

Marine Protected Areas as Biological Successes and Social Failures in Southeast Asia

PATRICK CHRISTIE¹

*School of Marine Affairs and Henry M. Jackson School of International Studies,
University of Washington, 3707 Brooklyn Avenue Northeast,
Seattle, Washington 98105-6715, USA*

Abstract.—Marine protected areas (MPAs) are of growing interest globally. They are principally studied from a biological perspective, with some cases documenting improved environmental conditions and increased fish yields. The MPAs that meet narrowly defined biological goals are generally presented as “successes.” However, these same MPAs may, in fact, be social “failures” when social evaluation criteria are applied. A review of four MPAs in the Philippines and Indonesia demonstrates this scenario. The cases are reviewed using standard measures of biological and social success. Their historic and present management structures are reviewed. It is suggested that a strong linkage exists between social and biological success, with social considerations determining long-term biological success. This finding implies that standards for measuring both biological and social success should be applied equally and that MPAs should be designed to meet multiple social and biological goals. The evaluation and portrayal of MPAs has implications for the management of a particular MPA and the broader discourse surrounding marine environmental management.

Introduction

The marine protected area (MPA) literature to date is mainly comprised of studies considering the biological significance of this management approach. The so-called “spill-over effect,” connectivity, appropriate dimensions, and habitat representation are some of the most active areas of inquiry (e.g., Russ and Alcala 1996; Salm et al. 2000; NRC 2001; Roberts et al. 2001). As highlighted in a recent essay by seventeen social scientists, MPA research and the resultant literature is generally lacking detailed accounts of the social implications of MPAs and the activities associated with them such as fishing, recreational diving, tourism, and research (Christie et al. 2003c). This paper grew out of a conference sponsored by the National Oceanic and Atmospheric Administration (NOAA) in 2002 as an attempt to fill this notable gap in MPA research and published literature (NOAA 2002). There are a few notable exceptions to this characterization (e.g., Trist 1999; Sandersen and Koester 2000; Pollnac et al. 2001),

and it is clear that MPAs, and protected areas in general, are beginning to attract considerable attention by those mainly interested in the human dimensions of environmental management.

The lack of social research on MPAs has led to at least two unfortunate conditions: an incomplete understanding of how to most effectively utilize this popular management tool and omissions from the scientific literature of potentially fascinating accounts of human responses to MPAs (Christie et al. 2003c; Mascia et al. 2003). One example of an omission is the general underrepresentation of conflict surrounding MPA establishment and implementation in the MPA literature. This paper will demonstrate that, in the tropics, conflict often stems from the marginalization of artisanal fisheries by other forms of resource utilization such as dive tourism. While this conflict (and its reporting) may be disconcerting to some environmentalists and scientists advocating MPAs, a careful consideration of the receptivity of fishing communities to MPAs is fundamental for their long-term success (Agardy et al. 2003).

If the measure of MPA success is mainly based on biological metrics, then it is plausible that some MPAs, at least in the short term, may be considered

¹ E-mail: patrickc@u.washington.edu

biological successes while simultaneously causing social harm such as conflict and economic and social dislocation for disadvantaged communities (such as artisanal fishing communities near MPAs). In response, the marginalized community may either strongly resist the imposition of the MPA or initially support the MPA but then lose interest. Field research presented in this paper and other accounts demonstrates that this scenario is not uncommon and has a strong destabilizing effect on any MPA (Trist 1999; Sandersen and Koester 2000; Christie et al. 2003a, 2003b; Oracion 2003).

Based on the experiences of four failing or vulnerable MPAs, this study comments on the implications of ignoring social complexities associated with MPAs. In conclusion, a case is made to improve our understanding of the complex and mixed results of MPAs thus far. The intent is to help ensure their biological and social success and to improve the likelihood that they will provide tangible benefits such as increased biodiversity and improved fisheries and tourism management.

Methods

This study is based on a comparative analysis of four MPAs in Southeast Asia—San Salvador Island (Philippines), Twin Rocks (Philippines), Balicasag Island (Philippines), and Bunaken National Park (BNP, Indonesia). All locations are coral reefs. The author was directly involved for 3 years in the establishment of the MPA on San Salvador Island. The first three MPAs are small (between 3-ha and 125-ha no-take areas), while Bunaken National Park consists of a large, zoned space (89,056 ha of land and sea area) that includes small no-take areas (up to approximately 25 ha) for dive tourism.

