term effect of limiting fishing pressure, eliminating destructive fishing, and continually protecting the no-take sanctuary. The most compelling evidence for spillover

is presented in Russ *et al.* (2003) for the surgeon fish *Naso vlamingii*. Over an 18-yr period, biomass of this species increased by a factor of 40 adjacent to the reserve boundary, but not at greater distances. Catch per unit effort was 45 times higher near the reserve boundary than for all other fishing grounds around the island. Russ *et al.* (2004) describe the effects of protection as having direct benefits for fishers in terms of reduced fishing effort, higher catch, and enhanced standard of living. However, Russ and Alcala (2004) emphasize that marine reserves require long-term protection (2-4 decades) before biomass of large target species is restored.

An alternative approach to analyzing the effects of management on fisheries was taken by Russ and Alcala (1996b, 1999, 2003a), who compared Apo I. and Sumilon I., two islands with contrasting management histories. Though the Apo Island reef system was protected later than that of nearby Sumilon I., protection and management of Sumilon has been inconsistent. This may be due to the lack of a resident community on Sumilon; the classic "tragedy of the commons" (Hardin, 1966). Visiting the island only to fish, fishers have not developed a sense of ownership/ stewardship, making enforcement difficult. In addition, political pressures from a corrupt local government resulted in periodic breakdown of enforcement regulations. Incidences of *muro-ami* fishing coincided with a major typhoon in the mid-1980s, leaving the reserve devastated (Russ and Alcala, 1996b; Russ and Alcala, 1999). The effects of sustained management (Apo) vs. the breakdown of protection (Sumilon) on predatory fish biomass suggested that fish communities respond to protection (or lack thereof) very quickly (Russ and Alcala, 1996b, 2003a). The authors found that with the opening of the reserve to fishing in Sumilon, density of large predatory fish immediately declined. Density increased within the Apo sanctuary over time, and several

years of recovery time were necessary to regain lost biomass once protection in Sumilon was re-established.

In this day of increasing rates of worldwide environmental degradation, biologists are frequently asked to make management plans and decisions without sufficient information. Fisheries resources, upon which a significant portion of the world depends for protein and income, are under increasing threat. Often, it is the most marginalized and impoverished communities that are responsible for this threat—people least able to think about the future implications of their actions. Blending the urgent needs for both conservation and improved living standards of the Apo Island fishing community has resulted in what data suggest is a sustainable fishery; one which has not resulted in significant reef degradation and has resulted in improved living standards. It has been successful due to the insights of early marine biologists and social scientists of Silliman University and the commitment of Apo Island residents to try what surely must have been a risky venture when first presented to them. This story has provided the impetus for an unknown number of other such communities in developing countries worldwide. Shedd Aquarium in Chicago, U.S.A. recently adopted the Apo Island community as a model of fishery and biodiversity conservation, creating a substantial display that highlights local architecture, culture, handicrafts, and, most importantly, the rich diversity of its reefs.

Coral reef health assessments

The coral reefs of Apo Island have remained consistently healthy since their protection. Unlike many other reefs in the Philippines with portions delegated as reserves, Apo has not required a lengthy recovery period following a history of human-induced degradation. Table 1 summarizes data on coral health from a variety of studies over a 20-yr period, showing consistently high coral cover.

Table 1. Summary of data on coral reef health assessments, 1980-2003.

Live Hard Coral Cover	Site	Source
50-74% ("good" category)	5 sites around island	Gomez *et al.* (1981)
44.2% (reserve) 15.5% (non-reserve)	sanctuary & SW reef	MCDP (1985)
44% (reserve area) 28% (non-reserve) Mean = 32%	sanctuary & SW reef whole island mean	Savina and White (1986)
41.3% (reserve) 35.2% (non-reserve)	sanctuary & SW reef	White & Calumpong (1992)
52% (reserve) and 7.25% (non-reserve)	reserve & SW reef 1995 data (2002)	Reboton & Divinagracia
increase from 34.7% (1982) to 56.6% (2002)	sites around island	White (2002)
decrease from 62% (1998) to 12% (2001), with subsequent increase to 56% (2003), p ost El Nino	sanctuary; permanent transects	Raymundo (2003)

