

Ensuring sustainability of community participation in locally-managed marine protected area in north-western Cagayan, Philippines

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Article information

Received: April 17, 2022

Revised: July 1, 2022

Accepted: July 4, 2022

Keywords

Community participation,
Establishment of marine protected areas,
Livelihood projects,
MPA,
North-western Cagayan,
Probit model

Abstract

The establishment of marine protected areas (MPAs) by the local or national government is a popular conservation tool in the Philippines. Participation among community members is an important consideration for the success of its implementation. While remarkable community involvement is observed during planning and establishment of MPAs, sustaining this voluntary participation is a challenge in the implementation stage. To ensure sustainability of participation, this paper investigates the socio-economic conditions and factors that influence the participation of villagers using the probit model taking the case of a locally-managed MPA in north-western Cagayan, Philippines. The results of the study showed that participation is affected by socio-economic and demographic factors (income, age, gender, household size), fishing characteristics (gears and boat ownership), the presence of incentives (livelihood projects and *payao*), and the manifestation of leadership (village leaders). The findings of the study could be used to increase the tendency of a community to participate in MPA management by instituting policies geared towards sustaining their involvement.

1. Introduction

The Philippine's 18,000 km coastline provides various economic and social benefits; hence, it is not spared the problems facing any common resource property. Decline in catch rates and degradation of coastal habitats are the common consequences of unregulated fishing practices. The situation has become disturbing, especially as many of coastal dwellers highly depend on the natural resources for their livelihoods. One of the coastal resource management strategies being used to address this situation is the establishment of marine protected areas (MPAs). A typical MPA in the country is composed of a marine reserve with a fish sanctuary, or "no-take" zone. A marine reserve is an area where fishing and other activities are allowed, but regulations are set to control access, while a sanctuary is a zone where all extractive practices, such as fishing, shell collection, seaweed gleaning, and the collecting of anything else including human access is prohibited (DENR

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et al., 2001). The Philippine MPA Database has at present 1,800 MPAs recorded, most of them locally-managed (Cabral et al., 2014). MPAs in the country are classified as either locally-managed or nationally-managed. Locally-managed MPAs are relatively small, managed by people's organizations and supported by local government units as part of their mandate under the Fisheries Code of the Philippines (Republic Act 8550, as amended by Republic Act 10654), while nationally-managed MPAs are part of the protected area system established under the National Integrated Protected Areas System Act (Republic Act 7586), managed by the national government, with multi-sectoral management boards through the Department of Environment and Natural Resources (Conservation International Philippines, 2013).

Similar to any other coastal municipalities in the country, the municipality of Claveria in the province of Cagayan is not free from anthropogenic activities that progressively degrade its coastal and marine resources. In order to prevent the further deterioration of the resources, the Local Government of Claveria enacted an ordinance in 2000 which provides for the development, conservation, regulation, and management of the coastal fisheries and aquatic resources within the jurisdiction of the municipality through Resolution No. 104, S-2000. The ordinance included the establishment of MPAs to include marine reserves and sanctuaries (Municipality of Claveria, 2000). However, it was only in 2011 when the MPA was formally established, bearing the name Taggat Norte MPA.

One of the factors identified for the successful implementation of an MPA as a coastal management tool is the cooperation and involvement of the local stakeholders or community participation (White et al., 2002; Pollnac et al., 2001). The realization of an MPA as a conservation tool improves when the local community participate (Pollnac et al., 2001), as engagement of local residents leads to a sense of trust, collaboration, and ownership, thereby contributing to successful MPA implementation (Christie & White, 1997).

In 2008, while the Taggat Norte MPA was being legislated but was not yet fully functional, Launio et al. (2010) conducted a study to understand the socio-economic status and livelihood of the fishing stakeholders, as well as to examine their attitudes to and perceptions of marine resource values and conservation. Despite being non-operational at that time, the results of the study confirmed that the fishers in the area recognized the non-market values of the resources and agreed to the need for an MPA. To evaluate the management effectiveness of Taggat Norte MPA, an MPA assessment using the Management Effectiveness Assessment Tool was conducted in 2013 which showed that community participation during the MPA establishment process was highly noted, as shown in **Figure 1** (MPA Support Network, 2014). Community participation in this assessment was measured as the engagement of the local residents in the MPA establishment process through consultations and public hearings (Conservation International Philippines, 2013).

