

Success and Failure of Marine Protected Area Management Affecting the Fish Catch by Adjacent Fishermen in Sarangani Bay, Mindanao, Philippines

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Abstract

Marine protected areas (MPAs) are widely advocated as one of the most important tools for conservation and fishery management. Four MPAs were studied: Glan Padidu, Kapatan, Kamanga and Tuka. The status of these MPAs was assessed based on MPA management, ecological health of the coral reef and the productivity of fishermen. Status of MPA management was determined by interviews with the MPA managers and actual validation of the information through actual visit of the areas. Interviews with the fishermen living adjacent to the MPAs were conducted to determine their productivity before and after the MPA establishment based on the catch per unit effort (CPUE). The CPUE of the fishermen increased after five years of well managed MPAs. However, failure in MPA management in two MPAs, followed by the cessation of protection of the areas in 2009, has decreased the CPUE. On the other hand the non-involvement of the local fisher folks in management of Kamanga MPA created some misunderstanding and unfavorable perception of the fishermen. For them this MPA did not help increase their CPUE as they are allegedly prohibited to fish around the protected areas. Tuka MPA which is relatively well managed among the three MPAs shows an increase in the CPUE of the fishermen.

Keywords: coral reef, marine resources, MPA

Introduction

Background of the study

The intensity of human pressure on marine systems has led to a push for stronger marine conservation efforts. Recently, marine reserves have become one highly

advocated form of marine conservation. Reserves will be essential for conservation efforts because they can provide unique protection for critical areas, provide a spatial escape for intensely exploited species, and potentially act as buffers against some management miscalculations and unforeseen or unusual conditions (ALLISON *et al.* 1998). The number of marine reserves or marine protected areas (MPAs) established and/or planned worldwide has grown dramatically in recent years (GUIDETTI 2006). The Philippines, which was the site of some of the earliest marine reserves, has followed this pattern with a current estimate of more than 300 MPAs, most with some no-take component. These have been legally established since the humble beginning of marine conservation and fishery management efforts starting in 1970 in Sumilon and Apo Islands in the central Philippines (ALCALA and RUSS 2006) and constitute the country's primary tool for coastal resource management (HIND *et al.* 2010).

In addition, MPAs have been claimed and are widely advocated as one of the most important tools for the protection and management of coastal, marine and fishery resources (POLLNAC *et al.* 2001, PIETRI *et al.* 2009, HIND *et al.* 2010) including coral reef management (ROBERTS and POLUNIN 1991, ALLISON *et al.* 1998, BOHNSACK 1998). Marine reserves, as defined by ALCALA (2001) are areas of marine environment protected from various forms of human or extractive exploitation. Activities like fishing or the collection of any organism in the area are completely banned. The marine areas outside the MPAs are referred to as non-reserves or fished areas, where fishers are allowed to fish using traditional, non-destructive fishing gear that is species-selective.

As an effective tool for the protection and management of coastal, marine and fishery resources, marine reserves and marine parks had been established for the protection of fish and other marine organisms, increasing fishery yields and reducing conflicts between groups of fishery stakeholders (ALCALA 2001). The potential use of marine reserves in the management of coral reef fisheries, for example, includes the protection of a critical stock biomass to ensure recruitment supply via larval dispersal to areas that are fished and to maintain enhanced fish yields to areas adjacent to reserves through the movement of adult fish (RUSS and ALCALA 1996). By restricting fishing access to one particular area, the goal is to allow fish to reproduce and thrive peacefully. The "spill over" effect of the fish population born within the protected area into the water surrounding the MPA is expected to occur, increasing the number of fish available for fishers to catch (RUSS and ALCALA 2004).

MPA establishment is one of the common strategic interventions in coastal resource management (CRM) in the Philippines with a huge range of potential functions. However, they may also have limitations as to how much they can actually satisfy specific management objectives. Fishery resources are very important in developing countries like the Philippines where large numbers of coastal people are dependent on them both for their income and as their main protein source. BEGER *et al.* (2005) stated that many coastal communities rely on the sea for income and food, commonly at subsistence level, and, therefore, declining resources combined with population growth lead to increased poverty. The resulting urgent need for resource

management has been recognized by many institutions and local communities that have initiated marine resource management projects.

The Philippines lies close to the center of tropical marine biodiversity and is home to some of the most complex and diverse ecosystems known (DEVANTIER *et al.* 2004). This biodiversity and associated rich ecosystems are natural renewable resources that also support millions of people. Despite the productivity and richness of the natural resources of the Philippines, they are under substantial pressure from a rapidly growing human population (2.4% per annum growth rate) and widespread poverty (WHITE *et al.* 2002). Thus, the productive marine habitats of the country are being degraded, and poses a threat to the food security of the people.