Survey data at ten year intervals from 1982-2002 showed steady increases in coral cover, from 34.7% (1982) to 56.6% (2002; White, 2002). This period encompassed two El Niòo events, 1982-83 and 1997-98, but the timing of surveys did not coincide with major bleaching. Raymundo (2003a) conducted annual surveys for Reef Check within the reserve beginning with the 1998 El Niòo bleaching event. The reserve reef was badly affected by bleaching, due to

the spatial dominance of a highly susceptible coral species, *Galaxea fascicularis*. Annual survey data noted a sharp post-bleaching decline in hard coral cover (Table 1), with a simultaneous increase in soft coral. Since that time, hard coral cover has increased to pre-bleaching levels and soft coral has declined. An in-depth examination of recovery two years post-bleaching revealed significant losses of tissue of *G. fascicularis* and recruitment of new colonies onto the bare skeleton provided by dead coral (Raymundo and Maypa, 2002, 2003a). Comparing data sets with differing sampling intervals and spatial scales can reveal long- and short-term trends. White's (2002) 20-yr data set revealed little long-term effects of two bleaching events, while the shorter-term, smaller scale data sets (Raymundo, 2003a) showed a large reduction in hard coral cover, followed by recovery lasting several years. These studies elucidated responses to El Niòo events in a relatively unimpacted marine reserve, an area of current research interest, particularly since such events are predicted to increase in both frequency and severity (Hoegh-Guldberg, 1999).

Empirical studies have been limited, though the high quality of the Apo reef and its proximity to Silliman University makes it a prime site for research on reef ecology. Raymundo and Maypa (1997) examined recruitment patterns of scleractinian corals within the reserve, noting that competition by barnacles lowered recruitment. Raymundo (2001) reciprocally trans-planted coral fragments between two sites of differing health and water quality (Apo Reserve and Bais Bay), and found superior growth and survival in fragments growing in the more favorable Apo reserve site. Calumpong *et al.,* (2000) attempted a giant clam restocking program within the Apo Reserve, but were only marginally successful due to high mortality of stocked clams. A recent survey of coral diseases revealed that Apo Island exhibited the lowest disease prevalence out of eight reefs surveyed in two regions in the country (Raymundo *et al.,* in review).

Economic valuation of natural resources: A new concept for scientists

Resource managers have come to the realization that placing a monetary value on a natural resource can be a powerful means of illustrating the effects of either protecting or losing that resource to overexploitation or conversion. Such a tool is particularly useful for non-scientists, government officials, and other decision-makers (Spurgeon, 1992). However, determining the economic value of a coral reef can be difficult, as attributes such as "educational value" and "biodiversity" are difficult to quantify. White and Cruz-Trinidad (1998) outlined the productivity of Philippine coastal ecosystems and discussed various ways of attaching monetary values to these ecosystems. An estimated US$1 billion is contributed to the Philippine economy annually from small-scale fishers (White *et al.,* 2000), but over- and destructive exploitation result in considerable monetary losses. The economic loss suffered as a consequence of ecosystem degradation and productivity reduction makes a compelling statement. In contrast, a recent report by Calumpong *et al.* (in press) cites that only 38% of tourism revenue is used for management of the Apo MPA, showing that a well-managed reserve can net a substantial income from user fees.

Tourism can alleviate such losses and lessen fishing pressure, but development of tourism enterprises must be managed. Oracion (2001) discusses the differences of mass tourism vs. ecotourism, stressing the importance of the behavior of individuals (resort owners, dive guides, etc.) in promoting a conservation approach. The author cites Apo's management history as the major reason for its success as an ecotourism destination, and Vogt (1997) discusses the Apo experience as a potential model from which other ecotourism enterprises could be developed. However, several economic analyses of tourism-derived benefits have stressed that few local residents derived direct income from tourism (Vogt, 1997; Cadiz and Calumpong, 2000; Oracion, 2001). Cadiz and Calumpong

