

Perceptions of Local Residents of the Value of Marine Resources and Protected Areas: The Case of San Miguel Island, Bicol

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Abstract

This paper examines the perceptions of local residents of San Miguel Island (SMI) regarding the value of marine resources and protected areas in relation to socioeconomic and fishing profile information. Results suggest that perceptions of marine resource conservation and MPAs are affected by resource dependency levels and to some extent by education, household size and the presence of secondary sources of income. Implications for policy are: (1) identifying the fishers who are displaced by the MPA establishment and prioritizing them in alternative livelihood plans which might improve the support for the MPA and other conservation efforts; (2) ensuring that the population of young dependents (0-15 yrs old) on the island (around 40%) will get higher education, and possibly directing awareness campaigns to this segment of the population; and (3) considering measures to support improvements in the non-fishing and non-farm economies surrounding the island to increase opportunities for residents to take on secondary jobs.

Keywords: MPA (Marine Protected Area), ordinal probit, San Miguel island, perception

1. Introduction

The participation and support of local residents is indispensable for the sustainability of marine protected areas (MPAs) (Pollnac et al., 2001; White et al., 2002). However, in order to elicit support and participation, it is important to understand residents' socioeconomic conditions, and their attitudes and perceptions of the value of marine resources and marine resource conservation.

An existing theory from the field of social psychology is that a person's behavior is determined by his intention to perform the behavior and that this intention is, in turn, a function of his attitude toward the behavior and his subjective norm (Ajzen

and Fishbein, 1980). Although the second factor, subjective norm, is not covered by our data set, and this study is limited to determining the overall opinion of fishers regarding the value of marine resources and their awareness of MPAs, the theory is partly assumed when positing that when fishers have a high cognizance and appreciation of the value of marine resources, they are more likely to act in support of marine conservation initiatives especially when the limiting conditions are addressed.

This paper presents a case study of San Miguel Island (SMI) in Bicol, Philippines. SMI is located in the east part of Tabaco City south of Lagonoy Gulf, a major fishing ground in the Bicol Region

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(Figure 1). Lagonoy Gulf is a 3,701km² fishing ground linked to the Pacific Ocean (Figure 1). Coral reefs (170 km²), seaweed-seagrass beds (83 km²) and mangroves (6 km²) comprise its critical habitats (Soliman, 2008). The gulf is characterized by multi-species and multi-gear fisheries, dominated by gillnets and handlines catching tunas, small pelagic, large demersal and coral reef fishes. Fishers also gather fry fish such as milkfish, siganids, and groupers.

Using data from 1994 and 2004, researchers showed that the gulf is heavily overfished - the number of gear units operating in the gulf has increased by 40% during the period, yet fisheries production progressively declined (Dioneda, et al., 2004). In the same period, habitat researchers reported that mangrove communities were highly exploited; the standing crop values of seagrass and seaweed beds were significantly increased, and coral reefs were stable with around 40% in fair live coral condition (Soliman et al., 2005). They found coral conditions in non-MPA sites stable and coral conditions within the MPA sites improved.

Currently, there are six MPAs in the gulf. We focused on the SMI-MPA, one of the most mature among the MPAs in the gulf. It is at least one square kilometer in size and was recognized as one of the best-managed MPAs by PhilReefs (a consortium of Philippine marine research agencies) in 2000. The SMI-MPA consists of a 1.25 km² buffer or reserve zone where fishers are allowed to fish using traditional gear, and a 1 km² no-take sanctuary where no fishing is allowed except for educational and scientific purposes. It is co-managed by an MPA council consisting of members of the bantay dagat including the barangay (village) chair.

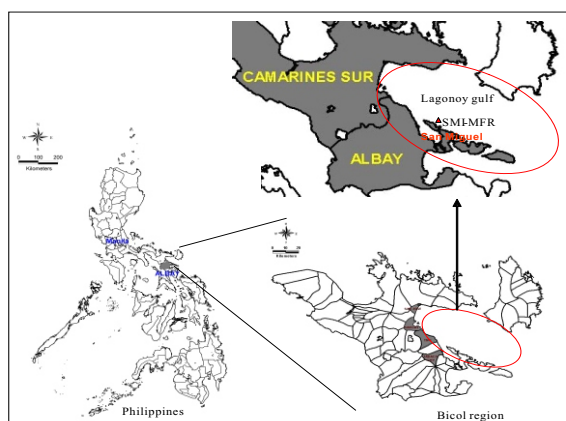


Fig. 1. Location of Sun Miguel Island in Bicol, Philippines.

