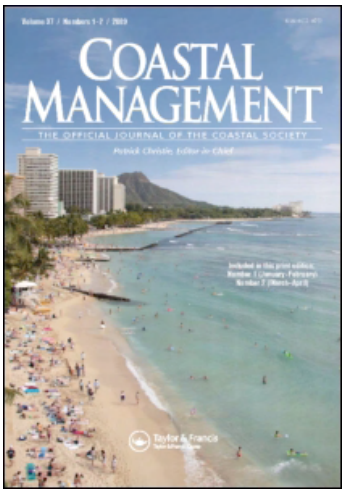

Coastal Management
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713626371

Information Diffusion in Two Marine Protected Area Networks in the Central Visayas Region, Philippines

Diana Pietri [a]; Patrick Christie [ab]; Richard B. Pollnac [c]; Roxie Diaz [d]; Agnes Sabonsolin [d]
[a] School of Marine Affairs, University of Washington, Seattle, Washington, USA [b] Henry M. Jackson School of International Studies, University of Washington, Seattle, Washington, USA [c] Department of Marine Affairs & Coastal Resources Center, University of Rhode Island, Kingston, Rhode Island, USA [d] Coastal Conservation and Education Foundation, Cebu City, Philippines

First Published on: 01 May 2009

To cite this Article Pietri, Diana, Christie, Patrick, Pollnac, Richard B., Diaz, Roxie and Sabonsolin, Agnes(2009)'Information Diffusion in Two Marine Protected Area Networks in the Central Visayas Region, Philippines',Coastal Management,37:3,331 — 348
To link to this Article: DOI: 10.1080/08920750902851625
URL: http://dx.doi.org/10.1080/08920750902851625

Coastal Management, 37:331–348, 2009

ISSN: 0892-0753 print / 1521-0421 online
DOI: 10.1080/08920750902851625

Information Diffusion in Two Marine Protected Area Networks in the Central Visayas Region, Philippines

DIANA PIETRI,[1] PATRICK CHRISTIE,[1,2]
RICHARD B. POLLNAC,[3] ROXIE DIAZ,[4]
AND AGNES SABONSOLIN[4]

[1]School of Marine Affairs and [2]Henry M. Jackson School of International Studies, University of Washington, Seattle, Washington, USA
[3]Department of Marine Affairs & Coastal Resources Center, University of Rhode Island, Kingston, Rhode Island, USA
[4]Coastal Conservation and Education Foundation, Cebu City, Philippines

In order to strengthen biological and social success of community-based marine protected areas (MPAs) in the Philippines, many organizations have begun instituting MPA networks. In the Central Visayas Region, Coastal Conservation and Education Foundation and Fisheries for Improved Sustainable Harvest are implementing socioecological networking initiatives. Educational programs, employing diverse methods such as cross visits and community MPA monitoring, are integral components of these projects. This article analyzes the relationship between education, information diffusion, and standard measures of MPA success (e.g., MPA rule compliance and fish abundance) in communities participating in these networks. Surveys were conducted with 13 individuals per community in 36 communities. Statistical tests reveal that the presence of a clear MPA leader, participation in cross visits, and presence of community environmental education programs were the strongest predictors of social and biological MPA success. Formal education programs (e.g., management committee member trainings) independent of other processes did not demonstrate strong statistical relationships with MPA success. Overall, the findings of this study demonstrate the current and potential benefits and efficacy of education programs for communities in MPA networks. When linked to a strong infrastructure for information diffusion, education programs have the potential to increase both biological and social MPA success.

Keywords environmental education, information diffusion, marine protected areas, Philippines

This research was supported through the generous support of the Pew Charitable Trust as part of a Pew Fellowship in Marine Conservation awarded to Dr. Patrick Christie and a grant from the David and Lucile Packard Foundation and the National Center of Ecological Analysis and Synthesis (Principal Investigators Christie and Dr. Richard Pollnac). We acknowledge the invaluable assistance of Dr. Enrique Oracion, Agnes Sabonsolin, Roxy Diaz, Malcolm Hipponia, and the informants of this study.

Address correspondence to Diana Pietri, School of Marine Affairs and Henry M. Jackson School of International Studies, University of Washington, 3707 Brooklyn Ave NE, Seattle, Washington, 98105-6715, USA. E-mail: dianap@u.washington.edu

Introduction

Marine Protected Areas and Marine Protected Area Networks

Marine protected areas (MPAs) are a common tool for the protection of coastal, marine, and fishery resources. Biological benefits of MPAs include enhanced larval dispersal, spillover of protected species into adjacent areas, increase of fish biomass within reserves, and recovery and rehabilitation of species within MPAs (Roberts et al., 2001; Halpern, 2003; Russ et al., 2005; McClanahan et al., 2006). While MPAs are not a panacea for marine resource problems, no-take marine reserves in particular are an essential tool in rebuilding fish stocks and supporting ecosystem-based management (Pauly et al., 1998; Ward & Hegerl, 2003; Zeller & Pauly, 2004).

In recent years there has been an increase in the amount of academic literature stressing the importance of the social dimensions of MPAs and their impacts on MPA success (e.g., Pollnac et al., 2001; Christie et al., 2002; Oracion, 2003; Christie, 2004; Oracion, 2005; McClanahan et al., 2006). In many instances, even if an MPA has strong ecological potential for success, social strife within the community eventually leads to deterioration of the biological resources (Christie, 2004). Social MPA goals include restoration of commercial and subsistence fisheries, creation of ecotourism opportunities, and empowerment of coastal communities (Christie et al., 2002; White et al., 2002; White et al., 2004).

MPA networks—as opposed to single, disconnected MPAs—may be able to provide increased protection for marine species. Research regarding MPA networks is still in its nascent stages; however, researchers have begun to recognize that ecological networks of MPAs will be important tools in marine resource conservation (Guenette et al., 1998; Bell et al., 2006; Mora et al., 2006; WCPA/IUCN, 2007). Ecological MPA networks create interconnected areas for dispersal of spawning stock biomass and increase the potential number of recruits (Guenette et al., 1998). On the social level, by creating links between participating communities and helping foster relationships between individuals in these communities, MPA networks can help overcome collective action problems commonly associated with marine reserves, such as free riders from neighboring areas (Jones, 2006). They also can aid the resolution of conflicts between stakeholders and facilitate more efficient use of resources (WCPA/IUCN, 2007).