(2000) report that only 20% of tourism-supporting revenue (estimated at US$180,859/yr) went directly to Apo Island residents, but a later estimate calculated that 37% of user and entrance fees go directly to the community as livelihood assistance, subsidized electricity, and transportation (Calumpong *et al.,* in press). However, the same report cites that dive operators derived the most benefit from tourism-related activities on Apo. Similar figures were found by Bernardo (2001) for both tourism revenue (US$193,138-US$238,487/yr) and benefits actually received by the community (26-31%). Under the NIPAS law, 75% of income from MPAs goes to the community managing the area, while 25% goes to the national government. However, bureaucratic delays have resulted in a lag time between the collection of fees and their availability to the community. This has caused a slight political upheaval within the Apo community. Two factions have developed that are at least partially defined by their "pro-" vs. "anti-" PAMB stance, as this situation is the direct result of management takeover by PAMB (E. Oracion, pers. comm.). Oracion (2001) cites the lack of funds for infrastructure projects and social services as the cause for the failure to democratize tourism benefits. This is particularly true in situations, such as in the Apo community, where many are not directly involved in tourism-related activities. In addition, tourism has generated problems for residents; tourists and fishers often conflict, as tourists scare fish away and have reportedly destroyed a number of fish traps (Bernardo, 2001; Raymundo, 2002; Raymundo and Maypa, 2003b; M. Pascobello, pers. comm.). Oracion (pers. comm.; ongoing research) states that some residents strongly support a diving ban within the sanctuary. Reboton and Calumpong (2000, 2003) report ongoing damage to the coral community from poorly trained tourist SCUBA divers, necessitating the enforcement of a "carrying capacity" limit for tourist divers on the reserve. Such studies highlight the necessity of careful planning of tourism ventures. Ecotourism is often touted as a

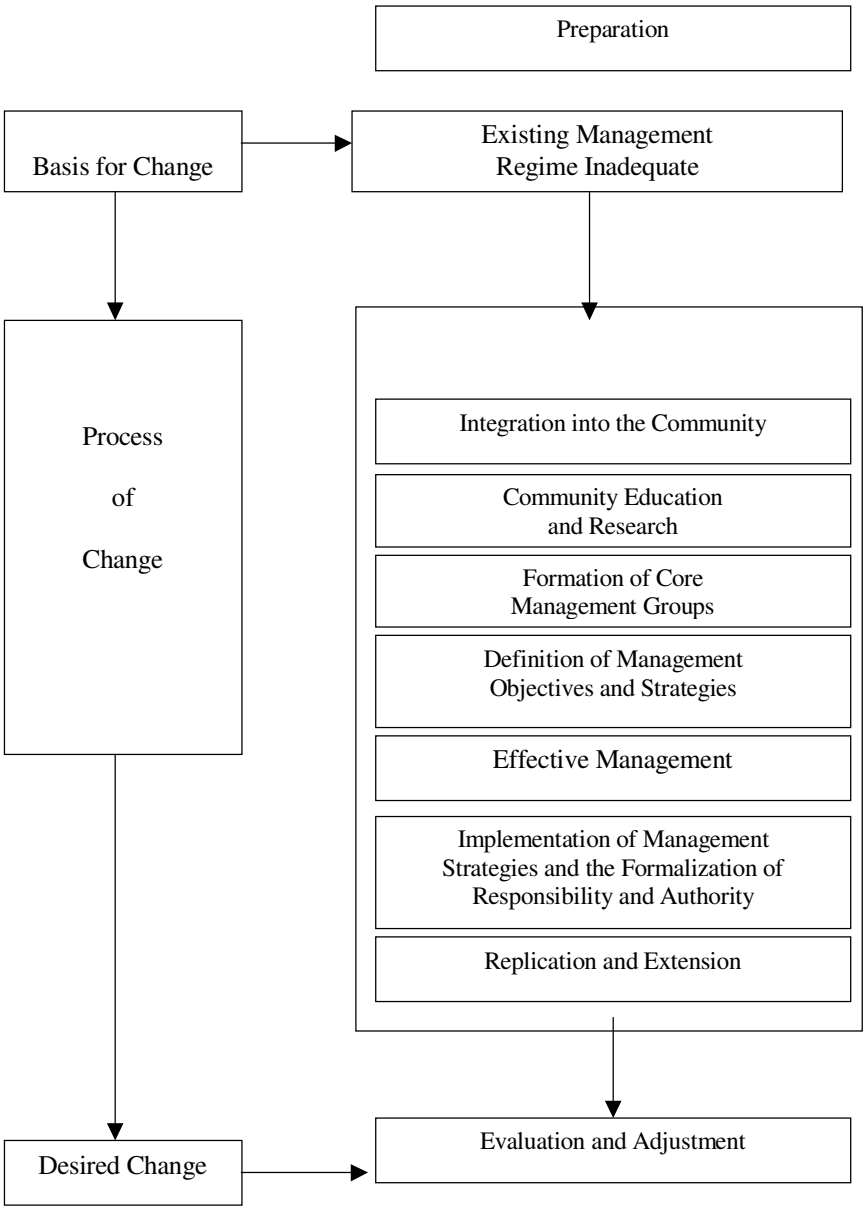
panacea, a solution for both environmental and poverty problems. But panaceas do not exist; every potential solution has both positive and negative effects. The balancing act involves developing the positive effects while minimizing the negative ones. PAMB has been quick to act on the problem of tourist diver damage by delineating fishing grounds as "off-limits" to tourist divers and setting a maximum limit of the number of divers allowed per day on the reserve.