We briefly characterized the livelihood structure of households, and then assessed the local residents' attitudes towards marine conservation; and their perceptions of the changes brought about by the MPA's establishment. Finally, we analyzed the factors affecting these perceptions.

2. Methods

1) Data and Sources

This study used a data set gathered from 1035 randomly sampled respondents as part of a collaborative project between Bicol University and Kochi University on the adaptive capacities of households in SMI. Probability proportional to size sampling was used and adjusted to have a minimum of 100 respondents per village. Table 1 shows the population and number of samples by village.

Table 1. Population of household and number of samples, by village.

Barangay	Population ^a	Number of Households ^b	Number of samples
Agñas	1656	234	100
Hacienda	5452	1053	450
Rawis	1429	254	108
Sagurong	3082	576	246
Visita	1865	306	131
Total	13484	2423	1035

Source: ^a(NSO-2000)^b City planning development office (2006)

We gathered socioeconomic information and fishing profile information, and elicited the attitudes and perceptions of respondents towards marine conservation and MPAs. For perceptions, we asked respondents to evaluate statements using a 6-levels Likert scale, a slightly modified approach from that taken by Seenprachawong (2002).

2) Analysis

To determine the relationship between selected socioeconomic factors and the perceptions of the value of marine resources and MPAs, the ordered probit model was used, as it represents an ordered choice of more than two categories. The dependent variables, which are the perception questions (for example, the opinion of the respondent on the statement: "Establishing a marine sanctuary is necessary to preserve the natural marine environment.") can be "strongly disagree" which takes a value of 0, "disagree" which takes a value of 1, "slightly disagree" which takes a value of 2, "slightly agree" which takes a value of 3, "agree" which takes a value of 4, and "strongly agree" which takes a value of 5. Following Greene (2003), the model is built around the latent regression

$$y^* = v_i + e_i$$

where y^* is unobserved, but what we can observe is the chosen answer y ,

$$\begin{aligned}
 y &= 0 \text{ if } y^* \leq 0, \\
 &= 1 \text{ if } 0 < y^* \leq \mu_1, \\
 &= 2 \text{ if } \mu_1 < y^* \leq \mu_2, \\
 &= 3 \text{ if } \mu_2 < y^* \leq \mu_3, \\
 &= 4 \text{ if } \mu_3 < y^* \leq \mu_4, \\
 &= 5 \text{ if } \mu_4 < y^*,
 \end{aligned}$$

where μ_s are unknown parameters to be estimated; v_i is the observable component, a function of measurable factors, while e stands for certain unobservable factors. Assuming that the distribution of e is normal, then we have an ordered probit model. Normalizing the mean and variance of e to zero and one, we can calculate the probabilities that y^* is less than or equal to y from the standardized normal cumulative distribution function (see Greene, 2003 for details).

For this study, we specified the observable component of the model to be of the form,

$$\text{Perception} = f(\text{HHSIZE}, \text{CHHEDUC}, \text{PCTFINC}, \text{DSECINC})$$

where the dependent variable is the answer chosen in the Likert-scale. Independent variables, on the other hand, consist of hypothesized determinants of fisher perceptions and other variables, namely, the following: HHSIZE, the number of household members; CHHEDUC, a categorical

variable representing the respondents' level of educational attainment; PCTFINC, an index derived by dividing the total income from fishing by the total household income; and DSECINC a dummy variable which takes a value of 1 if the respondent has a secondary source of income. The corresponding b's of the independent variables are the parameter estimates. A caveat necessary in the interpretation of these coefficients is that in the case of the ordered response models, only the signs of the changes in the boundary probabilities are unambiguous (Greene, 2003), hence only the boundary probabilities will be interpreted here. We used estimating models for each of the statements which can act as proxies for the various non-market values. We performed the descriptive analysis using MS Excel and SAS 8.1, and we estimated the ordinal probit models using the statistical software NLOGIT 4.0.

3. Results and Discussion

1) Sample household characteristics

The average household size is almost six (i.e. on average there are four children). Most of the respondents were born within SMI with less than 5% born outside the Bicol region. Less than 5% have attained education beyond the high school level. Table 2 shows other selected characteristics of the household members.

Table 2. Selected characteristics of the SMI household population.