Despite the fact that studies were conducted to observe the community participation during the planning and establishment phase, it is indispensable to examine their attitudes during the implementation phase. Attitudes of the community towards the MPA need to be understood and followed as they shift over time (Pomeroy et al., 2007). For the sustainability of the MPA, the following activities, based on their management plan, were undertaken by the community members in a voluntary manner: (1) to oversee the security of the MPA from illegal activities and the enforcement of laws; (2) to conduct monitoring and assessment of the coastal and marine resources inside and outside the MPA; (3) to assist in fund sourcing for the sustainable management of the MPA; and (4) to organize an information drive in the community about MPA concepts and guidelines. This study, therefore, evaluates the socio-economic conditions of the villagers and analyzes factors that influence their voluntary participation in a locally-managed MPA, taking the case of Taggat MPA in Claveria, Cagayan. The findings of this study could provide significant information to resource managers for the effective implementation of MPA programs by encouraging the participation of communities on a long-term basis.

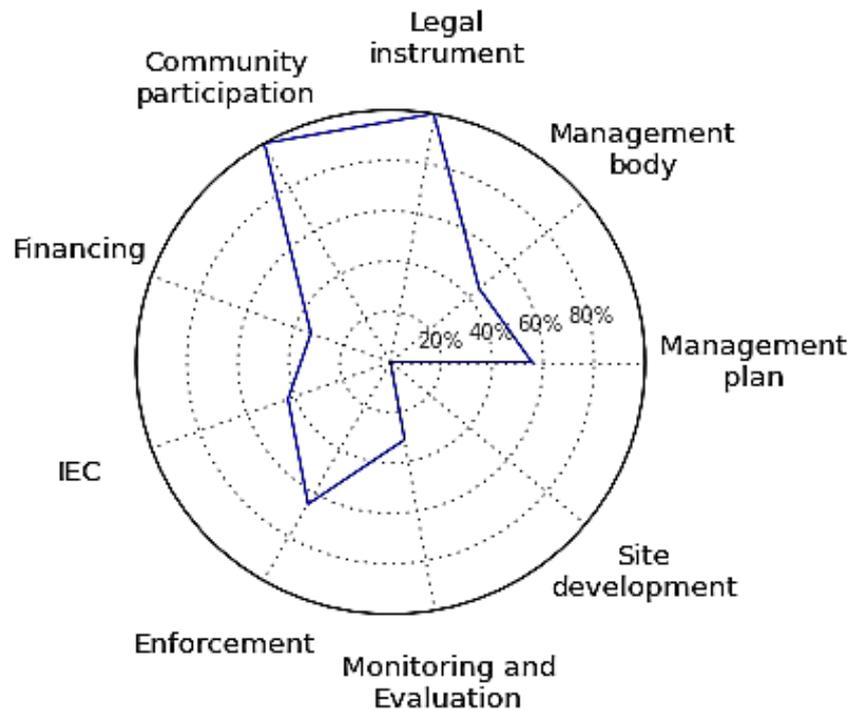


Figure 1 Radar diagram showing the MPA-Management Effectiveness Assessment Tool assessment of Taggat Norte MPA.

Source: MPA Support Network (2014).

Philippine MPA Database: <http://www.mpa.msi.upd.edu.ph> (Retrieved 10 June 2016).