All four MPAs have both conservation and economic development goals. The Philippine management processes—commonly characterized as “community based” or “comanagement”—were particularly attentive to issues of social equity and grassroots participation from the inception (White and Savina 1987; White et al. 1994; Christie et al. 2002, 2003a, 2003d). These MPAs were intended to both improve coral reef conditions and spur community-level sustainable development. Bunaken National Park was established to simultaneously meet conservation and economic development needs at a number of levels (Merrill 1998; Salm et al. 2000). The MPAs, therefore, overlap in both environmental and social goals,

but, as highlighted in the subsequent analysis, utilize different approaches; operate at different scales; and have different histories. All management regimes aspired to some form of comanagement but with differing degrees of resident, private sector, and governmental–institutional influence (Christie and White 1997).

The analysis draws from published accounts and recent biological and social field research. To consistently evaluate these four MPAs, commonly utilized measures of biological and social success are applied to each case. An evaluative matrix was developed that includes biological and social variables. For this study, measures of biological success for an MPA include increased fish abundance, fish diversity, and living coral cover. Other data on coral substrate are available in cited studies.

The social indicators of success are drawn from the following sources: the National Research Council report on MPAs (NRC 2001), the recently developed social research agenda derived from a NOAA-sponsored workshop involving over 100 social scientists (NOAA 2002; Christie et al. 2003c), a recently published guide to the socioeconomic dimensions of coral reefs (Bunce et al. 2000), and the few social research studies of MPAs in the tropics (e.g., Trist 1999; Pollnac et al. 2001). While there are numerous possible measures of social impact, the following measures of success are applied since they have been shown to be critical in the Southeast Asia context: broad stakeholder participation, equitable sharing of economic benefits, and the presence of conflict–resolution mechanisms (White et al. 1994; Pollnac et al. 2001, 2003; Pomeroy et al. 2003).

Fish Species Richness and Density

The author recorded the diversity and abundance of fish in a 500-m² area demarcated by a 50-m transect line (laid at approximately 7 m deep, parallel to the reef crest) serving as the upper boundary. The observers swam 10 m along the line, then down the slope and 10 m parallel to the line, and then back to the line in this pattern until reaching the transect end. This procedure was repeated in the opposite pattern back to the beginning of the transect line. The number of individuals per species was noted, employing logarithmic categories for those species with large numbers of individuals. The families surveyed were surgeonfishes (acanthurids), rabbitfish (siganids; also known as spinefoots), sea basses (serranids; also known as groupers), snappers (lutjanids), grunts

(haemulids; also known as sweetlips), emperors (lethrinids), jacks (carangids), fusiliers (caesionids), breams (nemipterids), goatfishes (mullids), parrotfishes (scarids), sea chubs (kyphosids; also known as rudderfish), triggerfish (balistids; also known as leatherjackets), butterflyfishes (chaetodontids), angelfishes (pomacanthids), wrasses (labrids), and damselfishes (pomacentrids). Anthids (family Serranidae) and *Zanclus cornutus* (known as the moorish idol) were also counted. The first twelve fish listed are commonly targeted by fishers due to higher market values and recorded as “target species.” A range of 4–8 transects, each covering 500 m², was completed for each monitoring site, and confidence in mean estimates are represented by 95% confidence intervals on each figure. Dr. Alan White collected most of the pre-1998 data in Anilao and Balicasag (both in the Philippines). Mr. Jonathan Apurado was also involved in collecting recent data in these two sites.

Interviews

In addition to biological assessments, in-depth, semi-structured interviews were conducted with key informants to investigate, among other topics, local opinions of MPAs, management systems and rules, perceived benefits and costs, and implementation challenges. The 73 informants were dive resort owners, fishers, MPA advocates, and scientists. Eighteen informants in Twin Rocks, 15 informants in Balicasag, and 40 informants in Bunaken were interviewed. The author lived on San Salvador Island for 3 years (1987–1990) and periodically visits to conduct research. Dozens of management documents and published accounts were reviewed in order to identify management goals and issues. Interview data for Twin Rocks and Bunaken were analyzed using Atlas.ti software (Scientific Software Development, Berlin, www.atlasti.de) that allows for systematic analysis of qualitative information.

This analysis consisted of identifying and labeling relevant themes within interviews (e.g., employment, perception of the MPA, etc.). Once interviews were coded, search commands (using code labels) were used to scan the interviews for quotes meeting two or more criteria (e.g., “dive resort owner” and “perception that the environment is improving”). As trends emerged (or predicted ones did not), theoretical memos were affixed to each code label. These analytic memos served as starting points to relate findings to the relevant literature and biological findings.

This approach allowed the researcher to create an “analytic trail” that demonstrates how conclusions were reached.