Item	Frequency	Percent
Gender		
Female	2826	47.64
Male	3106	52.36
Civil Status		
Married	1919	32.35
Single	3892	65.61
Separated	12	0.2
Widow/Widower	109	1.84
Educational Status		
No formal Education	861	14.51
Elementary Undergraduate	2037	34.34
Elementary Graduate	1090	18.37
High School Undergraduate	1179	19.88
High School Graduate	468	7.89
Vocational Graduate	159	2.68
College Undergraduate	57	0.96
College Graduate	81	1.37
Living with Family		
Yes	5558	93.70
No	374	6.30

2) Livelihood diversification and income composition

Farming and fishing are the major sources of livelihood and income for the local residents is based on the number of working household members engaged in these activities (Table 3). In terms of average household income composition, however, Figure 2 shows that on average, the total income from non-farm and non-fishing activities does appear to be significant. Most of these income sources are in the personal or company service sectors.

Table 3. Occupational structure of working household members, SMI, n=1675.

Occupation	Frequency	Percentage*
Fishing	347	20.7
Fishing-related	19	1.1
Farming	538	32.1
Rural nonfishing/nonfarm	514	30.7
Migrant nonfishing/nonfarm-domestic	341	20.4
Migrant nonfishing/nonfarm-overseas	26	1.6
Income from receipts	17	1.0

*multiple responses

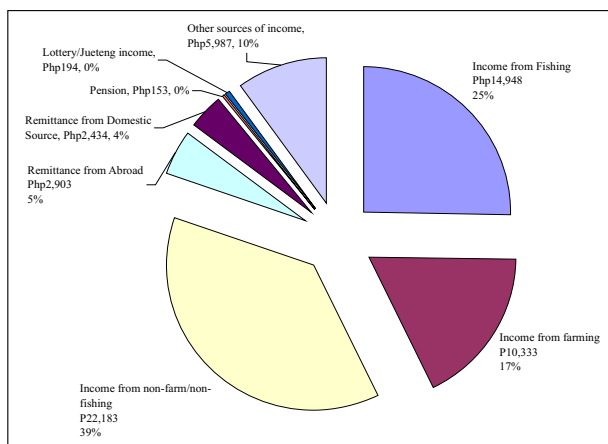


Fig.2. Average household income composition, SMI, 2008.

3) Fishing profile and marine resource-use pattern

The fishers at SMI have, on average, 22 years' fishing experience, and 57% are boat owners. Of the boat owners, 43% own motorized vessels. Table 4 shows a basic fishing profile based on the

household survey. The information on fishing location reveals three important points: (1) a significant number of fishers fish near or around SMI and Tabaco Bay; (2) a significant number of fishers from SMI go as far as Catanduanes and Pacific Ocean offshore; and (3) fishers at SMI, which is under the jurisdiction of Tabaco City, fish in other towns such as Tiwi, Rapu-rapu and even as far as Sorsogon Bay. The fishery is multi-gear although dominated by hook and line gear and by gillnets.

Based on FGDs conducted in the area, fishing operations seem to be seasonal and largely affected by the southwest monsoon (November to March) and the northeast monsoon (June to October). Peak fishing season depends on the gear used. For hook and line, which is the most commonly owned gear on SMI, fishing occurs year round although the peak season is from March to June.

Table 4. Selected fishing characteristics, SMI, 2008.

Item	Frequency	%
Location of Fishing-related Activity (%)		
Agñas	8	2.4
Catanduanes	86	26.0
Hacienda	22	6.6
Lagonoy Gulf	32	9.7
Pacific Ocean/Sirangan	30	9.1
Rapu-rapu	1	0.3
Rawis	3	0.9
Sagurong	23	6.9
San Miguel Island	39	11.8
San Miguel Bay	3	0.9
Sorsogon Bay	1	0.3
Tabaco Bay	81	24.5
Tiwi	2	0.6
Main Gear Used		
Bottom gillnet/Set gillnet	34	10.0
Gillnet	59	17.4
Hook and line	183	53.8
Multiple handline	26	7.6
Spear gun	17	5.0
Others	21	6.2
Number of fishing months		
3	2	0.58
4	5	1.45
5	16	4.64
6	24	6.96
7	31	8.99
8	33	9.57
9	30	8.7
10	17	4.93
11	3	0.87
12	185	53.33
Fishing frequency		
Mean no. of months per year	9.89	
Mean no. of days per month	19.95	
Mean no. of hours per day	9.91	

4) Attitudes and Perceptions

Table 5 presents a summary of the responses of the local residents of SMI with regard to perceptions of marine resource value. The local residents have a positive recognition of the value of protecting and preserving the marine resources as indicated by their evaluation of the belief statements. For example, around two-thirds of the respondents agreed or

strongly agreed that it is necessary to preserve the natural environment for its bequest value and that doing so is their duty. However, when it came to a "willingness to spend money", many of the respondents hesitated. This suggests that in the case of the local residents, it may not be very accurate to measure their value judgements using monetary amounts as they may be too constrained financially.