This article shall focus on two emerging MPA networks in the Central Visayas Region of the Philippines and the role that environmental education and information diffusion play in these networks. The two networks (which are in varying stages of implementation) are centered on existing MPAs, and while there are some ecological connections between the individual MPAs, the networks focus more on social components, such as linking the communities managing the MPAs. Therefore, these networks will be referred to as *emerging socioecological networks.*

Information Diffusion and Education

It is useful to employ some concepts from the fields of social networking and information diffusion when thinking about MPA networks. While the information diffusion framework is not a perfect corollary, it does provide a constructive point of reference for considering social aspects of MPA networks. Rogers (1995, 5) defines diffusion as, "the process by which an innovation is communicated through certain channels over time among the members of a social system." In the general literature, *diffusion* sometimes refers to the spontaneous or unplanned spread of information or ideas, whereas *dissemination* often is defined as

the controlled and managed spread of information. Rogers (1995), however, frequently uses diffusion to refer to both the controlled and spontaneous spread of information, and throughout this article, *diffusion* will be used similarly to refer to both contexts.

For socioecological MPA networks, the network itself or individual MPAs within it are the innovations that must be diffused. One of the first steps in this process is obtaining knowledge of the innovation (Rogers, 1995). For MPAs, this knowledge could be provided through environmental education. Although there are many definitions of environmental education, this article will use the definition of Stapp et al. (1969, 31): "Environmental education is aimed at producing a citizenry that is *knowledgeable* concerning the biophysical environment and its associated problems, aware of *how* to help solve these problems, and *motivated* to work toward their solution."

The emphasis of this definition on knowledge, awareness, and motivation is notable. Critics of environmental education have suggested that many programs lack such a holistic approach (Iozzi, 1989; Gigliotti, 1990). This has led to "ecologically concerned citizens" who fail to understand their own role in environmental problems (Gigliotti, 1990). Educators can avert these issues by focusing on supplying participants with practical information about behavioral change and specific actions that they can engage in to solve environmental problems (Gigliotti, 1990). Environmental knowledge is essential; however, personal attribution of environmental actions and development of positive attitudes and appreciations can be much more important in determining an individual's behavior (Iozzi, 1989; Alessa et al., 2003). This demonstrates the importance of both environmental awareness and knowledge in education programs.

Environmental education programs may include formal education techniques, such as (1) activities that take place in formalized settings with captive audiences (Lück, 2003; Barney et al., 2005); (2) informal methods that are less traditional and focused on personal communication and specific problems and actions (Cabanban & White, 1981); or (3) encompass a combination of these methods. In marine resource management this hybrid approach is common, with activities ranging from local manager trainings to community participation in biological monitoring. Community participation in coral reef monitoring, for example, simultaneously meets data collection needs and fosters ecological awareness and knowledge (Stepath, 2000). However, these programs have faults. In studying training and education programs in Southern Tanzania for fisheries officers and elected officials, Howe (2001) found that while community educators were enthusiastic and committed, limitations such as insufficient funding and time decreased the programs' potential and narrowed their scope to a select group of individuals. This suggests that without the ability to move the lessons of the programs beyond the participants and diffuse the information through the communities, the success of education programs will be limited.

The relative "homophily" or "heterophily" of a social system will affect the rate of diffusion (Rogers, 1995). "Homophily" is the degree of similarity between interacting individuals in relation to aspects such as social status and education, whereas "heterophily" is the degree of dissimilarity (Rogers, 1995). Homophilous interactions accelerate diffusion, but they also circumscribe it to a single social system or set of actors within the system. Heterophilous communications, on the other hand, create cognitive dissonance in the receivers of the message. Similarly, environmental education programs can present information that counters an individual's beliefs and creates cognitive dissonance. This leads to psychological tension that may motivate the individual to change his or her behavior and beliefs to better align with the new information (Orams, 1995). By connecting different communities—and by extension, linking individuals who may have already adopted a new innovation, such as implementation of an MPA, with individuals in communities that

have not yet adopted these ideas—MPA networks can potentially increase heterophilous communications; introduce new innovations that create cognitive dissonance; and possibly, prompt behavioral change (Crawford et al., 2006).

MPA networks may act as formal knowledge networks or learning networks, which allow individuals with common concerns to work together to strengthen their knowledge bases and learn from individuals within the network (The Heinz Center, 2004; Creech & Willard, 2005). In coastal resource management, a key goal of learning networks is recognizing and transferring useful innovations, which both stimulates these innovations and encourages learning (The Heinz Center, 2004). Learning networks will be most effective if members make sure to: (1) incorporate network activities into daily MPA management; (2) ensure that the network has a clearly defined communication structure; and (3) emphasize building and strengthening relationships between individuals in the network (Howell, 2007). Environmental education programs for network members could provide a means of increasing and sustaining the effectiveness of these networks.

As these studies suggest, within a social network education and information diffusion are necessary counterpoints to each other. Theoretically, the cumulative effect of the interactions between environmental education and information diffusion increases marine knowledge and awareness, in turn promoting environmentally responsible behavior and leading to improved resource conditions. In an MPA network setting, educational programs have the ability to enhance the social components of the networks and increase information diffusion between the parties, essentially creating an "educational spillover effect."

The Philippines, Marine Protected Areas, and Education Efforts

The Philippines boasts highly diverse coral reefs, which are home to over 900 species of fish and 500 species of coral (World Bank, 2006). It is considered to be the center of reef fish biodiversity (Carpenter & Springer, 2005). Unfortunately, these resources exist in a largely degraded state. Many of the reefs have been weakened by destructive fishing techniques (Burke et al., 2002) and an open-access fishing regime has depleted important fish stocks (World Bank, 2006). As population has increased so has fishing effort, and in recent years fishermen have experienced rapidly declining yields (World Bank, 2006).

The Philippines hosts an extensive MPA system, with over 1000 established MPAs (generally no-take reserves), many of which are community-based efforts (CCEF, 2008). A decentralized governance structure—as exemplified in the Local Government Code of 1991 and the Fisheries Code of 1998 (RP LGC 7160, 1991; RP PFC 8550, 1998)—has helped facilitate the establishment of these MPAs. To increase support for and encourage participation in MPA efforts, managers often use environmental education (Cabanban & White, 1981; White & Vogt, 2000; White & Courtney, 2004). Environmental education is specifically mentioned in Article 53 of the Philippine Environment Code of 1977, which states that government agencies implementing environmental protection laws "shall undertake public information activities for the purpose of stimulating awareness and encouraging involvement in environmental protection" (P.D. No 1152 1977). Community organizing plays an essential role in this process by helping resource users "identify and prioritize their resource problems and needs and empowers them to begin to work together towards finding solutions" (Cascia, 2000, 20). While these approaches mirror the emphasis of Stapp et al. (1969) on knowledge, awareness, and motivation, they also add an essential component—empowerment. Learning and empowerment are linked strongly (Ferrer et al., 2003), and empowered communities can identify and mobilize to solve environmental problems more effectively (Duthy & Bolo-Duthy, 2003). Leadership is an additional

element that is related to community mobilization and empowerment. Community leaders are an essential factor for Philippine MPA initiatives (White & Vogt, 2000; Pollnac et al., 2001; White et al., 2002): strong local leaders have been shown to greatly aid MPA implementation and compliance (White & Vogt, 2000; Pollnac et al., 2001).