Results and Discussion

Of the four well-documented MPAs in the Philippines and Indonesia that were chosen, all met standard biological criteria of success more consistently than standard criteria of social success (Table 1). In general, initially successful management processes at San Salvador Island, Twin Rocks, and Balicasag Island MPAs have deteriorated over time without consistent and long-term support of governmental agencies and non-governmental organizations that initially established them. Poorly managed controversy and conflict are derailing these MPAs. In Bunaken National Park, mandated by the Indonesian national government and supported with external aid, management and the enforcement of no-take areas is proceeding but in a manner that does not necessarily reflect the interests of many local fishing communities. Based on lessons from the other sites, this represents an unstable situation that likely requires corrective measures. To highlight gross similarities and differences, one point was assigned whenever a site effectively met a criterion of success (even in the most lenient sense).

San Salvador: Initial Success Eroded by Interpersonal Conflict

Each MPA has a unique and interesting history that helps explain the above characterizations. On San Salvador Island, initial success in community-based management (Christie and White 1994; Christie et al. 1994; White et al. 1994; Katon et al. 1999) has given way to intense interpersonal conflicts that have arisen between long-standing rivals within the community (Christie et al. 2003a). The MPA management process has become an opportunity through which such conflict, ongoing between key community leaders for more than 40 years, has expanded. While seemingly trivial (and underreported), such interpersonal conflict can have a strong detrimental impact considering the community-based nature of the management system.

Established in July 1989, San Salvador Island’s 125-ha no-take MPA continues to be protected by a few committed advocates from the community and a supportive local mayor. Therefore, at least until 1999, environmental conditions were improving or staying constant while the management process become in-

Table 1.—Evaluation matrix of four MPAs in Southeast Asia: San Salvador Island, Philippines; Twin Rocks, Philippines; Balicasag Island, Philippines; and Bunaken National Park no-take tourism zones, Indonesia.

Criteria	San Salvador Island	Twin Rocks	Balicasag Island	Bunaken National Park ^a	Criteria summation
Biological					
Increased fish abundance	Yes	Yes	Initially, no longer	Likely	3
Increased fish biodiversity	Yes	Yes	Initially, no longer	Likely	3
Improved habitat (coral substrate)	Yes	Yes	Yes	Likely	4
Social					
Broad stakeholder participation	Initially, no longer	Initially, no longer	Initially, no longer	Yes	1
Broad sharing of economic benefits	Possibly (due to increased fishery yields)	No	No	No	1
Presence of conflict-resolution mechanisms	Initially, no longer	Initially, no longer	Initially, no longer	Yes, only sporadically utilized	1

^a There are no baseline data available for Bunaken National Park. Therefore, the characterization of increases in fish and improved coral cover as “likely” is based on interviews and comparisons between sites within the park.

creasingly tenuous (Figure 1). Species richness has increased from 126 species belonging to 19 families in 1988 to 138 species belonging to 28 families in 1998 (Christie and White 1994; Christie et al. 2003a).

Some former supporters complain that advocates are unwilling to share responsibility and are heavy handed in their methods of enforcement. As a result, the island community, which formerly appeared to be

unified behind the MPA (Christie et al. 1994; Katon et al. 1999), is now clearly divided (Christie et al. 2003a). While enforcement is an important ingredient for successful programs, it is important for long-term sustainability that wide stakeholder support exists (Peluso 1992; Brechin et al. 2002; Lowe 2003). Without considerable conflict-resolution interventions, the likelihood that management will continue for another

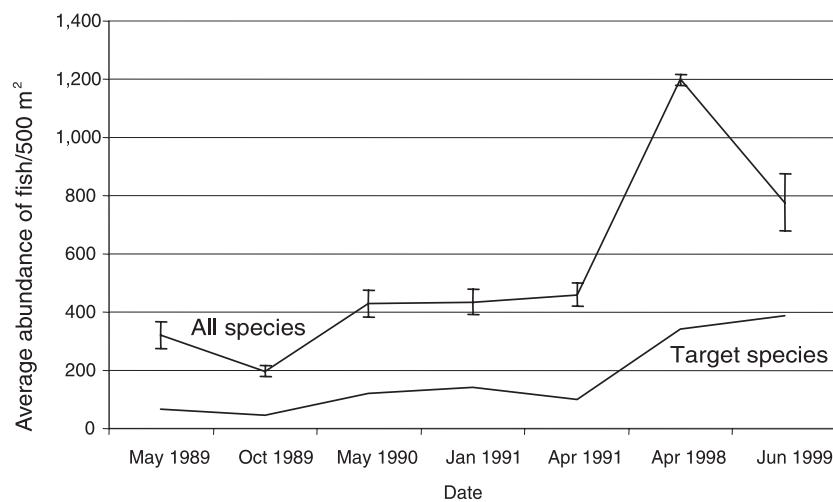


Figure 1.—Average abundance of fish over time, San Salvador Island, Philippines. From Christie et al. (2003a).

decade is unlikely based on recent interviews and comparative research on design principles for such management systems (Ostrom 1992; Pollnac et al. 2001).