Table 5. Percentage distribution of responses to marine resource value perception statements.

Value/Statement	Strongly Disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly Agree	No Response	
	1	2	3	4	5	6		
(1) It is necessary to preserve the natural environment so that my grandchildren may benefit from it. (proxy for Bequest value)	0.1	0.6	0.3	9.5	40.0	40.0	9.6	
(2) I have a duty to protect the coral reefs, seagrass beds and mangroves. (proxy for Intrinsic value)	0.1	0.6	1.2	13.4	43.9	31.3	9.6	
(3) I want to protect the coral reefs, seagrass and mangroves because marine life depends on them. (proxy for Existence value)	0.0	0.3	0.9	16.5	45.7	27.1	9.6	
(4) I am willing to spend money to protect coral reefs, mangroves and seagrass beds because they help protect the community from floods. (proxy for Indirect use value)		0.2	2.6	7.3	31.2	38.2	10.9	9.6
(5) I am not using the coral reefs and mangroves now, but I am willing to spend money now to protect them in case I want to use them in the future. (proxy for Option value)		0.4	1.7	5.1	28.4	33.8	20.6	10.0

(Source: own survey, 2008)

On MPAs, 25% of the respondents strongly agreed that it is necessary to establish MPAs to preserve the natural environment (Table 6). Only around 3% slightly disagreed, disagreed or strongly

disagreed. A Majority of the respondents also agreed that MPA establishment can increase fishers' income although only a little over 10% of them evaluated it with certainty.

Table 6. Percentage distribution of responses to the perception statements regarding the SMI-MPA.

Perception statements	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree	No knowledge
(1) Establishing an MPA is necessary for preserving the natural environment.	0.4	0.9	1.8	17.6	42.0	24.6	13.1
(2) Establishing an MPA increase s fisher’s income.	0.3	3.3	4.4	23.3	37.8	16.0	15.0
(3) Establishing an MPA only decreases the fisher’s income from fishing.	10.6	27.9	18.7	14.3	10.1	3.6	14.8

Since the SMI marine reserve has existed for more than five years, we also asked residents' opinions on the impact of the MPA's existence on major marine resources. The Results are shown in Figure 3. Many of the respondents were either not aware or had no knowledge of the issue, but a majority of those who responded made positive evaluations. Of the three indicators, fish catch appeared to be slightly less impacted. Other positive changes mentioned by respondents were increased discipline among fisherfolk and the creation of possible opportunities for tourism. Negative perceptions included a lack of information dissemination and orientation, a lack of alternative livelihoods for displaced fishers, and a biased implementation.

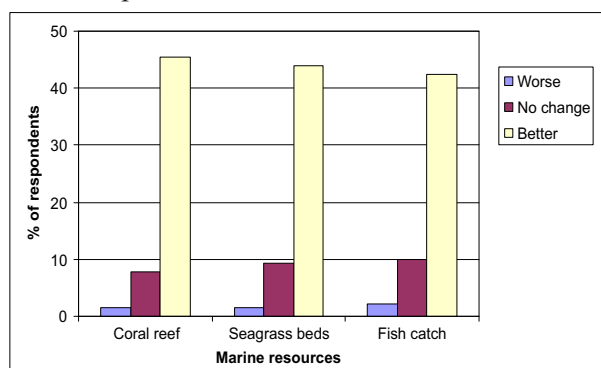


Fig. 3. Perceived change before and after MPA establishment.

5) Factors affecting perceptions of marine resource conservation

Table 7 presents the estimated parameters of the ordered probit model where the dependent variable is the scale of agreement or disagreement with the perception question. For the statement indicating bequest value, all the independent variables are statistically significant at a 10% level of significance. All have positive signs indicating a direct

relationship. Also, when local residents are more dependent on a marine resource, as indicated by the fishery income ratio or PCTFINC, they are more likely to agree that it is their duty to protect marine resources (proxy for intrinsic value), and that they basically want to protect the marine resources for their habitat function. This implies that small-scale fishers, dependent on marine resources, agree with the idea of preserving marine resources for future generations. HHSIZE and DSECINC are significant factors affecting agreement with the statement on preserving the marine resources as a means of protecting the community from floods. The larger the family size, the more likely they are to agree with the idea of preserving resources for flood protection. The statement involved a willingness to spend money which probably explains why those with secondary incomes were more likely to agree.