2. Materials and methods

Claveria is a coastal municipality which lies at the north-western part of the province of Cagayan in the Philippines. It is bounded on the north by the Babuyan Channel, on the east by the municipality of Sanchez Mira, on the west by the municipality of Sta. Praxedes, and on the south by the province of Apayao. It is politically subdivided into 41 villages, of which 12 are along the coastal areas. It has a total land area of 19,400 ha, of which 46.6 % is used for agricultural purposes, 32.38 % is for residential areas, 0.5 % is classified as commercial zones, and 19.45 % is classified as forest lands. Furthermore, the municipality has approximately 98 ha of rivers and creeks and 13.16 km of coastlines (Municipality of Claveria, 2009). With the vast agricultural land, and rich marine and coastal resources, most residents depend on farming and fishing for their livelihoods.

To safeguard the sustainable production of fish and other aquatic resources, and after several developmental processes, the municipality established the Taggat Norte MPA (**Figure 2**) in 2011 through Municipal Ordinance No. 04, designating different management zones with identified usage and regulations. The MPA covers an estimated area of 891.8 ha, with a no-take zone of 21.6 ha. The Taggat Norte Fisherfolk Association, a registered people's organization, is authorized to oversee the operations and management of the MPA in coordination with the Local Government of Claveria, Taggat Norte Village Council, and the Municipal Fisheries and Aquatic Resources Management Council.

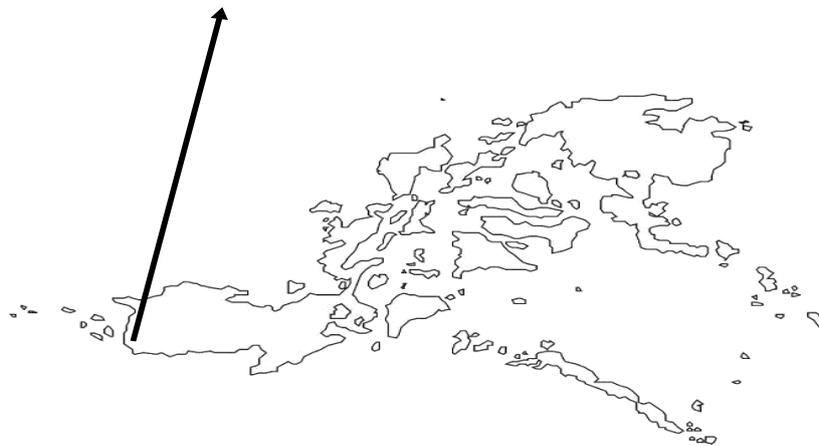
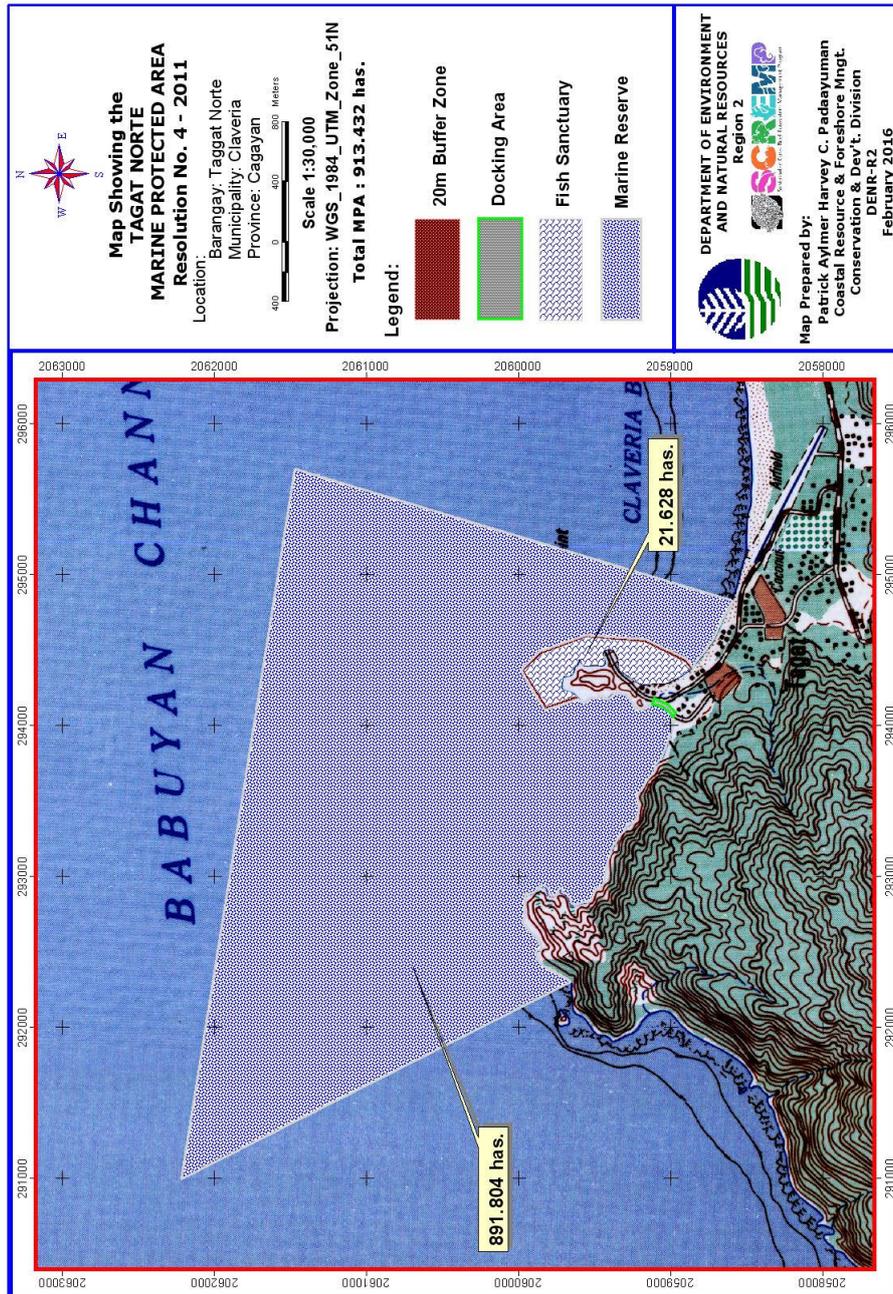