Laws governing the protection of wildlife species and their habitats in the Philippines have been formulated and the most important one is the Republic Act 7586, otherwise known as the National Integrated Protected Areas System (NIPAS) Act which was enacted in June 1992. This law provides for the establishment and management of protected areas in the Philippines. The Act serves as the legal basis for the “In Situ” conservation of biological diversity through the appropriate management of ecologically important areas for conservation and sustainable development.

The coastal region of Sarangani Province and General Santos City has seen rapid changes in recent years through industrial, urban and infrastructure growth. Meanwhile, the coastal region is home to a high proportion of the human population of Sarangani Province and General Santos City, many of whom are dependent on fishing. The coastal area provides invaluable benefits reaching millions of pesos annually from activities such as fishing, aquaculture, tourism and coastal transport of produce (DE JESUS *et al.* 2001). There is already serious concern that the environmental degradation of coral reefs and mangroves has seriously destroyed fish habitats and reduced near-shore fish stocks.

Sarangani Bay lies within the area of Sarangani Province with General Santos City on its northern side. It was declared as a protected seascape by virtue of the NIPAS Presidential Proclamation No. 756 dated 05 March 1996. The protected area falls under the general administration of the Department of Environment and Natural Resources and the management delegated to multi-sectoral groups, academe, non-government organizations (NGOs) and peoples organizations (POs), as stipulated in the above-mentioned Republic Act No. 7586, or the NIPAS Act of 1992.

At present, there are eight established MPAs within Sarangani Bay based on the record of the Regional Office 12 of the Department of Environment and Natural Resources. There are stories of success and failure in the MPA management of these protected areas, however there is no study conducted to verify the effect of the MPA establishment on the productivity of the fishermen living adjacent to these protected areas. Therefore, a socio-economic assessment of the status of the MPAs is necessary to find out the level of its implementation and its benefits to the fisher folks dependent on marine resources for their survival.

Objectives of the study

This study evaluates the present status of the marine protected areas in Sarangani Bay, Mindanao, Philippines in terms of the dynamics of MPA management, coral reef based on coral cover and diversity and productivity based on the catch per unit effort (CPUE).

Specifically, this study assesses the present status and condition of four MPAs of Sarangani Bay, Mindanao, Philippines in terms of compliance to basic features of a functioning MPA and the perception of the local people in establishing such MPAs in their area. It also determines the productivity of fishermen working near the MPAs in terms of CPUE.

Methodology

Study site

This study was conducted in Sarangani Bay, southeastern Mindanao, Philippines located at $5^{\circ} 33' 25'' - 6^{\circ} 6' 15''$ N and $124^{\circ} 22' 45'' - 125^{\circ} 19' 45''$ E beginning from the second week of November until the end of December 2010 in four different marine protected areas (MPAs). The province has a coastline of 226.4 km including a portion that belonged to the area of General Santos City (DE JESUS *et al.* 2001). Figure 1 shows the map of the study sites. The four MPAs belonged to three coastal municipalities under the province of Sarangani as follows:

- 1) Glan Padidu Marine Sanctuary, Glan, Sarangani Province;
- 2) Kapatan Marine Reserve, Glan, Sarangani Province;
- 3) Kamanga Marine Ecotourism Park and Sanctuary, Maasim, Sarangani Province;
- 4) Tuka Marine Park, Kiamba, Sarangani Province.

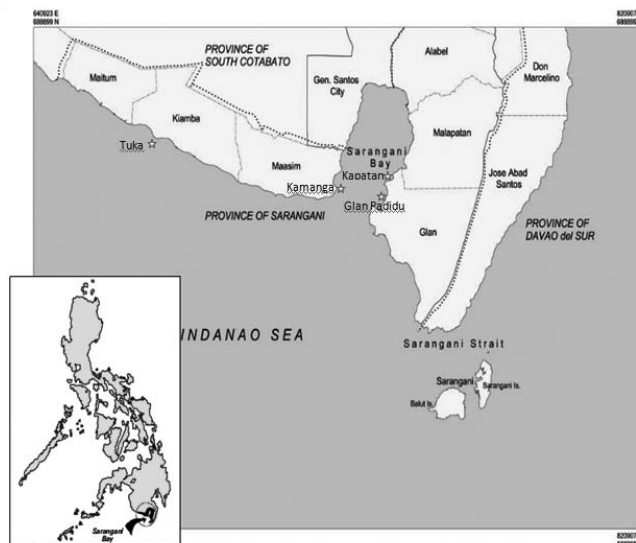


Fig. 1. Map of Sarangani Bay showing the study sites.

Glan Padidu Marine Sanctuary was established on December 05, 2000 by virtue of Glan Municipal Ordinance Number 2000-04. It is located on the east side of Sarangani Bay with an area of ten hectares that belonged to the area of Barangay Glan Padidu in the municipality of Glan, Sarangani Province. This MPA was managed by Muslim-Christian Fisherfolks Multi-Purpose Cooperative in coordination with the Barangay Council of Glan Padidu.

