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Using local user perceptions to evaluate outcomes of protected area management in the Sagay Marine Reserve, Philippines

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SUMMARY

Local user perceptions of resource trajectory and indicators of protected area outcomes can be useful in the assessment of integrated conservation projects, both marine and terrestrial. In-depth stakeholder surveys using 12 performance indicators were used to evaluate the perceived outcomes of the Sagay Marine Reserve (SMR), the Philippines. These indicators were a measure of whether the SMR had achieved its management objectives in the recent past and what local stakeholders expected in the future. The respondents' contextual situation could be correlated with their perceptions of SMR indicators. There was a generally high level of perceived equity and efficiency of SMR management outcomes, but the sustainability of the SMR, particularly the condition of the fisheries, had been poor over the previous 10 years. Few anticipated an improvement in sustainability indicators over the next 10 years. Respondents from an island village within the SMR had more negative (or less positive) perceptions of SMR outcomes because of their high dependence on the degraded resource, combined with physical and economic isolation. Specific remedies to enhance island villagers' satisfaction, such as greater participation, empowerment, alternative economic opportunities and fisheries protection, and replenishment, are necessary. This research serves as an example of how indicators perceived by local resource-accessing stakeholders can and should be main components of both marine and terrestrial protected area assessment.

Keywords: co-management, integrated coastal management, marine protected area, participation

INTRODUCTION

A prevailing challenge to sustainable coastal management is the rapid and continuous degradation of valuable coastal and marine resources. This is particularly true for the Philippines, where only 5% of the country's 27 000 km^2 of coral reef have been assessed as in excellent condition (Gomez *et al.* 1994). White and Cruz-Trinidad (1998) estimated that coral reefs contributed approximately US$ 1.35 billion to the country's economy, so rapid degradation of coastal resources has serious economic, social and biological implications. Hence, different sectors have implemented various efforts for coastal management in the Philippines over the past two decades.

The Philippines has expended considerable effort to improve coastal management, including the implementation of integrated coastal management (ICM) strategies (Vandermevien 1998). ICM is a dynamic and participatory process in which an integrated strategy is employed for the conservation and sustained multiple use of the coastal zone while taking into account traditional, cultural and historical perspectives and conflicting interests (Westmacott 2002). One key activity of ICM is the establishment of marine protected areas (MPAs), which are set aside for management and conservation measures (Alcala & Russ 1990; Russ & Alcala 1996; White *et al.* 2002). MPAs have been shown to increase reef fish and invertebrate abundance (Maliao *et al.* 2004), biomass and species richness (Bohnsack 2000), and to set the stage where the local people and the government can work together, leading to community empowerment (White *et al.* 2002).

The establishment of MPAs in the Philippines has been supported by various policies such as the Local Government Code of 1991, the National Integrated Protected Area Systems (NIPAS) Act in 1992 and the Fisheries Code of 1998 (Republic Act 8550). More than 100 community-based coastal management projects were implemented between 1984 and 1994 (Pomeroy *et al.* 1997), and approximately 440 coastal MPAs have been established.

Despite major protection efforts, only a meagre 10–25% of MPAs in the Philippines have been considered successful (Alcala 2001; Crawford *et al.* 2000 cited in Pollnac *et al.* 2001). Clearly, there is an urgent need both to assess the outcomes of MPA implementation and to provide clear recommendations on how to improve coastal management in the Philippines. Evaluation can demonstrate whether a MPA meets its objectives and can be used to modify strategies of resource managers and policy makers. The accumulation of evaluations may also reveal variables that consistently facilitate success or failure of MPAs in the Philippines or, more generally, the tropics.

One principal challenge to ICM evaluation is that it is difficult to demonstrate the quantitative linkages among human, natural and institutional settings (Otter & Capobiano

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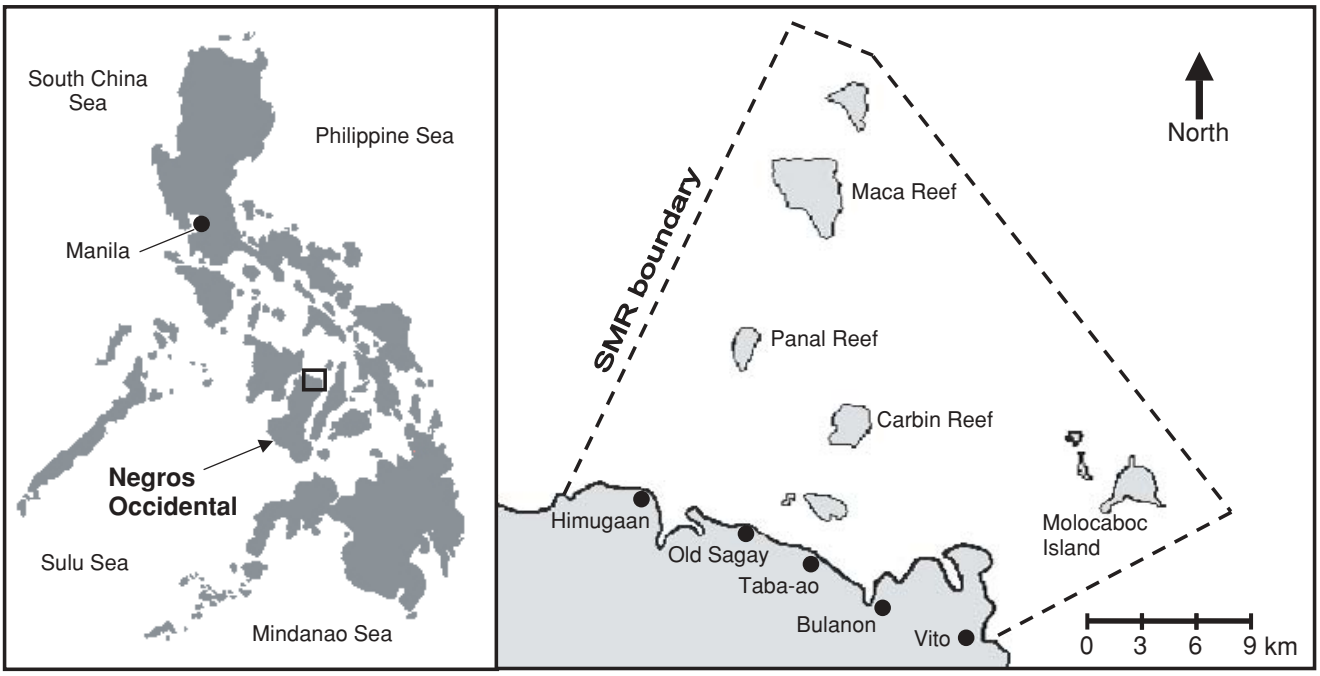