Twin Rocks: Initial Success Usurped by Influential Stakeholder

Twin Rocks is the site of a destabilizing conflict between dive resort owners and local fishing communities (Christie et al. 2003d; Oracion 2003). In the most superficial sense, this conflict stems from disagreements over whether recreational diving—a practice formally banned by the MPA's regulations but broadly ignored by dive shop owners—should be allowed in the small no-take area (approximately 3 ha). The inter-stakeholder conflict is grounded in class distinctions and perceptions of environmental management, a phenomenon apparent in other Philippine contexts (Nazarea et al. 1998). The involved dive shop owners are generally from the capital city, much more affluent than local fishers, and politically well connected with local officials (partly as a result of election campaign contributions). As a result, these elites are able to wield greater influence over MPA management practices and have usurped control from the founding community (Peluso 1992; Trist 1999; Sandersen and Koester 2000; Lowe 2003; Oracion 2003). As of 1999, the resort owners purchased the nearshore lands and are the main enforcers of the MPA. In July 2001, one owner was particularly committed and vigilant:

But what I'm telling the people in this community is, for the reef... we take care of it. [I spent] many sleepless nights [protecting the sanctuary]. I have to bear the burden of getting the ire of these people. That's okay. I don't care. As long as the fish are there. We will have to bribe people. I will resort to anything that will prevent any direct negative impact [on the sanctuary]...

Predictably, fishers, who initially voluntarily protected the no-take area (over a period of 7 years) as part of the community-based management regime, are either losing interest in the MPA or are plotting how to stop diving inside the reserve and reassert their influence. When asked why they are losing interest, informants expressed a general sense of mistrust of the dive industry and concern that MPA management is no longer fair. There is a struggle for ownership over this MPA and the resort owners are perceived as having violated the tenets of community-based resource

management (White et al. 1994; Pollnac et al. 2001; Oracion 2003). One community leader who dedicated years of voluntary effort has now distanced herself from this work:

Now, since the resort was established they [resort owners] are the ones who guard and protect the sanctuary. But I think they already took over the sanctuary and that's the problem now... Umm, they might hear my interview. They'll be angry with me...

Asked why this control was a problem as long as the sanctuary was protected, she replied, "it's the same, but the only thing is that sanctuary is for the community, now they [the resort owners] are already taking it over it." This MPA management process is suffering the fate of its own success in one community leader's opinion: "If there's good management, our coastal resources bloom. That's when divers came in. Resorts came in. But community-based management has also vanished..."

Figure 2 displays data from three locations—Twin Rocks (the enforced MPA), Arthur's Rock (a nonenforced MPA due to past conflicts), and a nearby non-MPA reef. Increase in fish abundance for target species for all sites has been marginally significant since 1995 (two-way analysis of variance [ANOVA], time, $P = 0.065$). There is a significant difference between sites (two-way ANOVA, site, $P = 0.033$), with Twin Rocks being significantly different from non-MPA sites (Scheffé's test, $P < 0.01$) but not significantly different from Arthur's Rock (Scheffé's test, $P = 0.195$). Twin Rocks target fish abundance in 2001 was 280.9 (± 134) individuals per 500 m². Target fish abundance has remained constant for the nearby non-MPA sites since 1995. This is an indication that any "spillover" from the MPAs is likely being caught by local fishers—a condition consistent with other MPAs in the Philippines (Christie et al. 2002). The greatest increase in target fish abundance for Twin Rocks took place between sampling in 1997 and 2001. A plausible conclusion is that once local resort owners took over management and enforcement of the no-take area there were immediate beneficial biological impacts.

From an exclusively biological perspective, conditions at Twin Rocks are only improving. From a social perspective, such disregard for the community-based regime represents a failure.