Social science research: what a small island fishing community has taught us

Experience with the Apo Island community has shown, unequivocally, that small island communities can and do respond favorably to a conservation program that brings them immediate benefits. Because island ecosystems (both the human and environmental dimensions) are contained and limited, the impacts of degradation and/or results of management and conservation are measurable and understandable among the local population. Thus, the positive reinforcement of improved stewardship of Apo Island resources over the years has led to a stable management regime based on lessons learned. A framework for community-based marine resource management has evolved from the experience, summarized in Figure 2. The steps in the social change process have all been present in the evolution of Apo Island management. These steps, although not always sequential and sometimes repetitious, are indicative of CB-CRM in many parts of the world today.

The significance of the roles of women and children are rarely acknowledged in male-dominated societies. Yet in fishing villages in the Philippines, women are often the more important economic force, though their responsibilities are described as secondary to those of their husbands. An analysis of the division of labor among families relying on subsistence fishing revealed the contribution of fisher's wives; although fishing activities themselves were largely

Figure 2. Framework for Community-Based Marine Resources Management



handled by men, their wives were responsible for preparations, fish processing, and selling/ trading (Oracion, 1998a). The importance of women as equal stakeholders and managers of scarce resources is largely unrecognized (Oracion, 1998a, 2000). On Apo, most women are involved in multi-tasking, taking on a variety of both domestic and income-generating activities simultaneously with little help from husbands. It has also been observed that the most productive involvement of housewives in income-generating tasks can only occur after their child-rearing responsibilities have lessened (Oracion, 1998b). Many of these women were among the first to actively protect the no-take zone; they describe the many hours spent sitting on the beach in the early 1980s, chasing fishers away from the sanctuary as they wove mats and baskets for sale and watched over their children (F. Candido, pers. comm.). Without this early informal "police force", it is doubtful that the sanctuary boundaries would have been respected. The participation of these women in management, decision-making, and conflict resolution has been documented by Torrequemada-Deguit (1989) and Oracion (2000), who highlight the importance of involving women in the CB-CRM process.

The issue of child labor in Negros Oriental fishing villages was reported by Abregana (1999). Child labor is a growing problem throughout Asia, the region with the greatest number of working children in the world. The author discussed the abusive nature of the deep-sea fishing industry, which recruits young boys for *muro-ami* fishing. Unlike boys from other fishing villages along the coast of Negros, however, those from Apo did not join the *muro-ami* boats. They had been warned by older relatives of the dangers inherent in this type of fishing, and the economic incentives were apparently inadequate to lure them away from fishing on Apo.

So, what has the Apo experience taught us?

It takes a long time and much effort to ensure that a management regime is truly sustainable. Given the status quo on the island, we can say with some certainty that the use of Apo's resources is within ecological limits. Indicators show that the coral reef is stable and healthy. The relatively positive returns from the coral reef fishery, and more recently tourism, have helped convince people and change attitudes in the community towards more sustainable use patterns. The commitment of the island community and its assisting institutions, such as Silliman University and the municipal government, have grown together with time. This has helped ensure a long-lasting protection of the resources that is not wavering. The small size and relative isolation of Apo Island and its close-knit community have made it easier to protect and manage the area in a holistic manner. Enforcement of the rules is internalized and no longer requires external policing. The recent development involving political factions surrounding management issues is more centered on the issues themselves; support for the sanctuary concept itself remains solid.

The mentoring of institutions from outside the island has been crucial to long term success. Silliman University continues to play a key role and the Department of Environment and Natural Resources is important in facilitating the management under PAMB. Involvement of Silliman University has been highly influential in sustaining the commitment and enthusiasm of Apo residents. As seen on Apo, a fully-integrated management approach is required that includes population control and reproductive health issues, alternative livelihood needs, health and nutrition, as well as interpersonal and political issues that often arise in small communities. Finally, a unique feature of community-managed or co-managed reserves is its intergenerational nature. By involving community members, children learn from their parents and grandparents, and grow up with the principles of conservation firmly embedded in their

ethics. They, in turn, pass these on to their children, creating the essential element of sustainability.