Figure 1 Map of the Philippines showing location of the Sagay Marine Reserve (SMR).

2000). Lacking controlled experimental data, one possible solution is to use a set of performance indicators that serve as 'benchmarks' of outcomes. Although indicators cannot always provide information on mechanisms of interaction, they can provide bottom-line evaluations of whether a project has achieved its objective(s), and can suggest key linkages for prioritization.

In evaluating outcomes of ICM projects, the ideal is to compare quantitative performance indicators before and during (or after) the project. Examples of such indicators are species' population characteristics (see Maliao *et al.* 2004), biodiversity assessments, income generation, equity of benefit distribution and other community livelihood parameters (see also Guijt 1999). Unfortunately, many ICM projects lack baseline quantitative information such as focal species abundance, habitat quality or local livelihoods. Data-depauperate situations such as this are common in projects with limited funds, particularly in developing countries.

A proposed solution to data-depauperate ICM projects is to use qualitative indicators based on the perceptions of local resource stakeholders. This strategy is an acceptable alternative, as long as it captures relevant aspects of environmental, economic and social dimensions (Fabbi 1998). Resource-accessing stakeholders may have an enormous depth of knowledge about the resource abundance, ecology and management (Walters 1997; Neis *et al.* 1999; see Berkes *et al.* 2000 for a review). Resource users view their environment in different ways and their actions are based on their perceptions, experiences and knowledge (Blaikie 1995). Perception indicators may therefore represent a crucial tool for evaluation, given the widespread lack of quantitative data in many biologically important regions. Not only do perception data allow evaluation of the general trend in resource condition over time, but also they provide insight into the community's assessment of an ICM project. Perceived effectiveness of an ICM project can also be used to gauge the willingness of communities to continue to participate, since the perceived benefits of participating in an MPA must outweigh the perceived costs (Ostrom 1990; Ostrom *et al.* 1994). Therefore, not only are local perceptions relevant for data-depauperate situations, but also they should be integrated into data-rich situations.

The Sagay Marine Reserve (SMR) in Sagay, Negros Occidental, Philippines (Fig. 1), was one of the pioneering coastal management interventions in the Philippines. Yet, the SMR can be categorized as data-depauperate. No pre-MPA fisheries data exist, so an evaluation of the MPA outcomes must rely principally on stakeholder perceptions.

This study had two objectives. First, we evaluated the stakeholder perceptions of SMR outcomes using several relevant performance indicators. Second, we investigated whether attributes of the stakeholders and the resource influenced stakeholder perceptions. The first objective can be described as a typical assessment of the SMR using local perceptions. The second objective allowed us to evaluate linkages to suggest SMR improvements.

Whereas the results of this study are directly applicable to the agencies directly involved with SMR management, this study should be of interest to conservation scientists seeking methods to evaluate outcomes of integrated conservation projects where quantitative baseline information may be lacking, or where indicators other than (or in addition to) quantitative biological parameters are used to measure outcomes.

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Table 1 History of the protection on different reefs within the SMR (source: Maliao *et al*. 2004).

Reef name	*Official protection history*	*Actual protection level*
Carbin	Established as a no-take zone in 1983. Strict protection began in 1995	Open access before 1983. Low-moderate, 1983–1995. High since 1995
Maca	Established as a no-take zone in 1991. Strict protection began in 1995	Open access before 1991, Low-moderate, 1991–1995. High since 1995
Panal	Established as a no-take zone in 1991, but never enforced	Open access to present day
Molocaboc	Established as a multiple-use zone in 1995	Open access to present day

STUDY AREA

The SMR is located at 11°0′59″N and 123°0′29″E, situated at the northernmost tip of the island of Negros Occidental, western Philippines (Fig. 1). It encompasses the entire 32 000 ha of Sagay municipal waters, which include sand cays, islands, shoals, coral reefs, extensive sea grass meadows and mangrove forests. There are six villages within the SMR, namely Himugaan-Baybay, Old Sagay, Taba-ao, Bulanon, Vito and the island village of Molocaboc. There are four main reef systems in SMR, namely Carbin Reef (200 ha), Maca Reef (1000 ha), Panal Reef (100 ha) and the fringing reefs of Molocaboc Island (see Table 1 for the management history of these reefs). These sites supported productive reef fisheries making Sagay waters a major fishing ground in the province of Negros Occidental.

The six coastal villages of SMR contain 40 361 persons, equivalent to 31% of the population of Sagay (Municipal Government of Sagay 1998). Fishing is the most important livelihood activity in SMR villages, undertaken by 1768 persons and accounting for approximately 78% of the average household income (Maliao 2002). Of the total fish catch, about 85% is sent to the local market. The most common fishing gears used are gill nets, hook and line, fish pots, bag nets, fish corrals and compressor diving (locally known as hookah). Some households on the mainland had alternative livelihood strategies, such as farming, to supplement fishing income.