Education programs have been part of MPA initiatives since the establishment of the first MPAs on Sumilon and Apo islands, in 1974 and 1982 (Cabanban & White, 1981; Alcala & Russ, 2006). These programs were "problem-centered" and "action-oriented," focusing on community organization, education, and empowerment (Cabanban & White, 1981; Alcala & Russ, 2006). Education programs have since come to be an essential part of community-based coastal resource management and are identified as a means by which community members can understand the importance and rationale of establishing an MPA, and their role in this process (Cascia, 2000; White et al., 2002). In regards to networks, localized MPA education programs could serve as useful tools for increasing support for MPA networking initiatives.

Coastal Conservation and Education Foundation and Fisheries Improved for Sustainable Harvest MPA Networks

This study focuses on two emerging socioecological MPA networks in the Central Visayas, Philippines—the Coastal Conservation and Education Foundation (CCEF), a domestic nongovernmental organization (NGO) based in Southeast Cebu, and the Fisheries Improved for Sustainable Harvest Project (FISH), a United States Agency for International Development–funded initiative in Danajon Bank, Bohol. Both CCEF and FISH have instituted socioecological networks of small community-based MPAs (Armada et al., 2009; Eisma-Osorio et al., 2009; CCEF, 2008; FISH, 2008).

Environmental education is included in the CCEF network through activities such as trainings for local leaders (who can serve as hubs of information diffusion), Information, Education, and Communications (IEC) campaigns, and cross visits—a tool where local MPA managers visit other MPAs in the network, meet with their fellow managers, and have an opportunity to see and discuss their MPAs (Eisma-Osorio et al., 2009; CCEF staff 2, September 17, 2007). CCEF also holds open public hearings that act as informational forums about the MPAs and MPA network and give community members an opportunity to ask questions and interact with CCEF staff (CCEF Staff 2, September 17, 2007). During the first two years of the project, there were multiple training activities and meetings, involving 2,184 participants that included students, local government officials, members of people's organizations, and others (CCEF, 2007). The broad scope of these activities increases heterophilous interactions and helps ensure the diffusion of the program's message to a wide and diverse audience within and between the communities.

FISH has a complex environmental education strategy that draws on the concepts of theories of education and communication. Dubbed the "transformational communications framework" (FISH Staff 2, September 13, 2007), its goal is to ensure that education programs transform mindsets of resource users and effect behavioral change. Education initiatives focus on municipal officials, who then conduct programs for their constituents and stimulate diffusion of the educational messages. In individual communities, participation in monitoring activities serves as a platform for localized education. The results of the monitoring are diffused through the community via small-scale, community-specific IEC efforts (Fish Staff 4, September 15, 2007). FISH also uses cross visits as an educational tool for local MPA managers.

This article analyzes community member perceptions of the CCEF and FISH emerging socioecological MPA networks. The analysis focuses on education programs in the communities and networks, information diffusion within and between the communities in the networks, and how these factors relate to each other and MPA success. The intent of this study is to provide MPA practitioners and managers with useful advice for planning and evaluating the educational components of MPA networking programs.

Methods

Study Sites, Survey Methods, and Quantitative Analysis

This study was conducted in communities with MPAs in South Cebu and Danajon Bank, Bohol (Armada et al., 2009; Christie et al., 2009; Eisma-Osorio et al., 2009). Oral, structured surveys were administered over a period of 2 months for 18 communities in each region (a total of 36 communities) (Figure 1). For each community, 12 respondents were interviewed: ten randomly selected resource users (e.g., fishermen, gleaners) and two members of the MPA management committee. (Management committee members are community volunteers who are part of the people's organization in charge of MPA management.) Surveys focused on issues such as education, management, and perceived MPA impacts. The statistical methods used in this analysis were modeled on the methods of Pollnac et al. (2001) in their study of Philippine community-based MPAs. The first part of the research focused on the effects of education and information diffusion on MPA success. Questions relating to these topics were developed for the surveys. Different sets questions were asked of the resource users and the management committee members. Each question was coded as a variable, and the results were averaged across the two groups for each of the 36 communities. Correlation analysis (Pearson's r) was performed to determine the relationships between these variables. Step-wise regression analysis was used to determine the variables' combined strength as predictors of MPA success, measured as resource users' perceptions of fish abundance, coral condition, MPA compliance, and strength of enforcement.

Principal component factor analysis was applied to the education and information diffusion variables to create multi-item measures of education and diffusion. Step-wise regression was used to assess the strength of the multi-item measures (factor scores) as predictors of the four MPA success variables.

Qualitative Analysis

In addition to the surveys, semi-structured interviews were conducted with six employees of CCEF and FISH. These interviews provided useful background about the educational aspects of the MPA networks and general management and communication issues within the MPAs. The responses were used to complement the results of the statistical survey analysis. It is important to note that while extremely useful, the observations and opinions of these individuals can be biased; FISH and CCEF employees are advocates for their MPAs and MPA networks and participate in the programs they were asked to comment on.

Results

Here we present findings that demonstrate the strongest statistical relationships. Results from additional statistical tests that clarify relationships are referenced when applicable.