A number of the studies cited above have attempted to use Apo as a model for other communities: for community-based management, for fisheries enhancement via the use of sanctuaries, for ecotourism. However, how applicable is the Apo experience to other communities? As stated above, Apo is a small island, with a tight-knit, cohesive community. It was relatively easy to impose a rule limiting fishing to Apo residents. Along an extensive coastline, such a delineation would be difficult and would necessitate an external policing force; poaching by 'outside' fishers is often cited as a major problem plaguing MPAs. The population of Apo is growing only slightly, partly because fewer people are emigrating to look for work elsewhere. Many families are aware of the value of having fewer children. In addition, the reef was in relatively good condition, and fishing pressure relatively low, when management was imposed; many community-managed MPAs are in areas with much higher fishing pressure and reefs that have been blasted, silted, or grossly over-fished (Aliòo, 2003).

So, what can we take from the Apo experience and apply to other communities? Although the aspects listed above may prevent a direct transplantation of the Apo model to larger, less insular communities, Apo continues to serve as an inspiration to such communities. In 2003, a group of government workers, fishers, and educators from Vietnam visited Apo Island to see the effects of management first-hand. They came away inspired and determined to find ways to incorporate the management approach within a culturally-acceptable framework for Vietnamese fishing villages. People's organizations throughout the Philippines continue to visit and interact with Apo residents, brought by community organizers who recognize the power of hearing the words from fishers themselves. Though the Apo story is merely a "drop in the bucket" in the huge sea of coastal communities desperately needing workable management solutions, its successes have

had a ripple effect, inspiring nearby Dauin municipality and other coastal communities to start their own programs. Several of these have become alternative dive sites for nearby resorts. Negros Oriental, alone, now boasts at least 28 marine reserves, though their size, enforcement effectivity, and budget commitment from local government differ widely. A total of 22 MPAs have been established within the Bohol Sea area, based on the Apo model (Alcala and Russ, 2003). In addition, it has had important impacts on national government policy and legislation. The lessons learned from the Apo marine reserve have implications for the open access nature of marine capture fisheries. This can be seen in the legislation of R.A. 7160, the Local Government Code, and R.A. 8550, the Fisheries Code of 1998. R.A. 8550 defined the jurisdiction of local government units (LGUs) for managing their coastal small-scale fisheries. Today in the Philippines, management of coastal areas is now in the hands of LGUs. It is important to keep these points in perspective—the key to Apo's success has always been the unfailing commitment of the community itself, supported by Silliman University, and local and national government. Community empowerment—the so-called "grassroots approach"—has proven its success where the traditional top-down, centralized approach has failed. This, perhaps, is the most important lesson, and one which can be transplanted and modified for other communities.

Nearly 30 years after the first marine parks were established, evidence is only now starting to accumulate to support the "spillover" concept. Obtaining proof is challenging as it involves multiple sources of data. One reason for the lack of evidence may be the time needed for fisheries to recover after heavy exploitation. Monitoring predatory fish biomass of Sumilon I. and Apo I. over a 17-yr period, Russ and Alcala (2004) concluded that time to full recovery to a pre-exploited state would take 15 yr and 40 yr for the two islands, respectively. This conclusion is based on current rates of biomass accumulation and life history aspects of the target

species. Such an extended recovery period would translate into a slow spillover effect, and highlights the need for long-term commitment to management.

Without a fundamental shift in attitude among stakeholders toward conservation, commitment is short-term; protection does not last. Sustainability is a key factor (Alcala, 1997; White, 1986; Russ and Alcala, 2003b), and is often brought about most effectively using a long-term multi-sectoral approach: partnerships between stakeholders, local government, support institutions, or NGOs (White and Deguit, 2000), and involvement of women in decision making (Oracion, 2001). Environmental conservation requires more than just an awareness of destructive activities on the environment; most fishers know they are using a destructive fishing method, but may feel they have few other options. Population control, alternative livelihood options, health and interpersonal/political issues must also be addressed. This is why it is called "Integrated Coastal Management".

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