The scenario of inter-stakeholder tensions, particularly between tourist brokers and resource users,

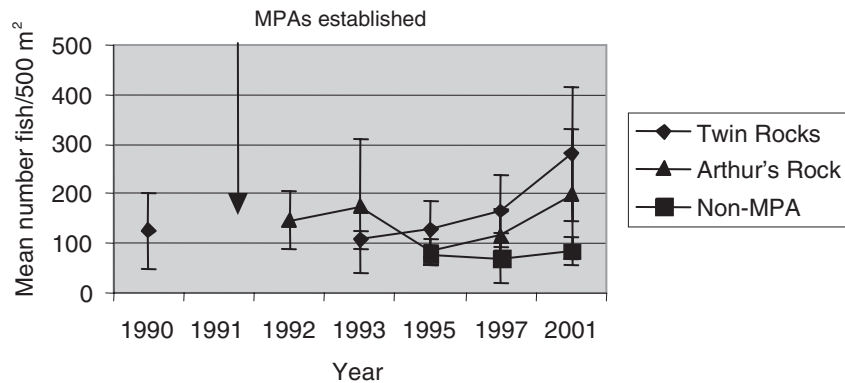


Figure 2.—Target fish abundance change over time (mean \pm 95% confidence interval). Two-way ANOVA for 1995–2001: time, $P = 0.065$; site, $P < 0.05$; time \times site, not significant. $N > 5$ per site. From Christie et al. (2003d).

is common (West et al. 2003). In fact, it is apparent (although again underreported by some advocates) in other conservation–tourism destinations such as Soufrière, St Lucia (Trist 1999; Sandersen and Koester 2000; Roberts et al. 2001) and Bunaken National Park (Salm et al. 2000; Christie et al. 2003b; Lowe 2003).

Some MPA advocates and scientists seemingly have determined that tourism is the most effective economic engine to propel the conservation agenda forward (Nichols 1999; Trist 1999; Lowe 2003). In such cases, it appears that enforcement systems are more common than incentive-based or self-monitoring management systems based on compliance rather than enforcement (Peluso 1992; Brechin et al. 2002). While most would argue that enforcement is necessary for MPA success, the growing tendencies toward coercive mechanisms that are not compatible with other cooperative options represents a break from the early successes of community-based and comanagement regimes in the Philippines and elsewhere (White and Savina 1987; White et al. 1994; Christie and White 1997; Brechin et al. 2002).

Balicasag Island: Lost Community Control Has Negative Biological Impacts

The insertion of central government agency control over a community-based MPA has the potential to undermine community support on Balicasag Island (Christie et al. 2002). Historically, the Philippine national government had formal control over fisheries resources. The passage of decentralization laws in the 1990s allowed community-based reserves to flourish in that context (White et al. 2002). However, the Phil-

ippines National Tourism Authority (NTA), which is an arm of the central government, has effectively laid claim to the Balicasag Island MPA. The NTA built a resort at the shores of the no-take area and now captures, along with offshore dive businesses, the majority of revenues generated by this MPA. Local residents are relegated to selling shells and t-shirts to visitors. While the NTA has stationed an armed guard at the MPA, he is unable to monitor the area effectively. Formerly supportive community members are now likely poachers, as manifested by declining fish populations inside and outside the no-take area (Christie et al. 2002).

Poorly managed social dynamics have real consequences for biological resources. Fish abundances (of target species within families such as Serranidae, Lutjanidae, Lethrinidae, and Carangidae) within the no-take area have declined 291% from a peak in 1986 (one year after MPA implementation) to a low in 1999 (Christie et al. 2002). Fish abundance on the reef near the no-take area have also severely declined from 1986 ($1,642 \pm 223$ individuals/500 m²) to 1999 (230 ± 65 individuals/500 m²). There is no longer any significant difference in fish abundance when comparing fishing areas on Balicasag (within 1 km of the no-take area) with nearby control sites where fishing is allowed, but without nearby MPAs. Even if Balicasag's MPA were effectively managed, it is likely that isolated MPAs will have a declining effect without a wider policy of fishing effort reduction in the Philippines (White et al. 2002). Initial success stories probably become magnets for increasingly desperate fishers from other areas in the Philippines. The Balicasag case provides evidence of the biological consequences of poorly functioning social

management systems and may suggest reorientations relevant to Bunaken National Park where fisheries and tourism coexist.

Bunaken National Park: Will Emerging Tensions Be Adequately Managed?

The Bunaken case illustrates the perennial issues that emerge when trying to simultaneously meet sometimes conflicting management goals for conservation, fishery enhancement, and tourism development in a complex context (Merrill 1998; Agardy et al. 2003). Bunaken National Park is unique from the other MPAs in this analysis since it represents an example of a relatively large national park established through national government decree in a context other than the Philippines (Salm et al. 2000). Nonetheless, lessons from the Philippines are relevant.