Kapatan Marine Reserve was also established on 05 Dec. 2000 by virtue of Glan Municipal Ordinance Number 2000-04 in the same time Glan Padidu MPA was established. It is located in the east side of Sarangani Bay but it is about eight kilometers north of Glan Padidu MPA. It has an area of 12 hectares in barangay Kapatan in the municipality of Glan, Sarangani Province. Kapatan MPA was managed by the Cabug Fishermen and Farmers Cooperative (CAFIFAMCO) in coordination with the barangay council of Kapatan.

Kamanga Marine Ecotourism Park and Sanctuary was established on 04 May 2006 by virtue of Maasim municipal ordinance No. 06-020. It has an area of 140.49 hectares located in the west side of Sarangani Bay, in the municipality of Maasim, Sarangani Province. It is managed by local government and the local people with the participation of a private resort situated just about 200 meters away from the protected area.

Tuka MPA on the other hand, Tuka Marine Park, has an area of 53.31 hectares located in Barangay Tuka, Municipality of Kiamba, Sarangani Province. It was established on 16 Jan. 2001 by virtue of Sangguniang Bayan Resolution No. 01-007. It is located in the west side of Sarangani bay 40 kilometers away from Kamanga MPA.

The three municipalities of Glan, Maasim and Kiamba where the MPAs in this study belonged have the longest coastlines among the six coastal municipalities in Sarangani Province and General Santos City (Fig. 2).

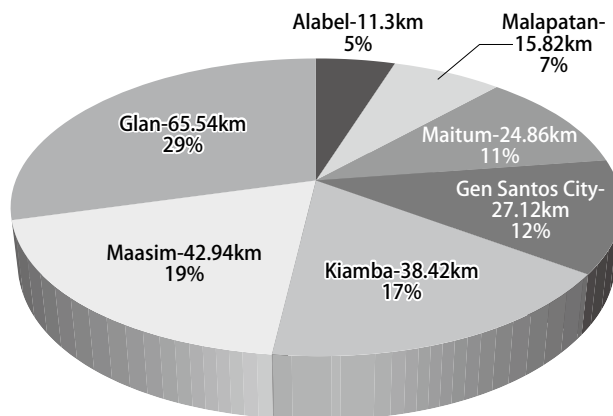


Fig. 2. Percent of coastline per coastal municipalities/city compared to that of the area profile.

Fishermen in all MPAs were using the “hook and line” as their fishing gear. This is the allowed non-destructive fishing gear for small scale fishermen fishing around the MPA area and commercial fishing is completely banned.

All MPAs are abundant in commercially important fish species which are target for fishermen. Based on the fish census conducted by Sarangani Environmental Conservation and Protection Center in 2009, Glan Padidu and Kapatan MPA which are both located in the same municipality have the following commercially-important species: Acanthuridae (17 species), Lutjanidae (10 species) and Scaridae (10 species). The major target species in Kamanga MPA are Acanthuridae (17 species), Labridae (11 species) and Holocentridae (7 species). Tuka MPA on the other hand has Acanthuridae (16 species), Mullidae (10 species) and Balistidae (8 species).

Assessment of MPA management

Documents related to the legal basis in the establishment of the MPA were gathered from different municipalities where the MPA is under its jurisdiction. Permission from the municipal mayors was first obtained before proceeding to the specific office concerned on MPA management. Structured interviews were conducted with the persons in charge of the four MPAs. The questionnaire contained questions to determine the presence of the following items: the legal basis for establishment of the MPA (local government ordinance); presence of MPA management plan; a budget from the local government to support the MPA; and information, education and communication conducted in the local community regarding MPA matters. The presence of violations such as fishing inside the protected area and/or fishing around the protected area using destructive fishing gear was also determined. The same question on the presence of fishing violation was also asked during the interview of the fishermen to validate the information. Establishment and maintenance of the set of features inherent to a functioning marine protected area such as the presence of marker buoys, community signboards, monitoring program and a guard house were also determined during the interview and were validated through actual visits to the different protected areas. The questionnaire was first checked and validated by an expert in Hiroshima University. Perceptions of the local residents whether they are favorable or not in the establishment of an MPA in their respective area were gathered. Open ended questions were part of the questionnaire where respondents can say more and express more of their opinions. The interview was administered using the Cebuano dialect because the majority of the respondents are using the language and all respondents can understand and speak Cebuano.

Productivity of the fishermen

Interviews were conducted with the small scale fishermen living adjacent to the MPAs and who are fishing in the area before the establishment of the MPA, five years after the MPA was established, and up to the present. The questionnaire was checked and was validated by a juror in Hiroshima University. Questions were designed to

determine what fishing gear is used, how many hours a fisherman spent fishing in the sea, how many persons were fishing together in one boat and how many kilograms of fish were caught in one fishing activity. The productivity of fisherman is expressed in term of catch per unit effort (CPUE) which was determined by dividing the total fish catch in kilograms by the number of hours spent and the result is further divided by the number of persons fishing together using one boat. Thus, CPUE refers to the kilogram of fish caught per hour per person. Awareness of the fishermen regarding the importance of the MPA and their perception of the effect of MPA establishment were also determined.