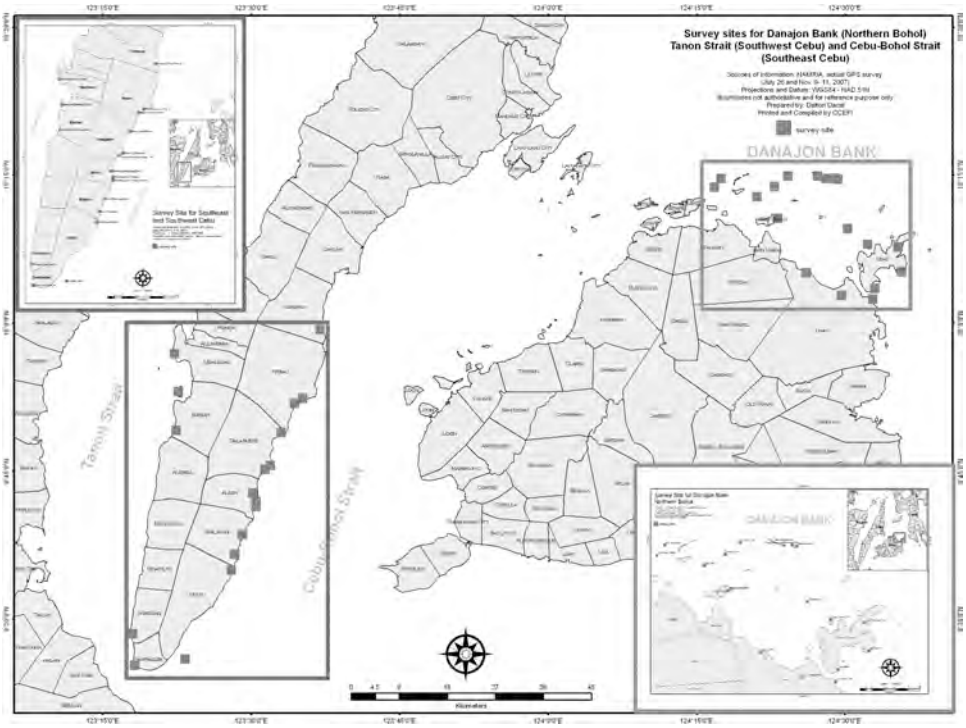

Figure 1. Cebu and Bohol study sites (CCEF 2008).

Environmental Education, Information Diffusion, and MPA Success

Table 1 presents correlations between the 15 education and information diffusion variables and the 4 MPA success variables. The table specifies if variables were derived from the resource user or management committee member surveys. Results for each user group were averaged within each of the 36 communities ($n = 36$). The MPA success variables (all from the resource user surveys) include biological (perception of *Fish abundance* and *Coral condition*) and social indicators (*MPA compliance* and *Enforcement*). *Fish abundance* and *Coral condition* were measured on a scale of 1 to 5 (1 = gotten much worse; 5 = improved a lot); *MPA compliance* was scaled between 0 and 4 (0 = no one obeys the rules; 4 = everyone obeys the rules); and *Enforcement* was ranked on a scale of 1 to 3 (1 = almost never; 3 = regular). All variables were standardized.

MPA education program in place (a dichotomous variable that asked resource users if there were MPA education activities in their communities) exhibited a significant correlation with the social success variable, *Enforcement*. None of the education variables correlated significantly with perceived biological success. For the information diffusion variables, a *Clear MPA leader* (a dichotomous variable asking resource users if there was a clear MPA leader in their community) demonstrated strong positive correlations with *Fish abundance*, *Coral condition*, and *Enforcement*, whereas *Management committee collaboration* (a variable asking management committee members if they collaborated with management committee members from other communities) correlated strongly with *Enforcement*.

Correlations between pairs of variables elucidate important relationships, but the combined effect of these variables may represent provide more useful information (Pollnac

Table 1
Pearson correlations between education and information diffusion factors and MPA success

	Fish abundance[R]	Coral condition[R]	MPA compliance[R]	Enforcement[R]
Education				
Formal monitoring program[C]	−.058	.102	.036	.030
Influence of monitoring information[C]	−.143	−.071	.102	−.065
Involvement in MPA training[C]	−.284	−.044	−.066	.013
Information learned from outside training participants[C]	.170	.102	−.287	−.065
Participation in cross visits[C]	−.073	.091	.297	.013
MPA education program in place[R]	−.041	.325	.299	**.572****
Information diffusion				
Monitoring information shared[C]	−.214	−.254	−.077	−.305
Sharing of cross visit information between management committee members[C]	.165	.133	−.043	−.193
Management committee collaboration[C]	−.046	−.015	−.087	**.456****
Influence of MPA stories[C]	−.009	−.210	−.090	−.224
Benefits of MPA network[C]	.039	.237	.079	.228
Community MPA consultation[C]	−.109	−.173	.004	−.217
Clear MPA leader[R]	**.402***	**.368***	.169	**.390***
MPA success stories heard[R]	.030	−.105	−.190	−.228
MPA failure stories heard[R]	.201	.191	.002	.106

[C] = Management committee member; [R] = Resource user * = $p < .05$; ** = $p < .01$; $n = 36$.

et al., 2001). This analysis employed a step-wise regression method (Table 2) that ran both forward and backward regression methods successively (Ho, 2006) to evaluate the strength of the education and information diffusion variables as predictors of perceived MPA success.

The criteria for entry into the model were a one-tailed *p* value of less than or equal to .05, and a *p* value of less than or equal to .10 for removal once the other variables entered into the model were held constant. The results exhibit a range of relationships. A *Clear MPA leader* emerged as an important predictor variable for *Fish abundance* (16.2% of total variance), *Coral condition* (13.5% of total variance), and *Enforcement* (14.2% of total variance). A *Clear MPA leader* was the only variable that appeared consistently in the regression models. An *MPA education program in place* was a significant predictor for two of the

Table 2
Predictors of MPA success

	Standardized Beta Coefficient	*T*	*p*
Dependent variable: Fish abundance[R]			
Clear MPA leader[R]	.402	2.562	.015
$R = .402$; $R^2 = .162$; Adj. $R^2 = .137$; $F = 6.565$; $p < .05$; $n = 36$;			
Dependent variable: Coral condition[R]			
Clear MPA leader[R]	.360	2.366	.024
MPA education program in place[R]	.316	2.075	.046
$R = .485$; $R^2 = .235$; Adj $R^2 = .189$; $F = 4.306$; $p < .05$; $n = 36$.			
Dependent variable: MPA compliance[R]			
No variables met statistical entrance requirements			
Dependent variable: Enforcement[R]			
MPA education program in place[R]	.564	5.001	.000
Clear MPA leader[R]	.289	2.547	.016
Management committee collaboration[C]	.383	3.161	.004
Information learned from outside training participants[C]	–.331	–2.812	.008
$R = .795$; $R^2 = .631$; Adj $R^2 = .584$; $F = 7.909$; $p < .05$; $n = 36$.			

[C] = Management committee member; [R] = Resource user.

dependent variables *Coral Condition* (10% of total variance) and *Enforcement* (32.7% of total variance). With the exception of *Information learned from outside training participants* (9.4% of total variance for *Enforcement*), the standardized beta coefficients show that all independent variables entered into the models demonstrated positive relationships with the MPA success variables. This indicates that increases in the aforementioned variables will increase the probability of MPA success.

Factor Analysis of Environmental Education and Information Diffusion Variables

Factor analysis is a statistical method that can be used to identify groups of intercorrelated variables for scale development. This provides a means of assessing the combined effects of the education and information diffusion variables. The study employed the principal component analysis technique with varimax rotation (Ho, 2006). Eigen values, scree test criteria, and overall variance explained were used to determine the number of components to extract. Table 3 shows the results of the factors analysis for the education variables.