Since 1994, its management has been the focus of two successive projects funded by the U.S. Agency for International Development that helped with management plan development and implementation. Recently, management has focused on rezonation, improving the enforcement of park zones, and addressing the impacts of dive tourism. As a result, biological conditions, especially the abundance of large target fish species, appear to have improved within tourism dive zones and now are significantly greater than in nearby zones with very similar physical and oceanographic conditions (Christie et al. 2003b). Baseline data are not available to assess this impact definitively; however, key informant interviews and comparisons of fish and coral data (between zones within the park) strongly suggest that the strict no-take management system is having environmentally favorable effects within tourism zones.

The management process in Bunaken has not been a smooth one and has generated considerable controversy (Merrill 1998; Salm et al. 2000; Lowe 2003). Initially, Indonesian central government agencies considered dislocating local fishing communities within the park. Local communities and an Indonesian nongovernmental organization effectively resisted that proposal. More recently, park managers have engaged local communities in a consultative process (hence the notation of broad community participation in Table 1) (Erdmann et al. 2004). While consultation is ongoing, some social scientists and local Indonesians have expressed concerns that the park management system is too hierarchical and implicitly favors the dive industry and particular ethnic or religious groups (Lowe 2003).

In short, some stakeholders do not feel that economic benefits are being equitably shared, a fundamental condition for long-term success of MPAs (Pollnac et al. 2001, 2003; Pomeroy et al. 2003). While dive tourism has been active in the area since the 1970s, the number of visitors has greatly increased since 1993. Approximately 13,361 Indonesian tourists and 7,213 foreign tourists visited BNP between March 2001 and March 2002. This is a dramatic increase from 2,248 visitors in 1985. These numbers are based on entrance fee collection figures collected by the local management board. In a 1999 survey, it was found that out of 368 jobs in BNP's tourism industry, only 24.5% went to native Bunaken National Park residents (V. Lee, University of Waterloo, unpublished report, 1999). As demonstrated in the Twin Rocks MPA, disparities in income and the perception that benefits are not shared equally is a potent scenario that can quickly undermine what popular support may exist. Neither these economic impacts nor hoped-for improvements in fish yields are adequately documented.

The new zonation scheme is also controversial. Interviews demonstrated that some fishers feel that the current zonation scheme is unfair on the grounds that it protects the best fishing areas exclusively for diving and does not allow for necessary seasonal relocation of fishing around the islands (Merrill 1998; Christie et al. 2003b). A Western dive shop owner in BNP in July 2002 stated, "I haven't given up any primary diving sites from zonation... The fishers probably feel that they gave up some of their primary fishing areas..."

These issues are being discussed through a complex consultation process, but it is unclear if park managers are willing to make major changes to management practices and zonation schemes. Consultative participation is generally considered to be the lowest form of participation in management (Christie and White 1997; Kay and Alder 1999). The terms of discussion have largely been set by the general principles outlined by Indonesian law regarding national parks and the conservation agendas of environmental organizations.

Conclusion: A Clear Understanding is Fundamental

The intent of this review is not to be dismissive of MPAs or the dedicated efforts of managers, but to highlight the complexities of establishing ambitious conservation areas in impoverished and socially strati-

fied contexts. It also suggests the need for a monitoring system that matches this biological and social complexity. The means by which MPAs are evaluated is not trivial and can lead to biased assessments. This study demonstrates that, while particular MPAs may meet biological goals, they may be, at least in the short term, considerably less effective in attaining basic measures of social success. If these social considerations—which will largely determine the fate of these MPAs—are ignored, MPAs are likely to continue to have high failure rates and eventually may fall out of favor as a management tool.

Perhaps the most troubling aspect of this review is that none of these MPAs have formal conflict-resolution mechanisms that operate impartially and represent all stakeholder interests equally. Rather, conflicts emerge and are generally addressed on an ad hoc basis or ignored until they reach a crisis stage. At this point, entrenched opinions make it difficult to diffuse the conflict (McCreary et al. 2001). While the creation of dependent relationships between local communities and external agents may be undesirable, there may be no other choice, considering the challenges facing these MPAs and local communities. Again, the provision of comprehensive assessments and third-party broker systems are fundamental to address entrenched conflict.

If large-scale social dislocation and strife are considered the necessarily price for environmental improvements, it may be tempting to consider coercive mechanisms as a means to force acquiescence to management regimes. Social theory strongly suggests that this strategy is likely to fail in the long term (Ostrom 1992; Peluso 1992; Brechin et al. 2002). Social monitoring has the potential to identify stakeholder opinions of management regimes and to moderate one-sided agendas.