Table 1 shows the number of respondents in every MPA. All local fishermen who are doing fishing activity around the MPA were interviewed. Since there is no data of the number of small scale fishermen available from the office of the barangay, the researcher did a house to house interview on the villages around the MPAs. Table 1 further shows that not all households were interviewed because some residents were not in their house during the interview time. Only small scale fishermen who were fishing around the MPA are interviewed.

Table 1. MPAs and the number of respective respondents.

MPA	Estimated number household near MPA	Number of valid respondents	
		Household	%
Glan Padidu MPA	44	33	75
Kapatan MPA	51	41	81
Kamanga MPA	36	28	78
Tuka MPA	53	36	68

Data

This study is descriptive. Frequency distribution and means were the main statistical calculations used. Data on the fish catch were analyzed in SPSS software using two-way ANOVA to determine the difference among MPA locations and different management periods. The result of ANOVA was further analyzed using Tukey's HSD test.

Results and Discussion

Assessment of MPA management

Glan Padidu MPA

Protection of Glan Padidu MPA was done soon after its establishment in the year 2000. This MPA was managed by Muslim-Christian Fisherfolks Multi-Purpose Cooperative (MCFMC) and Barangay Fisheries and Aquatic Resources Management Committee (BFARMC) in coordination with the Barangay council of Glan Padidu.

Protection of the area was successful at the start because there were volunteers doing the patrolling activity even during night time.

Approximately after five years of protection, there was already a noticeable increase in the fish population of the protected area as stated by the MPA manager which was confirmed by the local residents. However, in the year 2009 management failed and protection was not sustained (Table 2) because of some reasons mentioned by both the MPA management and the residents in the village adjacent to Glan Padidu MPA. According to the MPA manager in charge, the municipal government can allocate funds as honorarium of the “bantay dagat” or fish warden. However, this was not realized. As a result, protection was not sustained because there was a gradual withdrawal of fish wardens from their duty that eventually resulted in a gradual increase of violations such as fishing inside the protected area. One of the lessons learned in the study of RUSS and ALCALA (1996) is that surveillance is important, as intruders who violate the reserve can seriously damage the recovery process of fish populations.

Table 2. MPAs with respective dates of establishment and management status at the time this research was conducted.

MPA	Date established	Management status
Glan Padidu	05 Dec. 2000	MPA protection failed in 2009
Kapatan	05 Dec. 2000	MPA protection failed in 2009
Kamanga	04 May 2006	Continues to date
Tuka	16 Jan. 2001	Continues to date

Respondents said that since wardens were not compensated, they were discretely catching fish while doing patrols in the protected area to at least compensate their efforts. During the ocular observation, only a sign board and guard house remained and the MPA is no longer protected hence, open to fishing activities.

Non-compliance with marine protected area regulations is a problem worldwide, and this is being addressed through community programs (MCLANAHAN *et al.* 2005). Community-based coastal resource management has been widely applied within the Philippines. However, small-scale community-based reserves are often inefficient owing to management inadequacies arising because of a lack of local support, enforcement or poor design (BEGER *et al.* 2005). It was also stated by RIVERA and NEWKIRK (1997) and ALCALA (1998) that many projects related to the establishment of an MPA such as resource assessment and scientific monitoring, community preparation and organizing, capacity building, provision of alternative livelihoods, and conservation education were not sustainable when external intervention and funding ceases. This indicates the importance of the acceptance of MPA establishment by the locals and support from the local government in MPA establishment. This is true in Glan Padidu MPA where there is no financial support from the local government. MPAs have been

created as a favored conservation strategy. However, in many countries, insufficient government funds for enforcement and management of MPAs and poor support from local communities have limited the effectiveness of many reserves (ALCALA 1998, WHITE *et al.* 2002, MORA *et al.* 2006, SAMOILYS *et al.* 2007).

Table 3 shows that Glan Padidu MPA has only complied two out of seven items or features inherent to a functioning MPA such as the presence of guard house and signboards. However, five features such as marker buoys, monitoring program, budget from the municipal government allocated for maintenance of MPA structure and to carry out activities related to protection and management of said MPA were absent. There was also no management plan.

The results of the interviews reveal that 79% of the respondents of Glan Padidu MPA were in favor of the establishment of an MPA in their area, 15% were not in favor and 9% were neutral which means that they were not affected by the establishment of an MPA (Fig. 3). Most people were in favor because they enjoyed the benefits of increasing their fish catch while the MPA was still protected. They did not need to go to far away areas because they can do it productively around the MPA adjacent to their residence, thus saving time, effort and money by cutting down fuel consumption. On the other hand, 15% of the respondents were not in favor of the MPA as they perceived it as a cause of reducing their fishing area and banning other income-generating activities like collecting sea shells, or collecting “bangus” (milk fish) fries. They added that violations were also done by the fish wardens themselves because they had the access to directly roam around the protected area. Six percent (6%) or 2 out of 33 respondents had a neutral view of the MPA. They said that the existence of MPA did not provide any benefits for them.