Figure 2 Map showing location of the Taggat Norte Marine Protected Area in Claveria, Cagayan, Philippines (source: DENR Region 2).

To collect data, structured interviews were conducted with 180 respondents, who were randomly selected through methodical sampling from 363 registered households from the List of Household Heads in the village. The questionnaire was designed to solicit information on households' demographic structures, income sources, fishing profiles, support, knowledge and awareness of MPA, and participation in MPA management activities. Trained enumerators who were familiar with the local dialect (*Ilocano*) assisted in the conduct of face-to-face individual interviews. In addition, key informant interviews were conducted to supplement and confirm the information gathered. The key informants were composed of village officials, officers of fisherfolk associations, *bantay dagat* (sea guards), and technical staff from the Municipal Agriculture Office, the Provincial Agriculture Office, and the Bureau of Fisheries and Aquatic Resources Region 2.

To determine the relationship between selected predictors (socio-economic, demographic, and fishing profile) and the participation of respondents in MPA management, the probit model was used, since the dependent variable takes only binary values; 1 if the respondent participates in MPA management, and 0 if otherwise.

Following Wooldridge (2006), the probit model was derived from an underlying latent variable model:

$$y^* = \beta_0 + x\beta + u$$

where y^* is the unobserved, but what we do observe is,

$$y = 0 \text{ if } y^* \leq 0, \\ = 1 \text{ if } y^* > 0$$

where β is the observable component which is a function of measurable factors and u are certain unobservable factors. Assuming that u is normally distributed across observations, we normalize the mean and variance of u to 0 and 1, and we can calculate the response probabilities for y^* is less than or equal to y from the standard normal cumulative distribution function. For the individual regression coefficients, the sign conditions were used for interpretation. A positive coefficient means that an increase in the predictor leads to an increase in the predicted probability, while a negative coefficient means that an increase in the predictor leads to a decrease in the predicted probability.