Prior to 1983, the whole municipal waters of Sagay were *de facto* open access (Table 1). In 1983, Carbin reef was established as a no-take zone (sanctuary) through Municipal Ordinance Number 2. The sanctuary was later extended to Maca and Panal reefs in 1991 through Municipal Resolution Number 85. In 1995, the entire 32 000 ha of Sagay coastal waters were gazetted as Sagay Marine Reserve (SMR), and included as a Protected Seascape within the NIPAS of the Philippines by virtue of Presidential Proclamation No. 592. The current legal protection and management of SMR is a national law by virtue of Republic Act No. 9106 (the Sagay Marine Law), passed in April 2001.

The SMR, like other marine protected areas in the Philippines (White *et al*. 2002), follows a multiple-use model. The sanctuary zones around Carbin, Maca and Panal reefs are designated as no-take zones, where exploitation is prohibited. Outside of these no-take zones are buffer zones for traditional and/or multiple use, where the local residents only are allowed to practice traditional but sustainable fishing. This zone extends to the boundary of the SMR. Therefore, the formal rules prohibit extraction within the three no-take zones surrounding Carbin, Maca and Panal reefs, with traditional, non-destructive fishing practices allowed in all other areas of the SMR.

The establishment of the SMR led to higher investments in enforcement with the objective of increased reef protection. However, protection was not uniformly administered, and Panal and Molocaboc reefs remained *de facto* open access, so harvesting marine species generally has continued unchecked (Maliao 2002; Maliao *et al*. 2004). Destructive fishing practices are a serious concern to the conservation of marine resources in SMR.

The management of SMR is under the Protected Area Management Board (PAMB), which is co-chaired by the Department of Environment and Natural Resources (DENR) Regional Director and the Sagay City Mayor. The PAMB is composed of various sectors, such as the heads of the six coastal villages, local non-governmental organizations (NGOs), and fishers' organizations. Enforcement of protection in SMR is accomplished through the *bantay-dagat* (the sea-patrol), which is comprised of trained Sagay City employees equipped with patrolling equipment. Approximately 80% of the SMR budget is allocated to the bantay-dagat, with the remaining 20% designated for 'alternative livelihoods' for the six villages within the SMR.

METHODS

We collected stakeholder perception data by following the existing framework described by Pomeroy *et al*. (1997). By using an existing framework and following their methodology and analysis techniques, we hoped to produce results that could be compared to the most recent investigations on participatory coastal management in the Visayas, i.e. the Central Visayas Regional Project-1 (CVRP-1; Pomeroy *et al*. 1997). However, careful analysis of the CVRP-1 revealed that the objectives of those community-based coastal resource management projects differed from the SMR objectives. The CVRP-1 objectives included the improvement of nearshore fisheries user rights, improved coral reef management, mangrove replanting and strengthening of line agencies. In contrast, the SMR was established with the explicit objective of protecting the marine resource base. Outcomes such as improved user rights, active resource replenishment (with the exception of molluscs; Maliao 2002), or livelihood improvement were not specific objectives of the SMR. Therefore, although we used the same framework as previous researchers, we refrain from making direct comparisons

Table 2 The contextual attributes described for each respondent.

Name of Variable	*Description and data type*
Social	
Gender	Male = 1, female = 2
Age	Age of respondent
Number of years in school	Number of years of formal schooling
Residency	Number of years respondent had resided in the village
Location	The location of respondent's house. Island = 1, mainland = 2
Occupational	
Supplemental income	Income derived from non-fishing activities
Number of years fishing	The number of years the respondent had been fishing
Number of gears used	The number of fishing gears used by the respondent
Stay in fishing	Response to the question if he/she would continue fishing as a livelihood if given alternative livelihood outside fishing but of the same income level. No = 1, uncertain = 2, yes = 3
Economic	
Income trend	The perceived trend of income from fishing. Decreasing = 1, increasing = 2
% income from fishing	The total percentage of household income derived from fishing
House type	House type categories: (1) house, foundation and frames made entirely of light material, e.g. bamboo, *Imperata cylindrica*, or *Nypa* sp.; (2) house made entirely of light material but foundation and frames made of wood or lumber; (3) house made of combination of concrete and lumber for the walls and frames but *Nypa* sp. or *Imperata cylindrica* for the roof; and (4) house made of combination of concrete and lumber for the walls and frames with galvanized iron sheet for the roof
Outside remittances	Whether the respondent received outside remittances. No = 1, yes = 2
Access to credit	Whether the respondent previously received credit from government. No = 1, yes = 2
Project-related	
Heard SMR	Whether the respondent was aware of the existence of the SMR. No = 1, yes = 2
Knew SMR objective	Whether the respondent was aware of the objectives of the SMR. No = 1, yes = 2
Approval of no gleaning on Carbin Reef	Whether the respondent approved of the *de jure* protection from any gleaning activity given to Carbin Reef. No = 1, yes = 2
Approval of no gleaning on Maca Reef	Whether the respondent approved of the *de jure* protection from any gleaning activity given to Maca Reef. No = 1, yes = 2
Approval of no gleaning in Panal Reef	Whether the respondent approved of the *de jure* protection from any gleaning activity given to Panal Reef. No = 1, yes = 2
Resource related	
Resource well-being in 1992	The respondent was asked to rank the resource well-being in 1992 using the 10 point scale
Resource well-being now (2002)	The respondent was asked to rank the resource well-being in 2002 using the 10 point scale

between our results and those assessing projects with different objectives.

We interviewed 62 respondents (31 male, 31 female; 44 on the mainland, 18 on Molocaboc Island) from the six SMR coastal villages. Respondents were selected through proportionate random sampling using the 1999 SMR registry of fishers. We collected a total of 21 contextual variables for each respondent, including social, occupational, economic and SMR participation attributes (Table 2).

We used a set of questions categorized into twelve performance indicators to collect data on stakeholder perception of SMR outcomes (Table 3). Pomeroy *et al*. (1997) and Baticados and Agbayani (2000) also used performance indicators. Respondents were asked questions about the SMR in terms of the 12 indicators listed in Table 3. The respondent viewed a ladder-like diagram with 10 steps, where step 1 represented the worst possible scenario and step 10 the best possible scenario for every question (i.e. indicator). The only exception to this scale was when we asked about 'threats to the resource', in which a higher score indicated an elevated threat and a lower number indicated a lower threat. This exception was made so that the questions would be logical to the respondents.