The loadings on Table 3 are the correlations between the individual variables and the underlying component; higher loadings indicate higher correlations; hence, the variables most representative of the factor. The variables with the highest loadings on the first factor are mostly formal education measures—*Influence of monitoring data*, *Involvement in MPA training*, presence of a *Formal monitoring program*, and *Information learned from*

Table 3
Rotated component matrix for education variables

	Education 1	Education 2
Influence of monitoring information[C]	.832	.183
Involvement in MPA training[C]	.808	−.115
Formal monitoring program[C]	.697	.411
Information learned from outside participants in training[C]	.560	.207
MPA education program in place[R]	−.00169	.906
Participation in cross visits[C]	.291	.654
Percent variance explained	37.168	25.138
Total variance explained: 62.306%		

[C] = Management committee member; [R] = Resource user.

outside participants in training. This component is labeled "*Education 1*." The second factor had high loadings two variables that include both formal and informal education components—*Participation in cross visits* and an *MPA education program in place*. This factor is labeled "*Education 2.*"

The factor analysis for the information diffusion variables did not yield meaningful results and thus is not included in this analysis.

Merged Factors and MPA Success

After performing factor analysis, regression analysis was rerun to observe the predictive relationships between the merged education factors and the MPA success variables. The only education factor that demonstrated statistically significant relationships with MPA success was *Education 2*. This factor manifested modest relationships with *MPA compliance* (12% of the variance) and *Enforcement* (16% of the variance), and the standardized beta coefficients indicate positive correlations with each success variable (*MPA Compliance—R* $= .342$, $R^2 = .117$, Adj $R^2 = .091$, $F = 4.504$, $p < 0.05$, $n = 36$; *Enforcement—R* $= .400$, $R^2 = .160$, Adj $R^2 = .135$, $F = 6.469$, $p < 0.05$, $n = 36$). For *MPA compliance*, in the initial regression analysis, no variables met the statistical entrance requirements for the model; this is an instance of the weighted combination of the variables having a stronger effect than the individual variables. *Participation in cross visits* (a dichotomous variable that asked management committee members whether or not they had participated in cross visits) had no significant correlations with and was not a predictor of MPA success in the first part of the analysis, but as part of the *Education 2* factor, it is statistically significantly correlated with the social MPA success variables. Although these relationships are modest, they are statistically significant and do account for some of the variance in the relationships.

Discussion

In the various statistical tests, three variables emerged as having a greater number of statistically significant relationships with the dependent variables: a *Clear MPA leader*; *Participation in cross visits*; and an *MPA education program in place*. This section will

focus on these variables (and when applicable, other related variables) and how these findings relate to previous studies.

Leadership

Presence of a *Clear MPA leader* emerged as an important information diffusion variable. This variable was derived from a question asking resource users if they felt there was a clear MPA leader in their community. Leaders are an important theme in the diffusion (e.g., Rogers, 1995; Newman, 2001; Liebowitz, 2007) and Philippine MPA literature (e.g., White & Vogt, 2000; Pollnac et al., 2001; White et al., 2002; Christie, 2004). In this analysis, leadership was one of the strongest predictors of MPA success and was the only variable that appeared consistently in all of the statistical models. A *Clear MPA leader* was present in the regression models for *Fish abundance*, *Coral condition*, and *Enforcement* and demonstrated a statistically significant ($p < .05$) positive correlation with each dependent variable.

Strong leadership—in the form of a single leader or respected community groups—is essential to Philippine MPA initiatives (White & Vogt, 2000; Pollnac et al., 2001; White et al., 2002). "Capable and respected community groups" greatly aid MPA implementation (White & Vogt 2000), and early identification of a leadership group increases community compliance and empowerment (Pollnac et al., 2001). Although management committees should not be equated with a clear MPA leader, when asked to provide the leader's name, most respondents named a committee member. These committees represent a form of collaborative leadership, which provides leadership at multiple levels and can be equally effective as a single leader (Newman, 2001). Management committees are often responsible for MPA enforcement; thus, it is logical that leadership was a strong statistical predictor of *Enforcement*. A World Bank study (2000) of marine resource management in Pacific Islands also found that the strength local leadership influences the degree of enforcement.

Ideally, MPA leaders act as "opinion leaders" (Rogers, 1995) within their communities and positively influence others about the MPA. A CCEF employee stated that communities often have "local champions" who serve as MPA advocates both in their own and in neighboring communities. In the individual communities, these leaders play an even more important role than assisting outside organizations because, "it's better for fisher and fisher to talk rather than a marine biologist and a fisher" (CCEF Staff 1, September 17, 2007). Another CCEF employee indicated that in communities that are initially less supportive of MPAs, community organizers focus their efforts on gaining the support of local leaders—if they are unsupportive, it is unlikely that the rest of the community will support the MPA (CCEF Staff 2, September 17, 2007).

The importance of leadership demonstrates how information diffusion helps circulate the lessons of education programs. Howe (2001) found that capacity building projects and trainings with community representatives vested participants with a sense of stewardship, which then motivated them to share the information with others. This "personalization" of knowledge (Liebowitz, 2007) has been shown to have more positive effects than formalized education efforts (Cabanban & White, 1981). Additionally, educated community leaders may be able to bring a heterophilous element into more homophilous communities, thus sparking the adoption of a new innovation. By having more information about the MPAs and MPA networks, leaders bring new ideas to the community, and once these ideas have been introduced, they can spread quickly due to the homophily of the community (Crawford et al., 2006).

As asserted earlier, the interactions between education and information diffusion ultimately should lead to improved resource condition. For leadership, this hypothetical

relationship is supported by the statistical analysis: a *Clear MPA leader* demonstrated predictive relationships with both biological success variables. Interestingly, although leadership correlated positively with and was a predictor of *Enforcement*, it did not have significant direct relationships with *MPA compliance*. The management committee (along with the help of other local groups) generally controls enforcement efforts, and MPA leaders tend to be part of the management committee. While leadership might be indicative of strong MPA management, based on the results of this study, it does not indicate that community members will be compliant with the MPA rules. This could be attributed to community members feeling disenfranchised by MPA leaders. Other studies have found that overzealous leaders can co-opt MPA management and cause other community members to feel alienated and become noncompliant (Christie, 2004; Oracion, 2005; Christie & White, 2007; Majanen, 2007).

Cross Visits

Cross visits are a common practice in the Philippines. They involve MPA leaders from one community visiting a neighboring MPA, or even a renowned MPA like Apo Island. Cross visits provide managers with opportunities to see first-hand how other MPAs are managed and discuss issues and ideas with their peers. They can then diffuse this information throughout their communities. *Participation in cross visits*—a dichotomous variable from the management committee surveys that asked management committee members whether or not they had participated in cross visits—was identified as an education variable because the personal interactions and lessons learned represent a form of informal education.