For this study, the observable component of the model is specified in the form:

$$\text{Participation} = f(\text{hinc_tot}, \text{age}, \text{dsex}, \text{deduc}, \text{hhsiz}, \text{dbrgof}, \text{dbt_own}, \text{dfg_own}, \text{dLP}, \text{dfis_payao})$$

where the dependent variable is the involvement of respondents in MPA management in binary values. Independent variables consist of hypothesized predictors that may influence participation of respondents toward coastal resource management, particularly in the MPA, which are presumed to be theoretically and exploratory important, specifically: *hinc_tot* is the log function of the total household income; *age* is a numerical representation of the age of respondents; *dsex* is a dummy variable that takes a value of 1 if respondent is male and 0 if female; *deduc* is a dummy variable on respondent's level of educational attainment that takes a value of 1 if respondents reached at least high school and 0 if an elementary graduate or below; *hhsiz* is the numerical value of number of household members; *dbrgof* is a dummy variable that takes a value of 1 if the respondent is a village official and 0 if not; *dbt_own* is a dummy variable that takes a value of 1 if the respondent owns a boat and 0 if they do not own a boat; *dfg_own* is a dummy variable that takes a value of 1 if the respondent owns fishing gear and 0 if they do not own fishing gear; *dLP* is a dummy variable which takes a value of 1 if the respondent benefits from livelihood project intervention of the LGU and other external agents and 0 if not; and *dfis_payao* is a dummy variable which takes a value of 1 if the respondent is fishing in the *payao* area and 0 if not. *Payao* is a fish aggregating device used to attract fish in order to congregate, which was installed by BFAR to at least mitigate the negative impact of the MPA on the livelihood of the fishing community. The probit model was estimated using the statistical software R.

3. Results

Socio-demographic profile

Respondents are predominantly male (82.78 %), with an average age of 46 years old. Average household size is between 3 - 4. Most of the respondents are literate, having obtained high school level or higher (73.84 %). Almost half (47.78 %) of the respondents were immigrants who transferred to the village with their parents who worked in the now-defunct Taggat Industries, a logging company which operated in the village from the early 1950s until the late 1980s. The average number of years of residency in the village is 34 years.

Income distribution, source, and structure

Households in the village depend on several income sources (**Table 1**) but fishing and other fishing-related activities (45.90 %) served as the major source. Rural non-fishing or non-agriculture income comes from wages from regular employment, service (labor and tourism related-activities), transportation, and small enterprises. Households also receive income from the domestic and international remittances of family members and from monthly pensions of retired family members. Agricultural activities, such as part-time farming and livestock raising, contribute 3.59 % to the total household income.

The average total annual household income of the respondents is Php 98,795 (1 US\$ = Php 46.84 in September 2015). Results revealed that the villagers earn 57.96 % less than the national average (Php 235,000) and 49.33 % less than the regional cohort (Php 195,000) (FIES, 2012). The income distribution (**Figure 3**) shows convergence in the lower income bracket, as 60 % of the respondents have income lower than the average. The minimum household income is Php 9,600 while the maximum is Php 520,000. This translates to wide income inequality, with a Gini coefficient of 0.3979, but which still slightly better than the country (0.4605) and regional (Cagayan Valley) (0.4096) levels of income inequality (FIES, 2012).

Table 1 Income composition of respondents.

Variables	Value
Annual total household income (Php) ^a	98,795 (± 82,725)
Annual per capita income (Php) ^a	29,580 (± 25,840)
Share of income by source (% from the total household income)	
Fishing	40.84
Other fishing-related activities	5.06
Agricultural	3.59
Rural non-fishing/non-agriculture	36.49
Migrant workers (domestic and abroad)	9.63
Other receipts share	4.39

^aExchange rate as of September 2015 (1 US\$ = Php 46.84); values in parenthesis are standard deviations.