Respondents were asked to indicate on the ladder the step that best described their community and coastal resources 10 years ago (1992), presently (2002) and their expectation (prediction) for 10 years into the future (2012). This was done separately for questions comprising the 12 performance indicators. This technique allowed the respondent to provide direct ordinal judgments and placed a minimum demand on their memories. We analysed the perceived outcomes of SMR implementation across two time frames, namely 1992–2002 and 2002–2012, using a Wilcoxon matched pair signed rank test. Data were pooled across gender for this analysis because Maliao (2002) was unable to show statistical differences in perceived outcomes between men and women. For other analyses (below), gender stratification was retained.

The principle of the 12 indicators was that they represented outcomes associated with equity, efficiency and sustainability.

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Table 3 The set of performance indicators used to evaluate the perceived impacts of the SMR.

Indicators	*Theme of question sets*
Equity	
Participation in fishery management	Level of involvement of local users in coastal resource management (CRM) activities
Influence over fishery management	Level of bargaining power of local users over decision-making related to CRM issues
Control over fishery resources	Sense of local users' power to monitor and regulate the internal use pattern of fisheries
Fair allocation of access right to fishery resources	Allocation of the rights to enter and withdraw fishery products to different sectors of users
Household income	Household profits generated from fishing
Efficiency	
Fisher-fisher cooperation for fisheries management	Collaboration and teamwork between the local users over CRM activities
Government-fisher cooperation for fisheries management	Collaboration and teamwork between the local users and SMR team over reserve management activities
Level of conflicts related to fishery issues	Competitiveness and promptness of resolving disputes related to fisheries
Sustainability	
Fish abundance	General health of coastal resources measured by fish abundance
Community compliance with fishery-related rules	Conformity of behaviours of local users to the prescribed operational-level rules
Level of threat to fishery resources	Deviation of behaviours of local and external users from the prescribed operational-level rules
Communication between fishers and government on fisheries management	Information exchange between fishers and government on fisheries management

These three concepts are crucial to the long-term viability of a participatory conservation project. Equity is the real or perceived fairness of benefits received, or the potential goods forfeited due to the collective undertaking of SMR implementation. Efficiency in resource management is determined by transaction costs, and lower transaction costs suggest a higher likelihood of success. Sustainability criteria included biological indicators such as fish abundance, as well as institutional arrangements governing resource management (Ostrom 1990).

A correlation matrix between the contextual variables and the performance indicators was produced. This matrix was then used to perform a principal components analysis (PCA) with varimax rotation in order to reduce the indicators into components. The response variables used for PCA were the score differences between 2002 and 1992, because this difference provided information on outcomes over the last 10 years and was more relevant to assessment of the SMR than future indicator scores (speculation). The scree test and an appraisal of the elements in the components were used to determine the final number of components retained. For our analysis, we retained two components.

The final step of the analysis was a forward stepwise multiple regression to determine the relationship between the contextual variables and the principal components. The first step in this analysis was to calculate a 'component score' (*sensu* Pomeroy *et al.* 1997) for each principal component. The component score was the sum of all indicator responses of the respondent, weighted by the loading of that indicator in the component being analysed. We only included indicators with a loading greater than 0.5 (rounded to the nearest 0.1) in the calculation. The scores of the two components were then summed to obtain a 'total perceived performance' (TPP) score for each respondent (Pomeroy *et al.* 1997). The three component scores (PC1, PC2, TPP) were then standardized into Z-scores for each respondent. These calculations were done for every respondent, resulting in 62 independent component scores for each principal component.

Multiple regressions tested the contextual factors of each respondent against their component scores. Entry into the final regression equations was set at $\alpha < 0.10$. This analysis explored the influence of respondent context on perceived outcomes of the SMR.

RESULTS

Perceptions of SMR outcomes

There were no significant differences in any equity performance indicators across the 1992–2002 time frame (Table 4). Moreover, not one indicator was expected to improve in the subsequent ten years. Accessibility, ability to participate and income opportunities through fishing had median values of 8.0 for 2002, and were not statistically different from 1992 values. This suggests that overall the communities perceived the benefits to be fairly distributed among the members.

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Table 4 Median perceived indicator scores across 62 SMR respondents for 1992, 2002 and 2012. The *p* value refers to the significance of a Wilcoxon matched-pair signed rank test.

Performance indicators	*1992 (past)*	*2002 (present)*	*2012 (future)*	*p value 1999–2002*	*p value 2002–2012*
Participation	6.0	8.0	9.0	> 0.05	> 0.05
Influence over management	6.0	8.0	9.0	> 0.05	> 0.05
Control over resource	7.5	8.0	8.0	> 0.05	> 0.05
Fair access to resource	7.0	8.0	8.0	> 0.05	> 0.05
Income	7.0	5.5	6.0	> 0.05	> 0.05
Fisher-fisher cooperation	6.0	8.0	8.0	> 0.05	> 0.05
Government-fisher cooperation	6.0	8.0	9.0	< 0.05	< 0.05
Conflict	6.0	8.0	9.0	< 0.05	> 0.05
Fish abundance	10.0	5.0	6.0	< 0.001	> 0.05
Community compliance	6.0	8.0	9.0	< 0.001	> 0.05
Threat to resource	9.0	5.0	3.5	< 0.001	< 0.001
Communication	6.0	8.0	9.0	< 0.001	< 0.01

Two out of three efficiency indicators significantly improved between 1992 and 2002, namely government-fisher cooperation and the amount of conflict (Table 4). These efficiency indicators were high in 2002, with median values of 8.0 and 9.0, respectively. The government-fisher cooperation, having improved over the previous 10 years, was expected to continue to improve over the next 10 years as well.