In short, to begin to unravel the puzzle of how to meet both biological and social goals with MPAs, greater attention needs to be paid to social research as a complement to the already extensive biological research agenda (Agardy et al. 2003; Christie et al. 2003c; Mascia et al. 2003). Since MPA establishment and management is a complex undertaking with frequently contentious outcomes, particular attention should be paid to comparative studies and those that explore the likely inter-group and intra-group differences (Nazarea et al. 1998). A clear understanding of how different constituencies value marine resources and MPAs is a logical first step toward improving management practices. Based on site-specific studies, MPA management plans and monitor-

ing protocols should be designed to address local conditions.

Acknowledgments

The author takes sole responsibility for any errors in this analysis. Much of this research was made possible with the support of the David and Lucile Packard Foundation (grant number 2000-14654) and the National Science Foundation (grant number DGE-0132132). Field research relied on the ongoing collaboration with Alan White, Bogor Agricultural University and Silliman University. The comments of two anonymous reviewers were very helpful.

References

- Agardy, T., P. Bridgewater, M. P. Crosby, J. Day, P. K. Dayton, R. Kenchington, D. Laffoley, P. McConney, P. A. Murray, J. E. Parks, and L. Peau. 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. *Aquatic Conservation: Marine and Freshwater Ecosystems* 13:1–15.
- Brechin, S., P. Wilshusen, C. Fortwangler, and P. West. 2002. Beyond the square wheel: toward a more comprehensive understanding of biodiversity conservation as social and political process. *Society and Natural Resources* 15:41–64.
- Bunce, L., P. Townsley, R. Pomeroy, and R. B. Pollnac. 2000. Socioeconomic manual for coral reef management. National Ocean Service, National Oceanic and Atmospheric Administration, Silver Spring, Maryland.
- Christie, P., D. Buhat, L. R. Garces, and A. T. White. 2003a. The challenges and rewards of community-based coastal resources management. Pages 231–249 in S. R. Brechin, P. R. Wilshusen, C. L. Fortwangler, and P. C. West, editors. *Contested nature, promoting international biodiversity with social justice in the twenty-first century*. State University of New York Press, Albany.
- Christie, P., D. Makapedua, and Ir. L. T. X. Lalamentik. 2003b. Bio-physical impacts and links to integrated coastal management sustainability in Bunaken National Park, Indonesia. *Indonesian Journal of Coastal and Marine Resources Special Edition* 1:1–22.
- Christie, P., B. J. McCay, M. L. Miller, C. Lowe, A. T. White, R. Stoffle, D. L. Fluharty, L. Talaue McManus, R. Chuenpagdee, C. Pomeroy, D. O. Suman, B. G. Blount, D. Huppert, R. L. Villahermosa Eisma, E. Oracion, K. Lowry, and R. B. Pollnac. 2003c. Toward developing a complete understanding: a social science research