Table 3. Establishment and maintenance of the features inherent to a functioning marine protected area.

Features	Glan Padidu	Kapatan	Kamanga	Tuka
1.MPA management plan	X	X	X	On going
2.Budget/support from local government	X	X	X	✓
3.Information, education and communication	Not sustained	Not sustained	✓	✓
4.Marker bouys	X	X	(2 anchor bouys present)	Replacement is on going
5.Community signboards	✓	✓	✓	✓
6.Guard house	✓	X	X	X
7.Surveillance	X	X	✓	✓
8.Monitoring programs	X	X	X	X
Compliance	2	1	3	4

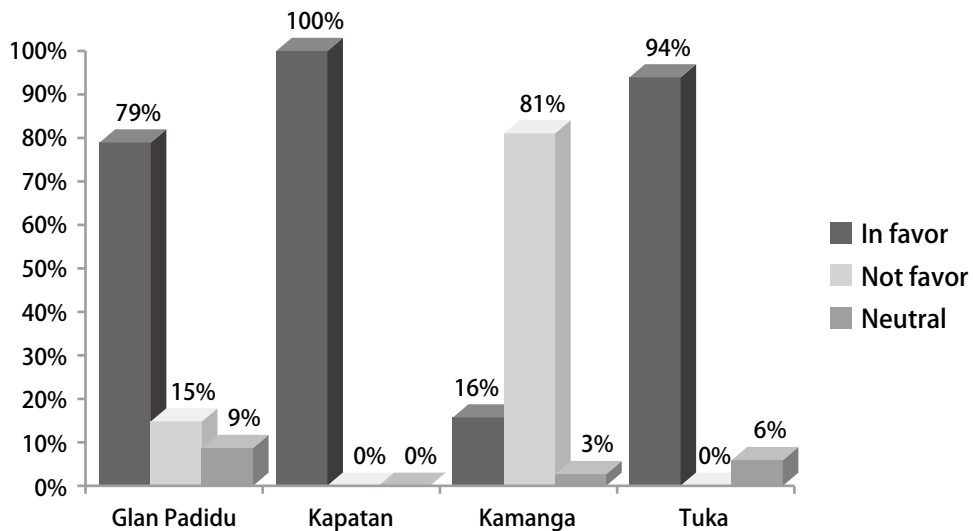


Fig. 3. Perception of the respondent on the establishment of MPA in their area.

Kapatan MPA

Kapatan MPA also had a good start as in Glan Padidu MPA. The area was managed by Cabug Fishermen and Farmers Cooperative (CAFIFAMCO) in partnership with the government of Barangay Kapatan. There was no budget for the honorarium of the fish warden from the municipal government, however, CAFIFAMCO allocated an amount for this purpose. Local people were actively participating in the protection of the area as all respondents appreciated the importance of establishing the MPA to their daily living. More effort on protection was done when one non-governmental organization (NGO) gave support on alternative livelihood to the members of CAFIFAMCO to compensate the reduction of the fishing area as a result of MPA establishment. The results of the interviews reveal that after five years of MPA establishment, fishermen had noticed an increase in the fish population as manifested by the increase in their fish catch for the same length of time they spent fishing around the protected area as compared to the time before the MPA was established. As a result, this MPA gained full support of the local people as the respondents were aware of the beneficial functions of the MPA. They said that this will give continuous and sustainable fish supply without destroying the source.

In later years, there seemed to have a gradual weakening of support from the local government of Kamanga for some political reasons. There was a sort of conflict in MPA management between the barangay council and CAFIFAMCO. One Barangay officials alleged that CAFIFAMCO was receiving financial assistance from an NGO and the barangay council of Kapatan was not anymore consulted by their activities. Another member of the Barangay Council protested that officers of CAFIFAMCO ignored them when it comes to financial matters but consulted them when they encountered problems such as fishing violations inside the MPA. Misunderstanding became worse

which resulted in the weakening of the collaboration between the Barangay council and CAFIFAMCO.

The officials of CAFIFAMCO also expressed their side that they exerted much effort to sustain the protection of Kapatan MPA by using the organization's fund for the honorarium of fish wardens but there were many times that they were disappointed when no proper imposition of penalty to the arrested fishing violators by the Barangay council. They felt that their efforts were just in vain. This resulted in repeated violations in the established MPA. In addition, the official of CAFIFAMCO also encountered serious problem on the entry of commercial fishing boats around the protected area. They learned that these violators were armed and this would endanger their lives if they pursued to stop them. They added further that when they referred this problem to the barangay government, they got no support. These were among the reasons why the fish wardens became lax in patrolling and protecting the area which resulted in the abandonment of the protected area making it open for public use. Surveillance is important as intruders who violate the reserve can seriously damage the recovery process of fish populations (RUSS and ALCALA 1996).