Perceived fish abundance significantly declined between 1992 and 2002 (Table 4), even though compliance and communication improved and threat declined. Moreover, the respondents generally did not expect fish abundance to improve over the next 10 years, an important result since livelihoods were tightly linked with that resource.

For 11 of the 12 indicators, the mainland respondents returned more positive responses toward the SMR than the Molocaboc Island residents. Differences in mainland and island perceptions of control over the resource, fairness in access to the resource, income, fisher-fisher cooperation, community compliance and communication were statistically significant. Whereas mainland respondents considered that control, access, fisher-fisher cooperation and communication had improved since 1992, island respondents felt that those indicators had worsened or remained stable over time (Table 5). In particular, Molocaboc residents had very negative opinions of their income situation (−3.0), indicating socioeconomic isolation from the mainland and/or significant loss of revenue from fishing. Both mainland and island respondents viewed the fish abundance having declined rapidly and at the same magnitude (−5.0; Table 5).

Table 5 Comparison of median indicator score differences (2002 score minus 1992 score), by respondent location; *p* value refers to the statistical significance of a Mann-Whitney U test. $n = 18$ for island and 44 for the mainland.

Performance indicators	*2002–1992*		*p value*
	Island	*Mainland*	
Participation	1.0	2.0	> 0.05
Influence over management	1.0	3.0	> 0.05
Control over resource	−1.5	2.0	< 0.05
Fair access to resource	−1.5	2.0	< 0.001
Income	−3.0	0.0	< 0.001
Fisher-fisher cooperation	−0.5	2.0	< 0.05
Government-fisher cooperation	0.0	2.0	> 0.05
Conflict	1.0	2.0	> 0.05
Fish abundance	−5.0	−5.0	> 0.05
Community compliance	0.5	2.5	< 0.05
Threat to resource	−3.0	−4.0	> 0.05
Communication	0.0	3.0	< 0.05

Correlation between contextual variables and single performance indicators

Five out of 21 contextual variables did not show a significant correlation with the perceived change of any performance indicator; these were respondent age, years of schooling, years of fishing experience, per cent income from fishing and receiving outside remittances (Appendix). Only one indicator (government-fisher cooperation) did not correlate with any contextual variable.

There was a positive correlation between the respondent's location and control, access, income, fisher-fisher cooperation, compliance and communication (Appendix). The income trend of the respondent was positively correlated with four performance indicators, namely control, access, income, fisher-fisher cooperation and compliance. As income increased, respondents tended to have a higher perception of those SMR indicators. Approval of no gleaning on Panal Reef and the receipt of credit were correlated with the perceived level of participation in the SMR management. The respondents contended that if all reefs were closed, then Panal Reef should be left open to maintain livelihoods of gleaners. These results were further reinforced by supplemental income aside from fishing, access to credit and knowledge of SMR objective being correlated with the perceived influence over resource management.

Composite indicators of SMR outcomes

The PCA generated two components that explained a total of 50.2% of the variance (Table 6). A third component, explaining 10.5% of the variation, was not retained because

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Table 6 Results of PCA with varimax with Kaiser normalization for twelve indicators of the SMR. Indicators with a component loading of 0.50 or higher (rounded to the nearest tenth) were retained for multiple regression.

Performance indicators	*Component 1*	*Component 2*
Income	0.79	0.13
Fisher–fisher cooperation	0.75	0.33
Access to resource	0.75	0.29
Compliance	0.75	0.11
Control over resource	0.53	0.04
Fish abundance	0.52	−0.35
Participation	0.49	0.43
Government–fisher cooperation	0.28	0.81
Conflict	0.11	0.77
Influence over management	0.03	0.73
Communication	0.39	0.59
Threat to resource	0.07	−0.08
Variance explained (%)	27.89	22.31

it had only two indicators with loadings greater than or equal to 0.5. Moreover, this component could not be used for later multiple regression, so it was discarded from further analysis. The indicators loading highest on component 1 were income, fisher–fisher cooperation, access, compliance, control, participation and fish abundance. The indicators loading highest on component 2 were government–fisher cooperation, conflict resolution, influence and communication. In general, the highest loading indicators of component 1 describe operational level dynamics in the SMR, i.e. within-community indicators. In contrast, the highest loading indicators of component 2 describe the dynamics between the community and external stakeholders, particularly the government agencies.

For the regression analysis between contextual variables and component scores, six contextual variables of component 1 were entered into the PC1 component score. The regression was statistically significant (adjusted $R^2 = 0.46$, $p < 0.001$). These six variables (with coefficient sign in parentheses) were income trend (+), location (+), age (+), approval of no gleaning in Panal reef (+), perception of the condition of the resource in 1992 (−) and house type (−) (Table 7).

Component score 2 was positively related to gender (women gave higher scores), approval of no gleaning on Panal, location of respondent and the amount of supplemental income (adjusted $R^2 = 0.22$, $p < 0.005$; Table 7). There were no negative coefficients.

The TPP score of the SMR was positively related to an increasing income trend, location of respondent, approval of no gleaning on Panal Reef and access to credit. This regression was statistically significant (adjusted $R^2 = 0.30$, $p < 0.001$; Table 7).

DISCUSSION

The respondents had a generally positive opinion towards equity and efficiency outcomes, and a mixed outlook on sustainability outcomes in the SMR for the period 1992–2002. Although most criteria showed improvement, fish abundance, the key to livelihoods in SMR, declined precipitously. Although in general opinions were positive, our findings suggest a lower level of indicator improvement than was found in other sites of the Philippines, such as the Central Visayas (Cebu and Negros Oriental; Pomeroy *et al.* 1997), Malalison Island (Baticados & Agbayani 2000) and San Salvador Island (Katon *et al.* 1999), where significant improvements of most

Table 7 Stepwise regression analysis between contextual variables and composite performance indicators.