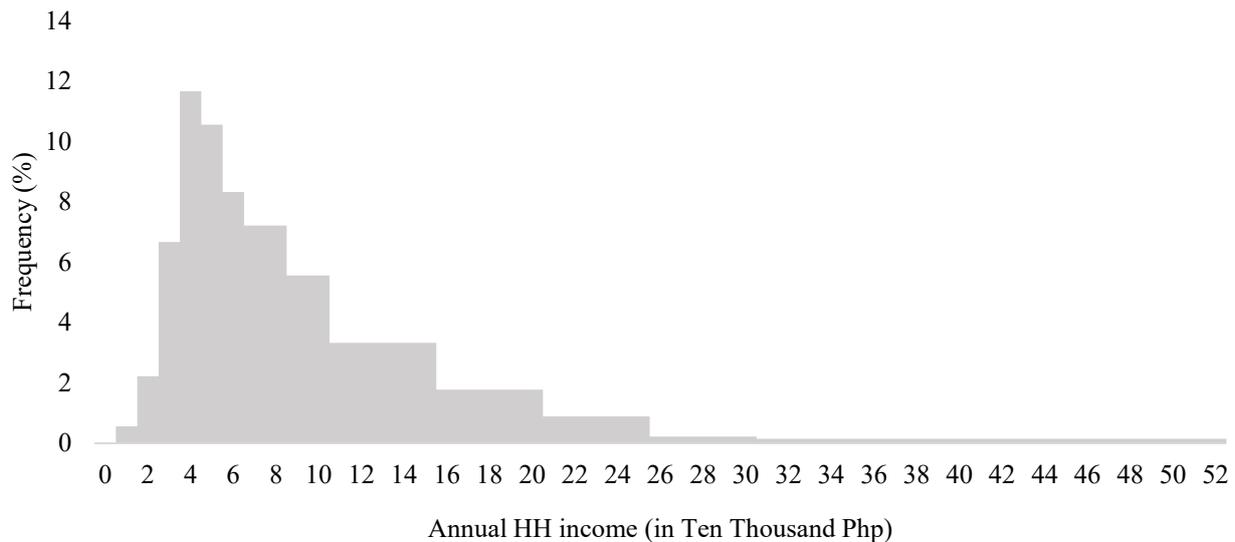


Figure 3 Income distribution of respondents.

Fishing profile and activities

Sixty five percent (65 %) of the respondents are fishers, and, out of them, only 67.52 % fished on a full-time basis, while the rest are part-time fishers who engage other jobs to supplement their income. Only one-third (33.33 %) of these fishers' own fishing boats, and 47.86 % possess fishing gear. The boats used are either motorized (76.92 %) or non-motorized (23.08 %). Most of the motorized boats are equipped with 16 hp gasoline or diesel powered engines, while non-motorized boats use paddles as a means of propulsion. Fishers who do not own boats and/or gear usually join boat owners, as a single craft usually has three to four crew members fishing together. Income from fishing is then divided among them, with an accounted share for the boat and/or gear. Average annual household income from fishing is Php 58,000.

Fishing activity in the municipality is multi-species and multi-gear. Major species caught, based on the accounts of the respondents, include dolphin fish, big-eye scad, trevally, anchovies, tuna (long tail/ skipjack), mackerel, squid, big eye scad, and hairtail. Common fishing gear used by the respondents include gill nets, hooks and lines, squid jigs, bottom-set longlines, and spear guns, depending on the season. Aside from the municipal waters (up to 15 km from the shoreline), the major fishing ground in the area is the Babuyan Channel.

Support of and participation of respondents for MPA management

Ninety three percent (93 %) of the respondents showed awareness on the presence of the MPA, with 76.67 % of the respondents claiming to support the establishment of the MPA. They believe that the MPA is beneficial in the preservation and protection of marine resources, which they claim result in an increase in catch and income. A portion of respondents (14.44 %) also show disagreement with the presence of the MPA, claiming that it lessens their fishing ground as it is beneficial to selected fishers only, while 8.89 % remained undecided, because they are not sure of the benefits of the MPA. Despite the high percentage of support for the establishment of the MPA, only 20 % of the respondents participate in its management by performing one or more of the management activities voluntarily. **Table 2** demonstrates the participation of respondents in specific management activities.