The protected area was not anymore protected from the latter part of the year 2009. Illegal fishing was observed by 100% of the local people interviewed. Violators are usually people from the neighboring villages doing activity that damages the coral reef like diving in the coral reef area using a "compressor" (diving with the use of supply of air) to scare the reef fish and driving them towards fishing net. People interviewed also observed a few members of the barangay council doing fishing activity inside the former protected area.

WHITE and VOGT (2000) stated that in developing countries, a lack of effectiveness can occur because of limited acceptance and support by adjacent communities that are always required for the establishment of a sustainable MPA. But in the case of Kapatan MPA, it was the people who favored and supported the MPA. These people blamed the non-supportive attitude of the local government that caused the collapsed of MPA protection. Lack of local government support will lead to MPA collapse as in the case of Sumilon marine reserve which MPA management collapsed and was opened to the public by the local leader (ALCALA 2001).

Based on the assessment of the features inherent in the functioning MPA, Kapatan MPA has no management plan; no budget or financial support from the local government, no guard house and no monitoring program. The information, education and communication previously conducted were not sustained; marker buoys they previously put up were gone and were not replaced, only community signboard remained (Table 3). The respondents were expecting and longing for the immediate revival of the protection of the former protected area because they had experienced and enjoyed the economic benefits specifically in the increase in their fish catch. This finding is shown in Fig. 3, that 100% of the respondents were in favor of the establishment of the MPA in their area.

Kamanga MPA

Kamanga MPA has another story different from the two previously discussed MPAs. Based on the assessment of the features inherent in the functioning MPA (Table 3), there was no management plan, no budget or financial support from the municipal government and no monitoring program. A community signboard was observed in the area and there were only two marker buoys observed in the area. There was no guard house in the MPA itself but surveillance was done by a policeman stationed in the nearby checkpoint along the highway about 400 meters away from the MPA.

One private resort is operating in the area very near to this MPA. Guests can do snorkeling and fund diving in this protected area using Self-Contained Underwater Breathing Apparatus (SCUBA). This resort is directly overseeing the area and coordinating with the nearby policemen in case there are fishing violations. The resort showed full support to the establishment of this MPA, in fact they offered a certain amount of funding every month for the maintenance of this protected area as mentioned by the MPA in charge of the municipal government of Maasim. However, it was not realized because of some technical problems on the process of transferring the fund from this private resort to the municipal government. Before the establishment of this MPA, there was consultation and planning with the local people. The owner of the resort offered some sort of alternative livelihood program for the local people/fishermen who were affected by reduction of their fishing area while waiting for the “spill-over” effect which will take some years. Local people will also benefit from the guests out of the fees they are supposed to receive as dive guide and from the rentals of their boats. However, these things were not also realized which made the local people disappointed. The introduction of alternative livelihood schemes is vital to reduce poverty generally and to compensate for the loss of fishing grounds that are included in no-take zones (RIVERA and NEWKIRK 1997, POLLNAC *et al.* 2001), but this was not realized in Kamanga MPA.

The local people show no support for the establishment of this MPA as revealed in Fig. 2, and only 16% of the respondents were in favor of the establishment of the MPA while the higher 81% were not in favor. The other 3% were neutral or they were not positively or negatively affected by the establishment of Kamanga MPA. This situation may not favor successful long term MPA management because according to UYCHIAOCO *et al.* (2000), POMEROY and CARLOS (1997) and DONE and REICHEL (1998) all stakeholders and community groups should participate in the decision-making process, including reserve design and management for a successful MPA. Experience has demonstrated that the success of marine protected areas (MPAs) as a management tool improves when the local stakeholders participate in planning and decision-making activities together with the government (HARVEY *et al.* 2001, POLLNAC *et al.* 2001, JAMESON *et al.* 2002).

The resort has diving facilities and the guests can use these for a fee if they want to do SCUBA diving or snorkeling in the area. This time, the guests need not rent a boat or hire a diving guide from the local people because the resort provides for this

purpose. The local people were complaining that they cannot get their share from the financial benefits out of the resort goers. This is contrary to what has been previously agreed upon during the planning stage of establishing this MPA. One of the respondents protested that “this MPA did not give benefits for us it is only the resort owner who is making money out of it”.

Kamanga MPA is well guarded by the police with a nearby police checkpoint; it is hard for the violators to encroach and do illegal fishing activity inside the protected area. The local people were also complaining about the lack of marker buoys for the MPA. This resulted in the conflict between the fishermen and the police because it was not clear for them the boundary of the protected area and until where they are allowed to fish. The fishermen were afraid that the previous incident when the police shot one fisherman who was allegedly fishing within the established MPA will happen again, so they resorted to do fishing in other areas far from the MPA. Local people said that this MPA has a high fish population as they observed even at the start of its establishment. They assumed that the fish population has already increased this time and they wished to enjoy the benefit of the spill-over effect. This situation is very crucial for the long term MPA management because the long-term sustainability of community-based MPAs depends largely on local people believing that the reserve is effective in enhancing fish populations (SUMAN *et al.* 1999, WALMSLEY and WHITE 2003).