Participation in cross visits did not correlate significantly with the MPA success variables. Pollnac et al. (2001) also found that cross visits did not correlate with biological measures of MPA success. However, in factor analysis and the subsequent regression analysis, the *Education 2* factor (consisting of *Participation in cross visits* and an *MPA education program in place*) was a predictor of *MPA compliance* and *Enforcement.* This demonstrates that although not a significant predictor on its own, cross visits—when combined with other educational activities—may have the potential to increase the probability of MPA success.

Although the statistical analysis did not yield strong results, FISH and CCEF employees view cross visits as essential education tools. A FISH employee asserted that cross visits are the best way to convince community members of the potential benefits of an MPA (Fish Staff 3, September 13, 2007). Another FISH employee stated that cross visits are, "one way of really showing [managers] the fruit of a successful MPA. . . . Some people will not really believe you unless they see an area and experience it themselves" (FISH Staff 2, September 13, 2007). Cross visits also are empowering to the visited communities, as the visits are a sign that stories about the success of their MPAs are reaching others. This recognition can inspire managers to continue their efforts (CCE Staff 1 and 2, September 17, 2007). However, it is important to note that while cross visits may be a useful tool, proper implementation is essential. Out of 72 management committee members surveyed, 28 had not yet participated in cross visits, although they indicated that they would be interested in future visits. This suggests that cross visits have yet to be fully implemented throughout the communities in the networks.

While this analysis has coded cross visits as an education variable, they are also a form of information diffusion. A CCEF employee stated that, "it's really *information* about management they're *exchanging*" (CCE Staff 1 September 17, 2007, emphasis added). According to Shanahan et al. (2001), the personalized communications (a factor already tied to leadership) that occur on cross visits are an important means by which people

develop environmental beliefs and values. Cross visits provide a forum for both personalized communication and learning exchange—one of the main goals of a knowledge network (Creech & Willard, 2005). Additionally, by giving participants an opportunity to interact with others who may have different beliefs or backgrounds, cross visits can increase the degree of heterophilous communications and aid the diffusion of new innovations (Rogers, 1995). Cross visits are also a forum for "peer learning," which helps leaders deal with common personal problems of leadership, such as isolation and burn out; these "leadership bonds" are one of the main benefits of these networks (Newman, 2001). This implies that cross visits also have the ability to strengthen MPA leadership, which would be notable given the recognized impact of leadership on MPA success. This relationship, however, is not supported by the statistical analysis, as *Participation in cross visits* had a very weak correlation ($r = -.033$, $p > .05$) with a *Clear MPA leader*. Again, this may point to a need for CCEF and FISH to ensure proper implementation of these cross visits.

On cross visits, MPA managers can exchange stories and anecdotes about MPAs. Managers then can share these stories with members of their community. *Participation in cross visits* had a strong positive correlation with the resource user variable *MPA success stories heard* ($r = .407$, $p < .05$). Apart from this relationship, however, the MPA narrative variables (*MPA success stories heard, MPA failure stories heard,* and *Influence of MPA stories on management*) did not demonstrate significant direct correlations with MPA success. Nevertheless, the potential strength of these narratives should not be discounted. Storytelling and narratives have been identified as important techniques in innovation diffusion (Shanahan et al., 2001; Denning, 2004, 2005) and provide a counterpoint to a "facts and figures" approach of formal education programs (Shanahan et al., 2001). While the surveys asked resource users to indicate if they had heard stories and what those stories had been, they did not ask the respondents from whom they had heard the stories, whether they went on to share these stories with others, and how these stories affected their behavior. Similarly, regarding cross visits, respondents were not asked about the content of the cross visits or their perceived success. These questions would have provided a more accurate means of assessing the power of the narrative, the success of cross visits, and the level of information diffusion stemming from these activities.

MPA Education Programs

Members of management committees may be knowledgeable about the justifications for MPA establishment, but without community support and compliance, MPA success is unlikely (Pollnac et al., 2001; Oracion, 2003; Christie, 2004; Oracion, 2005). Therefore, community education programs—which may include both formal and informal measures—are important. In the resource user surveys, respondents were asked about the presence of such education programs. For the management committee surveys, respondents were asked about the presence of and their involvement in MPA trainings.

An *MPA education program in place* (a dichotomous resource user variable asking respondents if there were MPA education programs in their communities) correlated strongly with *Enforcement* ($r = .572$, $p < .001$). An *MPA education program in place* also emerged as a predictor of both *Coral condition* (10% of total variance) and *Enforcement* (32.7% of total variance). Additionally, an *MPA education program in place* affected *MPA compliance,* and *Enforcement* as part of the merged factor *Education 2* (loading = .906). None of the variables from the management committee surveys demonstrated significant direct correlations.

Education programs for individuals within the community that are led by FISH and CCEF staff are integral to their capacity-building strategies. The predictive value of an *MPA education program in place* presented earlier provides quantitative support for potential of these programs. These findings are important due to the potential influence of education programs on capacity building and community participation—two factors that are key to the FISH and CCEF approaches (Armada et al., 2009; Eisma-Osorio et al., 2009). Community education programs serve as the basis for these activities: education is a necessary component of capacity building, and educated resource users are more likely to participate in the management process. Stakeholders participating in marine resource management must understand the rationale for and broader framework of the projects (White et al., 2006; Chuenpagdee & Jentoft, 2007), and local stakeholder support and ownership of coastal resource management programs is imperative for their sustainability (Olsen & Christie, 2000). Community education programs that stimulate increased community participation provide a useful tactic for tackling these issues.

It is interesting that the education variables from the management committee surveys did not demonstrate many significant direct relationships. In fact, the one variable that was a significant predictor for *Enforcement—Information learned from outside training participants*—demonstrated a negative correlation. However, it is still possible for the formal education variables to affect MPA success indirectly. For instance, presence of a *Formal monitoring program* did correlate significantly with an *MPA education program in place* ($r = .347$, $p < .05$), which was a positive predictor of MPA success. Oftentimes, results of formal monitoring programs are used as the basis for community education programs (Fish Staff 4, September 13, 2007). This could imply an indirect relationship between formal monitoring programs and overall MPA success. Further research could analyze potential indirect relationships and elucidate the potential significance of formal education variables.

Observational studies of environmental education programs for select community members have cautioned about the drawbacks of programs that only target a select group of individuals (White & Cabanban, 1981; Howe, 2001). Howe (2001) notes that it is difficult to determine the degree to which participants in education programs will be able to influence their peers' perceptions and behaviors. The potential disconnect between participants in a training program and the larger community demonstrates how environmental education programs can fail if not paired with a strong infrastructure for information diffusion.