Table 2 Participation of respondents in MPA management activities.

Management roles	Specific activities	% of respondents who participate in the activity*
Law enforcement	Guarding, surveillance, and patrolling to oversee the security of the MPA from illegal activities and for the enforcement of pertinent laws	12.78
Core monitoring	Monitoring and assessment of the coastal and marine resources inside and outside the MPA and spearheading the implementation of conservation activities, such as species enhancement and sea ranching	7.78
Income generation	Formulation of mechanisms for funding support for MPA implementation (e.g., user fee)	5.57
Information education campaign	Conducting information drive in the community on MPA concepts, guidelines and update	6.11

*only 20 % of the total respondents participate in MPA management; respondents can participate in 1 or more activities.

To decrease the probable effect of less fishing ground due to the establishment of the MPA, the local government, in collaboration with BFAR, provided the community with one set *payao*. The presence of *payao* in the municipal waters was a welcome development for the fishers, as the cost of fuel for fishing was lessened because they do not need go to indefinite areas to have a good catch. In addition, other livelihood projects, such as aquaculture and goat production, were also provided to the community. Reef discovery enterprise, an ecotourism activity, was also developed in the area. Villagers who take part in any of these projects invest time in the operation and management of it. Financial gains from these projects are not yet conclusive at this time, because it is still at the initial stage; nevertheless, household participants expect much from these interventions.

Factors influencing participation of respondents in MPA management

Table 3 shows the estimated coefficients for the probit analysis on the determinants of participation by respondents in MPA management. The sign conditions (positive or negative) of the coefficients interpret the probability of respondents in participating in MPA management. The model shows significant positive coefficients on all variables: income, age, gender, household size, village leader, fishing gear owner, recipients of livelihood projects, and fishing in the *payao* area. This means that respondents with higher incomes tend to participate in MPA management. The results also reveal that male respondents, older and with a higher number of people in their household, are more likely to participate in MPA management. Village leaders, as well as recipients of livelihood projects, also show high probability to be involved in MPA activities. Fishing gear owners also tend to participate in MPA management. Further, the results show significant negative

sign conditions for the variable of fishing boat owner. This implies that boat owners are less likely to participate in MPA management. A possible explanation is that, over many times, boat owners (mostly of motorized boats) fish in farther fishing grounds and spend more than several days in the area; hence, they do not have time to participate in MPA activities. With this fishing activity, boat owners have no chance to observe the spill-over effect of the MPA. The results also show little evidence that education is a significant determining factor for participation in MPA management. This suggests that education has no direct influence on respondents participating in MPA activities.

Table 3 Probit estimates on the determinants of participation by respondents in MPA management.

Variable	Estimates
Intercept	-12.4487*** (-3.899)
Total household income (log function)	0.60407** (2.442)
Age	0.0214* (1.867)
Gender	1.639* (1.872)
Educational attainment	0.4118 (1.144)
Household size	0.3165*** (2.985)
Village leader	2.386*** (3.179)
Fishing boat owner	-1.204** (-2.389)
Fishing gear owner	1.015** (2.287)
Recipients of livelihood project	1.1075*** (2.837)
Fishing in <i>payao</i> area	0.8286** (2.217)
Nos. of observations	180
Loglikelihood	-48.5627
McFadden's R Square	0.4608
AIC	119.13

***Statistically significant at 1 % level or better; **at 5 % or better, * at 10 % level or better.
 Value in parenthesis is z-value

4. Discussion

Local level participation in project developments, such as coastal resource management, has been recognized as an important factor in promoting change (Pomeroy et al., 1997). The involvement of the community in the management of MPAs is essential, because of their traditional knowledge and because they are the direct users of the resources (Fernandez & Subade, 2015). With clear comprehension of the factors that influence the participation of villagers in MPA management, resource managers can direct policies and mechanisms towards enhancing the long-lasting involvement of a community towards MPA management.