This eventually made the local people very cautious in their fishing activity and they are even afraid of fishing around the buffer zone of this protected area. Local people do fishing in far areas for fear of being suspected in fishing within the MPA. It is also hard for them to exactly identify the protected area because there were only two marker buoys present.

Despite of the non-compliance of some of the inherent features and less participation of the local people, unique from others, Kamanga MPA is ecologically well protected. However, it must be realized that the establishment of the MPA is for sustainable fisheries for the fisher folks aside from conservation purposes. PAJARO *et al.* (1999) as quoted by WHITE *et al.* (2002) suggested that a clear definition intended to protect and conserve commercially valuable marine organisms and enhance fishing grounds be made to exclude those areas whose values are more cultural or tourism related. Most MPAs being declared in the country are for biodiversity, habitat, and fisheries management with a secondary benefit being that of tourism in well-managed areas. Kamanga MPA was also established for the purpose of biodiversity, habitat, and fisheries management. The benefit enjoyed by the private resort out of tourism is just the secondary purpose.

The growth of MPAs in the Philippines is partly explained by the support and interest of the multilateral and bilateral donor agencies and development organizations, and the openness of the government to this assistance. Between 1984 and 1994, at least 25 foreign development agencies and eight donor countries (Australia, Canada, Denmark, Germany, Japan, Netherlands, the United Kingdom, and the United States) supported various community-based coastal resource management projects in the

country including the establishment of fish sanctuaries and marine reserves (POMEROY and CARLOS 1997). MPAs are also being initiated by a variety of NGOs as part of a broader effort to conserve coral reefs and manage fisheries. The key lesson according to WHITE *et al.* (2002) is that without the full endorsement of local communities and governments to take on the long-term responsibility of management, MPAs will not succeed, a lesson which Kamanga MPA managers should consider.

Tuka MPA

This MPA is managed by the municipal government of Kiamba. Based on the assessment of the features inherent to a functioning MPA, there is a compliance of four items out of eight listed in Table 2. A community signboard was present but there was no guard house. There was no monitoring program for this MPA at the time this research was conducted. Formulation of the Management Plan is going on and is near completion. Information, education and communication were also conducted. Tuka marine sanctuary was marked with buoys in 1998, however there were no marker buoys observed during the ocular observation in December 2010. The person in charge of the MPA said that procurement of new buoys was on-going and replacement will be done soon. Although the ordinance declaring this area as MPA was passed in the year 2001, the sanctuary was practically enforced since 1997 (DE JESUS *et al.* 2001).

The municipal government allocated budget for the activities and maintenance of this MPA is meager, but it is better than nothing, the person in-charge said. They have fish wardens who were doing surveillance around the MPA to avoid fishing violations. These fish wardens received a honorarium from the municipal government. Protection of this MPA continues and is going well and there was no fishing violation observed. Local people show positive support for the establishment of this MPA, and as shown in Fig. 3 94% of the respondents were in favor of the establishment of the MPA in their area. While there was no one who said that he is not in favor, 6% were neutral or they were not positively or negatively affected by the establishment of this MPA. An opinion shared by these neutral people that they will just follow what the government does.

This result points to a need for patience in expecting change in resource users' perceptions, adopting an approach in which there is more communication between fishers and managers, so that both are more aware of MPA functions, particularly closed areas and the indirect benefits.

Productivity of the fishermen

The different status of MPA management of four different protected areas has different effects on the productivity of the fishermen. Table 4 shows the data of the fishermen's fish catch as expressed in catch per unit effort (CPUE) in three different periods: (1) fish catch before the marine protected area was established; (2) fish catch after 5 years MPA was established; and (3) fish catch when this research was conducted in December 2010. The dates MPAs were established vary from each protected area to another and they are also indicated to give an idea when the MPA was on its fifth

Table 4. Productivity of fishermen in different MPAs expressed in catch per unit effort (CPUE).

CPU	Year established	Catch per unit effort (CPUE)				
		Before MPA		After 5 years		2010
		(Kg/person-hr)	(Kg/person-hr)	(%)	(Kg/person-hr)	(%)
Glan Padidu	2000	0.92	2.19	138	0.81*	-12
Kapatan	2000	0.88	2.20	150	0.80*	-9
Kamanga	2006	0.94	-	-	1.20	28
Tuka	2001	0.91	2.14	135	2.20	142

* CPUE after MPA management collapsed (protection stopped in 2009).

year. MPA management in two protected areas in Kamanga and Tuka continues while the other two in Glan Padidu and Kapatan failed in the year 2009 which resulted to the opening of these protected areas to the public. The data of the fish catch after the MPA management collapsed was also determined.