Independent variables	*Standardized coefficient*	*t value*	*Probability (2 tailed)*
Dependent variable: Component score 1: operational level dynamics			
Income trend	0.40	3.79	0.000
Location	0.27	2.69	0.010
Resource condition in 1992	−0.25	−2.48	0.016
Age	0.23	2.35	0.023
Agree to no gleaning on Panal	0.20	2.09	0.042
House type	−0.17	−1.72	0.092
Adjusted $R^2 = 0.46$, $p < 0.001$			
Dependent variable: Component score 2: community–external relations			
Gender	0.29	2.42	0.019
Agree to no gleaning on Panal	0.31	2.62	0.011
Location	0.29	2.54	0.014
Supplementary income	0.26	2.20	0.032
Adjusted $R^2 = 0.22$, $p < 0.005$			
Dependent variable: Total perceived performance (TPP) score			
Income trend	0.31	2.79	0.007
Location	0.37	3.30	0.002
Agree to no gleaning on Panal	0.24	2.19	0.033
Access to credit	0.21	1.89	0.064
Adjusted $R^2 = 0.30$, $p < 0.001$			

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performance indicators were recorded. Moreover, in our site there was high spatial heterogeneity in perceived outcomes, namely between island and mainland villages. Mainland respondents were much more positive in their opinions of SMR outcomes than Molocaboc Island respondents, who were less positive to negative about the previous 10 years of management.

None of the equity outcomes showed a statistically significant improvement between 1992 and 2002. The indicators participation, control and access to the resource were generally high (all at 8.0 in 2002), suggesting that they were present in the communities prior to the implementation of the SMR. In contrast, the income indicator was 6.0–7.0, indicating some dissatisfaction with past and present income opportunities (although still generally positive).

Two efficiency indicators, namely government-fisher cooperation and conflict, showed statistically significant improvement over time. This result suggests that since the implementation of the SMR, transaction costs have been decreasing. Increasing government-fisher cooperation suggests an increasing level of trust and reciprocity between the local people and the bantay-dagat or other SMR representatives.

The mixed results for sustainability indicators suggest key areas for improvement. Fish abundance declined from a score of 10.0 (the best possible situation) in 1992 to a score of 5.0 in 2002. The score of 10.0 for the 1992 fisheries condition is clearly an overestimate due to biased recollection of past fish availability, and is not consistent with the degraded condition of the reef ecosystem before 1992. Nevertheless, this large reduction in score was consistently reported by both island and mainland respondents and therefore is important evidence that the biological objectives of the SMR, as perceived by the local resource appropriators, are not being met. Two possible reasons exist for this result. First, there could still be substantial non-compliance with the general regulations of the SMR despite the decline in threat and increase in compliance scores. For example, although commercial fishing boats might respect the SMR boundaries (although Maliao 2002 refers to substantial violations), their activities occurred directly adjacent to the reserve and certainly have a considerable impact on the fish abundance in the SMR. Moreover, dynamite fishing is still a common occurrence in SMR. Dynamite fishers had fast boats and could easily elude the bantay-dagat, whose boats were so slow that the 'cat and mouse' game rarely resulted in apprehension of the violator by the reserve staff. It was also noted during the research that several inhabitants within SMR boundaries still practiced illegal reef gleaning, despite the result that community compliance was reportedly improving in both island and mainland sites. A second explanation for poor sustainability results is that even if compliance had increased, the fish populations may have been recovering at a very slow pace. Such a possibility was discussed by Maliao *et al.* (2004) for abalone, and could be applicable to the broader fisheries.

The spatial isolation of Molocaboc Island inhabitants was the most important factor in shaping the perception of outcomes. Location was significantly correlated with users' perceptions of control, access, income, fisher-fisher cooperation, compliance and communication, with island inhabitants scoring lower than mainland counterparts on all attributes. Moreover, location was a statistically significant predictor of the three component regressions (Table 7). Island inhabitants had apparently received fewer benefits than mainland inhabitants, and could therefore be seen as marginalized participants. Island inhabitants felt that equity of benefits, including control over the resource, access to the resource and income had been declining over the previous 10 years. The declining economic situation of the island inhabitants is likely to have been because of the limited and declining economic opportunities of the island inhabitants, coupled with their high dependence on the fisheries resource that had become more restricted as a consequence of SMR regulations.

The comparative dissatisfaction of Molocaboc Island inhabitants was a serious concern to the continued legitimacy of the SMR. The results we report suggest that modifications to the SMR management strategy are in order. Two possible solutions are available. First, it has been the strategy of some governments to relocate entire communities to the outside of protected areas, thus decreasing pressure on the resource and theoretically enhancing their income-generating opportunities. However, this practice has both ethical and logistical problems associated with it.

A more reasonable solution would be to try to improve the outcomes of the reserve for Molocaboc residents by improving participation, compliance with regulations, equity and fish abundance. Efforts must be made to increase participation of the Molocaboc Island fishers in the management of the SMR. A marginal increase in perceived community compliance from 1992–2002, which was significantly lower than the increase of perceived compliance by mainland respondents, indicates that Molocaboc islanders may be more informed of non-compliant activities than mainland counterparts, and therefore the island folk are one key to its improved management. The bantay-dagat is generally composed of mainland citizens hired by Sagay City. Molocaboc fishers should be included in the monitoring activities, through both physical and social empowerment (for example, monitoring vessels and a strong decision-making voice), combined with outreach or extension activities by the SMR management staff to clearly define the needs and solutions envisioned by the Molocaboc Island residents. Local perceptions on solutions should be considered along with practicalities, leading to future strategies. This would be an excellent first step in improving the outcomes of the SMR.

Fish populations need improved protection so that their numbers can rebound from decades of overexploitation. Improved monitoring techniques as described above, along with an aggressive restocking programme are necessary to protect the declining resource and promote its recovery.