6) Factors affecting perceptions of MPAs

Education (CHHEDUC) and fishery income ratio are positively significant factors determining the perception of the necessity of MPAs (Table 8). The factors determining perceptions with regard to the impact of MPAs on fisher income are ambiguous. There were no significant variables in the model involving the positive income impact. Household size, education, and fish income ratio, however, are significant determinants of the perception that MPA decreases fishers' income. The positive coefficient of PCTFINC suggests that the higher the resource dependence of respondents, the more likely they are to agree that MPAs decrease fisher income. Higher educational attainment, on the other hand, decreases the probability of households agreeing with the idea that MPAs decrease fisher income.

Table 7. Ordered probit estimates of the determinants of perceptions of the non-market value of marine resources

Variables	Bequest value proxy statement		Intrinsic value proxy statement		Existence value proxy statement		Indirect use value statement		Option value statement	
	Estimated coefficients	P-value	Estimated coefficients	P-value	Estimated coefficients	P-value	Estimated coefficients	P-value	Estimated coefficients	P-value
Constant	1.924 (0.214)	0.000 ***	2.157 (0.202)	0.000 ***	2.337 (0.239)	0.000 ***	1.611 (0.144)	0.000 ***	1.803 (0.156)	0.000 ***
HHSIZE	0.040 (0.023)	0.080 *	0.010 (0.020)	0.604	0.032 (0.019)	0.096 *	0.039 (0.016)	0.016 **	0.009 (0.017)	0.580
CHHEDUC	0.097 (0.050)	0.053 *	0.064 (0.044)	0.146	0.069 (0.043)	0.104	0.005 (0.034)	0.883	0.061 (0.036)	0.088 *
PCTFINC	0.359 (0.155)	0.021 **	0.395 (0.138)	0.004 ***	0.418 (0.136)	0.002 ***	0.025 (0.103)	0.810	0.129 (0.109)	0.238
DSECINC	0.948 (0.409)	0.020 **	0.334 (0.228)	0.143	-0.107 (0.188)	0.567	0.422 (0.171)	0.014 **	0.222 (0.172)	0.196
M	1.263 0.1367382	0.000 ***	1.496 (0.138)	0.000 ***	1.886 (0.193)	0.000 ***	1.771 (0.084)	0.000 ***	1.759 (0.097)	0.000 ***
LL0	-357.45		-450.284		-471.546		-744.9526		-669.8012	
LLc	-346.21		-443.303		-463.467		-738.662		-666.489	
N	927		927		927		927		891	

Note: Figures in parenthesis are standard errors ***-significant at 1% level, ** significant at 5% level; * significant at 10% level

Table 8. Ordered probit estimates of the determinants of MPA perceptions .

Variables	MPAs necessary for environmental preservation		MPAs increase income		MPAs decrease income	
	Estimated coefficients	P-value	Estimated coefficients	P-value	Estimated coefficients	P-value
Constant	1.880 (0.173)	0.000 ***	1.666 (0.148)	0.000 ***	0.332 (0.126)	0.008 ***
HHSIZE	0.009 (0.018)	0.626	-0.003 (0.017)	0.850	-0.026 (0.016)	0.097 *
CHHEDUC	0.097 (0.041)	0.018 **	0.048 (0.036)	0.179	-0.055 (0.033)	0.097 *
PCTFINC	0.268 (0.124)	0.031 **	-0.089 (0.107)	0.405	0.298 (0.100)	0.003 ***
DSECINC	-0.098 (0.178)	0.582	0.050 (0.16 8)	0.766	-0.141 (0.158)	0.372
M	1.478 (0.109)	0.000 ***	1.399 (0.077)	0.000 ***	1.124 (0.052)	0.000 ***
LL0	536.535		685.735		888.229	
LLc	-530.917		-684.435		-881.200	

Note: Figures in parenthesis are standard errors; ***-significant at 1% level, **-significant at 5% level; *-significant at 10% level

7) Implications for policy and research

The results suggest that perceptions of marine resource conservation and MPAs are affected by resource dependency level, indexed here by fish income ratio, and to some extent by education, household size and the presence of secondary sources of income. Thus, the implications for policy are the following: (1) identifying the fishers who are displaced by the MPA's establishment and prioritizing them in the alternative livelihood plans might improve support for the MPA and other conservation efforts; (2) ensuring that the population of young dependents (0-15 yrs old) on the island (around 40%) will receive higher education, and possibly directing awareness campaigns to this section of the population; (3) considering measures to support improvements in the non-fishing and non-farm economy surrounding the island to increase opportunities for residents to take on secondary jobs.

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