Recommendations and Conclusions

For the FISH and CCEF MPA networks, the expectation is that education programs and information diffusion between and within communities will increase MPA support and create more successful MPAs. Given the emphasis CCEF and FISH place on MPA education programs and the links between education and information diffusion, the number of statistically significant relationships with MPA success was lower than expected. The results of this study lead to recommendations for FISH and CCEF, and for MPA networks in general:

1. **Leadership**—FISH and CCEF recognize the importance of using local leaders as hubs for information diffusion within communities. These efforts should be prioritized and continued, as they are one of the most effective means of information diffusion. Additionally, outside organizations assisting MPA network initiatives should ensure that the leaders are effectively diffusing messages through their

communities. Organizations could do this by stressing the need for information diffusion in trainings with leaders, and periodically monitoring communities to assess the level of diffusion.

2. **Cross visits**—Cross visits provide a means of strengthening communication between individuals in an MPA network, and consequently, strengthening the network itself. However, a weakness of cross visits is the time and effort of management that must be exerted to realize them. When possible, outside organizations or local governments involved in assistance should provide honorariums and cover transportation costs for participating individuals. To ensure continued communication between individuals in the network, cross visits should become institutionalized activities that occur at regular intervals, and assisting organizations should find ways to facilitate on-going communication between cross visit participants so that they can continue to share information between visits. As with leadership, assisting organizations should find ways to ensure that the information MPA leaders learn on cross visits is properly diffused through their communities.
3. **Community education**—The lack of significant relationships between formal education initiatives for MPA management committee members and MPA success suggests that significant effort should be placed in guaranteeing diffusion of the lessons through and between communities. As already recommended, education efforts must stress the importance of information diffusion. MPA practitioners should continually monitor the effects of both formal and informal education programs, and adapt education and diffusion strategies to the needs of the individual communities and the networks.

In this analysis education and information diffusion were divided into discrete categories; however, in real life, they are intricately linked. This simplification of the variables may have obfuscated their true effects. Further research could clarify the relationships between education, information diffusion, and MPA success. Survey questions and in-depth interviews with community members could be tailored to address community members' opinions of education programs, how these affect their behavior and attitudes, and the overall effects of these programs. In the statistical analysis, education and information diffusion could be treated as both independent and dependent variables, and detailed exploratory testing could be conducted to discover factors that affect education and information diffusion. Finally, community social network analysis could help map the community social hierarchy and provide managers with a better idea of community opinion leaders who could serve as MPA and MPA network advocates.

Despite these potential improvements, the statistical data and interviews with FISH and CCEF demonstrate the current and potential benefits and efficacy of education activities, such as community education programs and cross visits, and their ability to create an "educational spillover effect." These programs should serve as important templates for other MPA networking initiatives, especially in countries with small-scale community-based MPAs. These education efforts should be continued, and more attempts should be made to study the results of these programs and the ways in which information is diffused within and between the communities in the MPA networks.

References

Alcala, A., and G. Russ. 2006. No-take marine reserves and reef fisheries management in the Philippines: A new people power revolution. *Ambio* 35(5):245–255.

Alessa, L., S. M. Bennett, and A. D. Kliskey. 2003. Effects of knowledge, personal attribution and perception of ecosystem health on depreciative behaviors in the intertidal zone of Pacific Rim National Park and Reserve. *Journal of Environmental Management* 68:207–218.

Armada, N., A. T. White, and P. Christie. 2009. Managing fisheries resources in Danajon Bank, Bohol, Philippines: An ecosystem-based approach. *Coastal Management* 37:308–330

Barney, E. C., J. J. Mintzes, and C. Yen. 2005. Assessing knowledge, attitudes, and behavior toward charismatic megafauna: The case of dolphins. *Journal of Environmental Education* 36(2):41–55.

Bell, J. D., B. D. Ratner, I. Stobutzki, and J. Oliver. 2006. Addressing the coral reef crisis in developing countries. *Ocean and Coastal Management* 49:976–985.

Burke, L., E. Selig, and M. Spalding. 2002. *Reefs at Risk in Southeast Asia*. Washington DC: World Resources Institute. 76 p.

Cabanban, A. S., and A. T. White. 1981. Marine conservation program using non-formal education Apo Island, Negros Oriental, Philippines. *Proceedings of the 4th International Coral Reef Symposium, Manila* 1:317–321.

Carpenter, K. E., and V. G. Springer. 2005. The center of marine shore fish biodiversity: The Philippine Islands. *Environmental Biology of Fishes* 72:467–480.

Cascia, M. 2000. *Introduction to the Establishment of a Community-Based Marine Sanctuary*. CRM Document No. 24-CRM/2000, Cebu City, Philippines. 70 p.

CCEF (Coastal Conservation and Education Foundation). 2008. http://www.coast.ph/ (accessed May 28, 2008).

CCEF. 2007. *Annual Report: Year 2, Phase 2 (November 1, 2005–December 31, 2006), Local Governance for Coastal Management Project*. Cebu City, Philippines: Coastal Conservation and Education Foundation. 16 p.

Christie, P., R. B. Pollnac, E. G. Oracion, A. Sabonsolin, R. Diaz, and D. Pietri. 2009. Back to basics: An empirical study demonstrating the importance of local-level dynamics for the success of tropical marine ecosystem-based management. *Coastal Management* 37:349–373.

Christie, P., and A. T. White. 2007. Best practice for improved governance of coral reef marine protected areas. *Coral Reefs* 26:1047–1056.

Christie, P. 2004. Marine protected areas as biological successes and social failures in Southeast Asia. *American Fisheries Science Symposium* 42:155–164.

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.

Chuenpagdee, R., and S. Jentoft. 2007. Step zero for fisheries co-management: What precedes implementation. *Marine Policy* 31:657–668.

Crawford, N., M. Kasmidid, F. Korompis, and R. B. Pollnac. 2006. Factors influencing progress in establishing community-based marine protected areas in Indonesia. *Coastal Management* 34:39–64.

Creech, H., and T. Willard. 2005. *Strategic Intentions: Managing Knowledge Networks for Sustainable Development*. International Institute for Sustainable Development. 150 p.

Denning, S. 2005. Transformational innovation: A journey by narrative. *Strategy and Leadership* 33(3):11–16.

Denning, S. 2004. Telling tales. *Harvard Business Review* 82(5):122–129.

Duthy, S., and B. Bolo-Duthy. 2003. Empowering people's organizations in community based forest management in the Philippines: The community organizing role of NGOs. *Annals of Tropical Research* 25(2):13–27.

Eisma-Osorio, R.-L., R. C. Amolo, A. P. Maypa, A. T. White, and P. Christie. 2009. Scaling up local government initiatives toward ecosystem-based fisheries management in Southeast Cebu Island, Philippines. *Coastal Management* 37:291–307.