In addition to improved management, greater investment in alternative livelihoods for Molocaboc Island residents would

improve SMR outcomes. Mainland respondents often had access to supplemental or alternative sources of income. Alternative income sources are a buffer from full dependence on the SMR; when the fisheries resource becomes less available or is more stringently protected, alternative sources can replace that loss. Molocaboc islanders had little or no access to alternative livelihoods. Any change in the fisheries resource would be more important to their livelihoods than to their mainland counterparts. Therefore, high priority should be placed on making measurable improvements in the availability of alternative incomes in addition to the increased participation of island communities in SMR management. However, it should be emphasized that alternative livelihoods should be viewed as supplementary income to fishing, rather than a replacement to the fishing livelihood strategy (see Pomeroy *et al*. 1997, p. 116).

Gender entered into the component score 2 regression, suggesting that women were well informed about the relations between the fishing communities and the government agencies. Indeed, this has been observed in the SMR. Women were frequently delegated to attend public and organizational meetings while men were fishing, and therefore they were very well informed of several aspects of SMR outcomes, such as government–fisher cooperation, conflict, influence and communication. There is a need to understand more fully how women contribute to the Reserve management and its success, and future research and extension activities should specifically target gender relations.

Income trend was an important attribute to the total perceived performance of the SMR. If and when fish abundances return to satisfactory levels, this perception of island respondents may improve. Yet it would be risky to base policy on a presumed future recovery of fish populations. We suggested in an earlier paper (Maliao *et al*. 2004) that biological recovery of abalone populations is occurring at a very slow rate, and from the present study we found that the respondents generally do not expect the fish populations to recover to an acceptable level within the next ten years. Therefore, we reiterate the above conclusion that alternative income opportunities should be considered with a priority towards the island fishers. This would maintain an incentive for local fishers to continue to comply with the SMR and continue with their efforts to protect the resource base while attempts to improve fish populations are initiated.

CONCLUSIONS

Using indicators of perceived performance by users towards outcomes of the Sagay Marine Reserve, Philippines, we analysed contextual factors of the respondents and correlated those factors with their performance scores. Using stakeholders' perceptions is a low-cost but powerful method to evaluate the performance and outcomes of protected area management. In particular, user perceptions are highly recommended in situations where quantitative data on past management indicators are absent and users are intimately involved with the daily acquisition of the resources in question. Data-rich conservation programmes would also greatly benefit from user-perception index assessments. Perceptions differed among stakeholders because of socioeconomic and physical asymmetries; our analysis was able to capture the influence of those asymmetries. Perception can ultimately be used to support activities and decisions crafted to promote collective action, recovery of the resource and improved management performance. Policy can use the results from analyses such as ours to accommodate those who may lose more in the trade-offs.

Specific to SMR, we discovered that the users' perceptions were linked with economic opportunities and location. Due to physical isolation of island communities, economic opportunities are more limited than those of mainland inhabitants. This is made even more challenging because the island users are highly dependent on the fisheries resource; conservation, reserve management and fishing restrictions will infringe on their livelihoods more than their mainland counterparts. Proactive, equitable policies and extension activities should be crafted to promote compliance of the island communities, including involving them more in the reserve management process, supporting island empowerment and income-generating opportunities outside of fishing that may enhance their perception of the SMR and its objectives. Additional investment in promotion of fisheries recovery would also help maintain traditional marine-based livelihoods.

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References

Alcala, A.C. & Russ, G.R. (1990) A direct test of the effects of protective management on abundance and yield of tropical marine resources. *Journal du Conseil International pour l'Exploration de la Mer* **46**: 40–47.

Alcala, A.C. (2001) *Marine Reserves in the Philippines: Historical Development, Effects and Influence on Marine Conservation Policy*. Makati, Philippines, Bookmark, Inc.

Baticados, D.B. & Agbayani, R.F. (2000) Co-management in marine fisheries in Malalison Island, central Philippines. *International Journal of Sustainable Development and World Ecology* **7**: 343–355.

Berkes, F., Colding, J. & Folke, C. (2000) Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* **10**: 1251–1262.

Blaikie, P. (1995) Changing environments of changing views? A political ecology for developing countries. *Geography* **80**: 203–214.

Bohnsack, J.A. (2000) A comparison of the short-term impacts of no-take marine reserves and minimum size limits. *Bulletin of Marine Science* **66**: 635–650.

Crawford, B., Balgos, M. & Pagdilao, C.R. (2000) Community-based marine sanctuaries in the Philippines: a report on focus group discussions. Coastal Management Report #2224, PCAMRD Book Series No. 30, Coastal Resources Center and Philippine Council for Aquatic and Marine Research and Development, Narragansett RI, USA, Los Banos, Laguna, Philippines.

Fabbi, K.P. (1998) Methodology for supporting decision making in Integrated Coastal Zone Management. *Ocean and Coastal Management* **39**: 51–62.

Gomez, E.D, Aliño, P.M., Yap, H.T. & Licuanan, W.Y. (1994) A review of the status of Philippine reefs. *Marine Pollution Bulletin* **29**: 62–68.

Guijt, I. (1999) Participatory monitoring and evaluation for natural resources management and research. Natural Resources Institute, Chatham, UK.

Katon, B., Pomeroy, R.S., Garces, L.R. & Salamanca, A.M. (1999) Fisheries management of San Salvador Island, Philippines. *Society and Natural Resources* **12**: 777–795.

Maliao, R.J., Webb, E.L. & Jensen, K.R. (2004) A survey of stock of the Donkey's ear abalone, *Haliotis asinina* L. in Sagay Marine Reserve, Philippines: evaluating the effectiveness of marine protected area (MPA) enforcement. *Fisheries Research* **66**: 343–353.

Maliao, R.J. (2002) Protecting the commons and sustainable development: evaluating the impacts of marine protected area in Sagay, Negros Occidental, western Philippines. M.Sc. thesis, Asian Institute of Technology, Bangkok, Thailand.