Dependency on marine resources with a low level of income and a high degree of inequality characterized the study site. Despite these circumstances, high favorable approval towards the establishment of the MPA was observed, as fishers believed in the central goal of the MPA, which is to protect their means of livelihood. Noting that level of income is a significant determinant of participation in the implementation of MPA activities, strategies to increase the income of the community needs to be given priority, as this ensures a higher probability of participation for the sustainability of MPA. Enhancing fishing practices without depleting the resources or the ease of access to non-fishery income sources can be considered as socio-political intercessions. Cinner and Pollnac (2004) found that higher income respondents are more likely to support resource management programs, invoking Maslow's theory of hierarchy of needs as a possible justification.

This was also confirmed in the studies made by Fernandez and Subade (2015) and in Launio et al. (2010), where fishers with higher income showed better perceptions toward MPAs.

MPAs alter the fishing behavior of the community due to the establishment of no-take zones and the implementation of restricted fishing practices. Arrangements are needed to be put in place to address the increased occupational risks to the fishers due to shifts in fishing grounds and travel time as result of the MPA (Pomeroy et al., 2007). The presence of *payao* in the initial stage of MPA implementation drew attention from the community, particularly the fishers, to support the resource management program. The provision of benefits that address the negative impact of the MPA results in an affirmative impression with resource users, specifically small-scale fishers. Although fishers travel a little farther, due to the shift in fishing grounds, the presence of *payao* decreases their hunting time, as fishes congregate within the device. The provision of alternative livelihood projects that provide additional and diversified income can encourage villagers to support MPA management, but careful deliberation should be done, as fishers prefer to work more in the sea through their fishing activities under the sustainable use of the marine and coastal resources (Ballad et al., 2017). Approaches to ensure the feasibility and economic impact of these projects need to be considered to ensure they can cover the burden of conservation through MPAs.

Spontaneous observation of the benefits of MPAs boost the intention of villagers to participate in MPA management. Russ et al. (2003) mentioned that local fishers around an MPA usually associate the improvements in their catch to the management tool. Hamilton (2012) added that fishing close to an MPA causes fishers to notice the spillover effects better and to have positive perceptions towards the MPA.

The involvement of village officials in MPA management encourages other villagers to participate. This study confirms that community support is easier to obtain when village officials are involved in the project. The participation of village officials in MPA management also warrants the enactment of regulations for resource conservation at the village level. This supports an earlier study of Ballard et al. (2017), where involvement of village officials in the MPA developmental processes increases the tendency of village residents to participate in MPA management.

5. Conclusions

The establishment of an MPA is the first attempt in this conservation measure strategy; however, sustaining its management and operation is one of the challenges faced by this approach. The support and involvement of the community contributes to the sustainability and success of an MPA, as revealed in this study. The socio-economic and demographic factors influence the participation of the community in MPA management. The tendency to participate in MPA management among villagers increases if: (1) they have higher income; (2) livelihood projects and/or incentives which defray the burden of the MPA are available; (3) impacts, such as spillover effects, can be observed, and (4) support from the village officials is realized. As most people in the coastal areas depend on fishing as a source of living, it is important that livelihood projects in place of the relocated fishing areas be considered. The introduction of institutional support policies and mechanisms taking into consideration the results of this study could contribute to the successful implementation of MPAs by ensuring and sustaining the participation of villagers.

Acknowledgements

The authors gratefully acknowledge the key informants, enumerators, respondents, the Local Government Unit of Claveria, Cagayan, and BFAR-Region 02 for their support, cooperation, and invaluable assistance in the conduct of the study. The assistance of DENR Region 2 in the provision of the MPA map, as well as the comments and suggestions of anonymous reviewers, are also recognized. This research is supported by JSPS KAKENHI Grant No. 26281062.

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