Ferrer, E. M., R. Cabaces, and L. Polotan-de la Cruz. 2003. *Affirming the Forces that Give Life and Energy: Revisiting the Theory and Practice of CBCRM in the Philippines*. CBCRM Resource Center, 2003.

FISH. 2008. Fisheries Improved for Sustainable Harvest Project. Available at http://www.oneocean.org (accessed May 28, 2008).

Gigliotti, L. M. 1990. Environmental education: What went wrong? What can be done? *Journal of Environmental Education* 22(1):9–12.

Guenette, S., T. Lauck, and C. Clark. 1998. Marine reserves: From Beverton and Holt to the present. *Reviews in Fish Biology and Fisheries* 8:251–272.

Halpern, B. 2003. The impact of marine reserves: Do reserves work and does reserve size matter? *Ecological Applications* 13(1):S117–S137.

The H. John Heinz III Center for Science, Economics and the Environment. 2004. *Innovation by Design: Improving Learning Networks in Coastal Management*. The Heinz Center. 120 p.

Ho, R. 2006. *Handbook of univariate and multivariate data analysis and interpretation with SPSS.* London: Chapman and Hall/CRC. 393 p.

Howe, V. 2001. Local community training and education in southern Tanzania—A case study. *Marine Policy* 25:445–455.

Howell, R. R. 2007. *Building Marine Protected Area Management Capacity: Designing a Global Learning Network for the World Heritage Marine Program*. Master's Thesis. Seattle: School of Marine Affairs, University of Washington.

Iozzi, L. 1989. What research says to the educator, part one: Environmental education and the affective domain. *Journal of Environmental Education* 20(3):3–9.

Jones, P. S. 2006. Collective action problems posed by no-take zones. *Marine Policy* 30:143–157.

Liebowitz, J. 2007. *Social networking: The essence of innovation*. Lanham, MD: Scarecrow Press, Inc. 130 p.

Lück, M. 2003. Education on marine mammal tours as agent for conservation—But do tourists want to be educated? *Ocean and Coastal Management* 46:943–956.

Majanen, T. 2007. Resource users conflicts in Mabini and Tingloy, the Philippines. *Marine Policy* 31:480–487.

McClanahan, T., M. J. Maranne, J. E. Cinner, and W. E. Kiene. 2006. A comparison of marine protected areas and alternative approaches to coral-reef management. *Current Biology* 16:1408–1413.

Mora, C., S. Andrefouet, M. J. Costell, C. Kranenburg, A. Rollo, J. Veron, K. J. Gastona, and R. A. Myers. 2006. Coral reefs and the global network of marine protected areas. *Science* 312:1750–1751.

Newman, A. 2001. *Built to Change: Catalytic Capacity-Building in Nonprofit Organizations*. A sabbatical report submitted to the David and Lucile Packard Foundation and The Nature Conservancy. 56 p.

Olsen, R., and P. Christie. 2000. What are we learning from tropical coastal management experiences? *Coastal Management* 28:5–29.

Oracion, E. G. 2005. Beyond physical space: The human and cultural complexities in marine protected area management. *Silliman Journal* 46(2):137–168.

Oracion, E. G. 2003. The dynamics of stakeholder participation in marine protected area development: A case study in Batangas, Philippines. *Silliman Journal* 44(1):95–137.

Orams, M. B. 1995. Using interpretation to manage nature-based tourism. *Journal of Sustainable Tourism* 4(2):81–94.

Pauly, D., V. Christensen, J. Dalsgaard, R. Froese, and F. Torres Jr. 1998. Fishing down marine food webs. *Science* 279:860–863.

Philippine Environment Code. 1977. Presidential Decree No. 1152, 1977.

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 Visayas, Philippines. *Ocean and Coastal Management* 44:673–710.

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.

Rogers, E. M. 1995. *Diffusion of innovation 4th*, ed. New York: Simon and Schulster. 519 p.

RP LGC. Republic of the Philippines. The Local Government Code of 1991. Republic Act 7160.

RP PFC. Republic of the Philippines. The Philippines Fisheries Code of 1998. Republic Act 8550.

Russ, G. R., B. Stockwell, and A. C. Alcala. 2005. Inferring versus measuring rates of recovery in no-take marine reserves. *Marine Ecology Progress Series* 292:1–12.

Shanahan, J., L. Pelstring, and K. McComas. 2001. Using narratives to think about environmental attitude and behavior: An exploratory study. *Society and Natural Resources* 12:405–419.

Stapp, W. B., D. Bennett, W. Bryan, J. Fulton, J. MacGregor, P. Nowak, J. Swan, R. Wall, and S. Havlick. 1969. The concept of environmental education. *The Journal of Environmental Education* 1(1):30–31.

Stepath, C. M. 2000. *Awareness and Community-Based Monitoring*. Proceedings of the 9th International Coral Reef Symposium, Bali. 23–27.

Ward, T., and E. Hegerl. 2003. *Marine Protected Areas in Ecosystem-Based Management of Fisheries. A Report for the Department of the Environment and Heritage*. Canberra, Australia: National Heritage Trust. 73 p.

White, A., E. Deguit, W. Jatulan, and L. Eisma-Osorio. 2006. Integrated coastal management in Philippine local governance: Evolution and benefits. *Coastal Management* 34:287–302.

White, A. T., and C. A. Courtney. 2004. Policy instruments for coral reef management and their effectiveness. In *Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs*, 5–35. Penang, Malaysia: World Fish Centre.

White, A., C. A. Courtney, and A. Salamanca. 2002. Experience with marine protected area planning and management in the Philippines. *Coastal Management* 30(1):1–26.

White, A. T., and H. P. Vogt. 2000. Philippine coral reefs under threat: Lessons learned after 25 years of community-based reef conservation. *Marine Pollution Bulletin* 40(6):537–550.

WCPA/IUCN (World Commission on Protected Areas/International Union for Conservation of Nature). 2007. *Establishing Networks of Marine Protected Areas: A guide for Developing National and Regional Capacity for Building MPA networks.* Non-technical summary report.

The World Bank. 2006. *Scaling Up Marine Management: The Role of Marine Protected Ares*. Washington, DC: The International Bank for Reconstruction and Development/The World Bank. 100 p.

The World Bank. 2000. *Voices from the Village: A Comparative Study of Coastal Resource Management in the Pacific Islands*. Washington, DC: The International Bank for Reconstruction and Development/The World Bank. 85 p.

Zeller, D., and D. Pauly. 2004. The future of fisheries: From ‘exclusive’ resource policy to ‘inclusive’ public policy. *Marine Ecology Progress Series* 274:295–298.