Municipal Government of Sagay (1998) Coastal resource management plan. Municipality of Sagay, Negros Occidental, Philippines.

Neis, B., Schneider, D.C., Felt, L., Haedrich, R.L., Fischer, J. & Hutchings, J.A. (1999) Fisheries assessment: what can be learned from interviewing resource users? *Canadian Journal of Fisheries and Aquatic Sciences* **56**: 1949–1963.

Ostrom, E. (1990) *Governing the Commons: the Evolution of Institutions for Collective Action*. New York, USA: Cambridge University Press.

Ostrom, E., Gardner, R. & Walker, J. (1994) *Rules, Games, and Common-pool Resources*. Ann Arbor, USA: The University of Michigan Press.

Otter, H.S. & Capobiano, M. (2000) Uncertainty in integrated coastal zone management. *Journal of Coastal Conservation* **6**: 23–32.

Pollnac, R.B., Crawford, B.R. & Gorospe, M.L.G. (2001) Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. *Ocean and Coastal Management* **44**: 683–710.

Pomeroy, R.S., Pollnac, R.B., Katon, B.M. & Predo, C.D. (1997) Evaluating factors contributing to the success of community-based coastal resource management: the central Visayas Regional Project-1, Philippines. *Ocean and Coastal Management* **36**: 97–120.

Russ, G.R. & Alcala, A.C. (1996) Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. *Marine Ecology Progress Series* **132**: 1–9.

Vandermevien, H. (1998) The development of marine indicators for coastal zone management. *Ocean and Coastal Management* **9**: 63–71.

Walters, J.S. (1997) Exploring local knowledge in tropical coastal ecology: participatory resource assessment in a Philippine fishing community. Ph.D. dissertation, University of Hawaii, Hawaii, USA.

Westmacott, S. (2002) Where should the focus be in tropical integrated coastal management? *Coastal Management* **30**: 67–84.

White, A.T. & Cruz-Trinidad, A. (1998) *The Values of Philippine Coastal Resources: Why Protection and Management are Critical*. Cebu City, the Philippines: Coastal Resource Management Project.

White, A.T., Courtney, C.A. & Salamanca, A. (2002) Experience with marine protected area planning and management in the Philippines. *Coastal Management* **30**: 1–2.

APPENDIX

Spearman's rank correlation matrix between contextual variables and performance indicators. * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$.

Contextual Variables	*Performance indicators*											
	Participation	*Influence*	*Control*	*Access*	*Income*	*Fisher–fisher cooperation*	*Government–fisher cooperation*	*Conflict*	*Fish abundance*	*Compliance*	*Threat*	*Communication*
Social variables												
Gender	−0.01	0.21	0.11	0.02	−0.02	−0.01	0.11	0.27*	−0.16	−0.06	−0.13	0.29*
Age	−0.02	0.11	0.09	0.23	0.15	0.20	−0.04	0.03	−0.04	0.10	−0.20	−0.04
Number of years in school	0.11	−0.21	−0.21	−0.16	−0.19	−0.20	−0.18	−0.14	0.22	−0.17	0.14	−0.05
Residency	−0.07	0.05	0.16	0.09	0.13	0.19	0.03	0.07	−0.11	0.10	−0.26*	−0.08
Location	0.15	0.21	0.30*	0.41**	0.37**	0.30*	0.18	0.14	−0.04	0.34**	−0.01	0.36**
Occupational variables												
Supplemental income	0.00	0.25*	−0.10	0.15	−0.02	0.05	0.21	0.16	−0.13	−0.04	−0.27*	0.12
Years fishing	−0.01	0.11	−0.07	0.00	0.05	0.05	0.10	0.02	−0.04	−0.06	−0.25	−0.01
Number of fishing gears used	−0.11	0.04	−0.23	0.00	−0.11	−0.04	−0.06	−0.11*	−0.14	−0.13	−0.12*	−0.27
Stay fishing	0.07	0.19	0.05	−0.01	0.07	0.13	0.09	0.05	0.37**	−0.08	−0.16	0.02
Economic variables												
Income trend	0.24	0.11	0.38**	0.31*	0.58***	0.37**	0.11	0.05	0.20	0.24	−0.01	0.14
% Income from fishing	0.05	−0.18	0.05	−0.11	0.05	0.03	−0.11	−0.13	0.15	0.05	0.13	−0.14
House type	−0.01	0.07	−0.31*	−0.16	−0.07	−0.18	−0.16	−0.11	0.15	−0.15	0.04	−0.05
Outside remittances	−0.07	0.10	0.14	0.14	0.04	0.12	−0.13	−0.11	0.19	0.05	−0.09	0.00
Access to credit	0.28*	0.33**	−0.15	0.11	−0.09	−0.02	0.07	0.06	0.13	0.00	−0.16	−0.06
SMR knowledge												
Knowledge of SMR existence	−0.13	0.18	−0.29*	−0.06	−0.09	−0.20	−0.10	0.01	−0.04	−0.25	0.16	−0.02
Knowledge of SMR objectives	0.01	0.29*	−0.17	0.03	0.01	−0.04	0.07	0.11	−0.06	−0.20	0.12	0.16
Approve no gleaning on Carbin	0.18	0.05	0.19	0.05	0.16	0.11	0.03	0.08	−0.04	0.17	0.05	0.29*
Approve no gleaning on Maca	0.17	0.03	0.11	0.11	0.12	0.23	0.10	0.11	0.06	0.15	0.10	0.28*
Approve no gleaning on Panal	0.39**	0.23	0.11	0.15	0.13	0.15	0.17	0.05	0.16	0.20	−0.04	0.15
Resource related												
Resource well-being 1992	−0.12	0.13	−0.11	−0.14	−0.09	−0.15	0.09	0.14	−0.64***	−0.27*	0.02	0.00
Resource well-being 2002	0.14	−0.10	−0.08	0.12	0.09	0.04	−0.06	−0.12	0.94***	0.13	−0.13	0.04