- agenda for marine protected areas. *Fisheries* 28(12):22–26.
- Christie, P., and A. T. White. 1994. Reef fish yield and reef condition for San Salvador Island, Luzon, Philippines. *Asian Fisheries Science* 7:135–148.
- Christie, P., and A. T. White. 1997. Trends in development of coastal area management in tropical countries: from central to community orientation. *Coastal Management* 25:155–181.
- Christie, P., A. T. White, and D. Buhat. 1994. Community-based resource management on San Salvador Island, the Philippines. *Society and Natural Resources* 7:103–117.
- Christie, P., A. T. White, and E. Deguit. 2002. Starting point or solution? Community-based marine protected areas in the Philippines. *Journal of Environmental Management* 66:441–454.
- Christie, P., A. T. White, B. Stockwell, and C. R. Jadloc. 2003d. Factors influencing integrated coastal management sustainability: focus on environmental conditions in two locations in the Philippines. *Silliman Journal* 44(1):286–323.
- Erdmann, M. V., P. R. Merrill, M. Mongdong, I. Arsyad, Z. Harahap, R. Pangalila, R. Elverawati, and P. Baworo. 2004. Building effective co-management systems for decentralized protected areas management in Indonesia: Bunaken National Park case study. United States Agency for International Development, Natural Resources Management Program, Jakarta, Indonesia.
- Katon, B. M., R. S. Pomeroy, L. R. Garces, and A. M. Salamanca. 1999. Fisheries management of San Salvador Island, Philippines: a shared responsibility. *Society and Natural Resources* 12:777–796.
- Kay, R., and J. Alder. 1999. Coastal planning and management. E&FN Spon, New York.
- Lowe, C. 2003. Sustainability and the question of “enforcement” in integrated coastal management: the case of Nain Island, Bunaken National Park. *Indonesian Journal of Coastal and Marine Resources Special Edition* 1:49–63.
- Mascia, M. B., J. P. Brosius, T. A. Dobson, B. C. Forbes, L. Horowitz, M. A. McKean, and N. J. Turner. 2003. Conservation and the social sciences. *Conservation Biology* 17:649–650.
- McCreary, S. J. Gamman, B. Brooks, L. Whitman, R. Bryson, B. Fuller, A. McNerny, and R. Glazer. 2001. Applying a mediated negotiation framework to integrated coastal zone management. *Coastal Management* 29:183–216.
- Merrill, R. 1998. The NRMP experience in Bunaken and Bukit-Bukit Raya National Parks: lessons learned from PAM in Indonesia. Natural Resources Management Program. Available: www.nrm.or.id/Content/Resources/Bibliography.asp (April 2003).
- Nazarea, V., R. Rhoades, E. Bontoyan, and G. Flora. 1998. Defining indicators that make sense to local people: intra-cultural variation in perceptions of natural resources. *Human Organization* 57:159–170.
- Nichols, K. 1999. Coming to terms with “integrated coastal management”: problems of meaning and method in a new arena of resource regulation. *Professional Geographer* 51:388–405.
- NOAA (National Oceanic and Atmospheric Administration). 2002. Marine protected areas social science workshop notes from breakout groups. NOAA, National MPA Center, Santa Cruz. Available: www.mpa.gov (April 2003).
- NRC (National Research Council). 2001. Marine protected areas: tools for sustaining ocean ecosystems. National Academy Press, Washington, D.C.
- Oracion, E. 2003. The dynamics of stakeholder participation in marine protected area development: a case study in Batangas, Philippines. *Silliman Journal* 44(1):95–137.
- Ostrom, E. 1992. *Governing the commons, the evolution of institutions for collective action*. Cambridge University Press, New York.
- Peluso, N. 1992. Coercing conservation: the politics of state resource control. *Global Environmental Change* 4:199–218.
- Pomeroy, R., E. Oracion, D. A. Caballes, and R. B. Pollnac. 2003. Economic benefits and integrated coastal management sustainability. *Silliman Journal* 44(1):75–94.
- Pollnac, R. B., B. R., Crawford, and M. L. G. Gorospe. 2001. Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. *Ocean and Coastal Management* 44: 683–710.
- Pollnac, R. B., R. Pomeroy, and L. Bunce. 2003. Factors influencing the sustainability of integrated coastal management projects in Central Java and North Sulawesi, Indonesia. *Indonesian Journal of Coastal and Marine Resources Special Edition* 1:24–33.
- Roberts, C. M., J. A. Bohnsack, F. Gell, J. P. Hawkins, and R. Goodridge. 2001. Effects of marine reserves on adjacent fisheries. *Science* 294:1920–1923.
- Russ, G. R., and A. C. Alcala. 1996. Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. *Marine Ecology Progress Series* 132:1–9.
- Salm, R. V., J. Clark, and E. Siirila. 2000. *Marine and coastal protected areas: a guide for planners and managers*. International Union for Conservation of Nature and Natural Resources, Washington, D.C.
- Sandersen, H. T., and S. Koester. 2000. Co-management of tropical coastal zones: the case of the Soufrière Marine Management Area, St. Lucia, WI. *Coastal Management* 28:87–97.
- Trist, C. 1999. Recreating ocean space: recreational consumption and representation of the Caribbean marine environment. *Professional Geographer* 51:376–387.

- West, P. C., C. L. Fortwangler, V. Agbo, M. Simsik, and N. Sokpon. 2003. The political economy of ecotourism—Pendjari National Park and ecotourism concentration in Northern Benin. Pages 103–115 *in* S. R. Brechin, P. R. Wilshusen, C. L. Fortwangler, and P.C. West, editors. *Contested nature—promoting international biodiversity conservation with social justice in the twenty-first century*. State University of New York Press, Albany.
- White, A. T., L. Z. Hale, Y. Renard, and L. Cortesi, editors. 1994. *Collaborative and community-based management of coral reefs: lessons from experience*. Kumarian Press, West Hartford, Connecticut.
- White, A. T., A. Salamanca, and C. A. Courtney. 2002. Experience with marine protected area planning and management in the Philippines. *Coastal Management* 30:1–26.
- White, A. T., and G. Savina. 1987. Community-based marine reserves: a Philippine first. Pages 2022–2036 *in* *Proceedings of coastal zone '87*. American Society of Civil Engineers, Seattle.