The data in Table 4 further shows that there is an increase of the CPUE of fishermen in all marine protected areas after five years when the MPA was established. When the breeding place is not subjected to disturbance from the entry of fishermen, it means that fish can breed successfully without stress and small fish can grow to maximum maturity. This is followed by the increase of fish population which conforms with the “spill-over effect” of ALCALA (2001). Similar studies conducted by RUSS and ALCALA (2004) revealed that after a considerable period of protection, there was an increase in fish population in the protected areas which will result to the increase of fish population available to the fishermen and an increase of fish catch. In addition, as protected stocks build-up, reserves are predicted to supply local fisheries through density-dependent spillover of juveniles and adults into fishing grounds. Because reserves contain more and larger fish, protected populations can potentially produce many times more offspring than exploited populations can (ROBERTS *et al.* 2001).

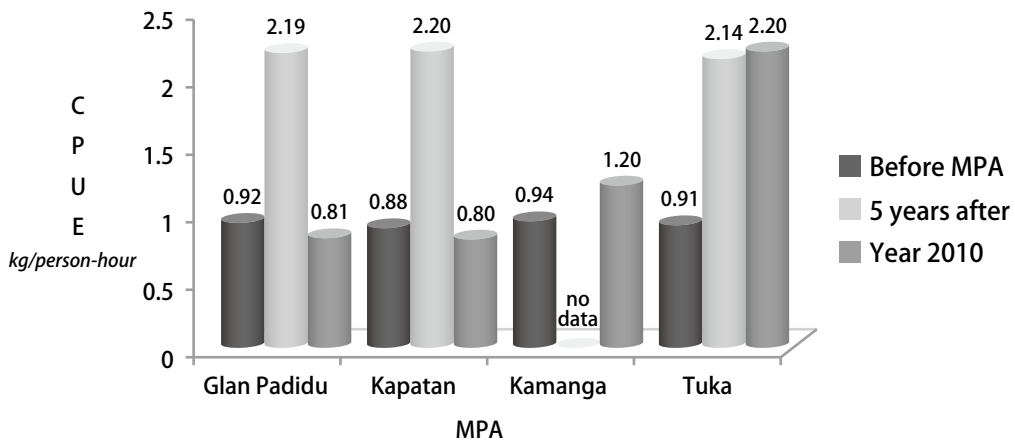


Fig. 4. CPUE of the fishermen in three different periods.

Figure 4 shows the data of fish caught in three different periods. The two protected areas of Glan Padidu MPA and Kapatatan MPA whose management collapsed have a similar trend of increase and then decrease of the fish catch. The CPUE of fishermen in Glan Padidu MPA before the establishment of the protected area was 0.92 kg/man-hour. After five years, it increased to 2.19 kg/man-hour or an increase of 138% of the previous fish catch. After the MPA management collapsed, CPUE decreased to 0.81 kg/man-hour, 12% even lower than the fish catch before MPA. The same trend is true for the Kapatatan MPA. There was an increase of 150% fish catch from 0.88 kg/man-hour before the MPA to 2.20 kg/man-hour after five years. And a decrease of 0.80 kg/man-hour or 0.09% lower than the fish catch before the MPA was established. The decline in fish caught at these unsuccessful MPAs may be attributed to the depletion of the fish supply because the protected areas are now open for public use and the breeding places are already disturbed and destroyed the coral reef as indicated in the presence of rubble and dead coral in the these areas during the ocular observation. The studies of RUSS and ALCALA (1989) and RUSS and ALCALA (1996) revealed that fishers who fish illegally or despite voluntary agreements will substantially reduce the efficacy of a reserve and a resumption of fishing quickly decreases fish populations. This depletion of fishery resources in these two MPAs may be further attributed to the increase of the population of the fishermen as stated by some of the respondents although there was no available data from the local government office on the population of the village before the establishment of the MPA and the population after the time the MPA management collapsed.

This increase and decrease of the fish catch is the usual trend as a result of MPA management failure. Sumilon Island Reserve provides some of the best evidence to date for the efficacy of protective management. Prior to the collapse of protection in 1984, the overall density of fish in the reserve parts of the island remained unchanged. When the protection of the marine reserve in Sumilon Island, Philippines, collapsed, after 9.5 years of restrictions on fishing, it was reopened to fishing and led to significant declines in reef fishing yields in areas adjacent to the reserve which suggest that the reserve had previously supported fisheries (RUSS and ALCALA 1999).

Kamanga and Tuka MPAs show the increase in the CPUE after five years. Protection of Kamanga MPA was started in the year 2006 and it was about to turn to its fifth year when this research was conducted in December 2010. Data in Table 4 show an increase of 28% from 0.94 kg/man-hours before the MPA to 1.20 kg/man-hours after five years. This MPA has shown low increase of CPUE compared to others which increased more than 100%. This may be explained by the fact that the fishermen were not fishing around the MPA because of some management problems previously discussed. In other words, the CPUE data of this MPA is not a measure of the spill-over effect of the increased fish population. People must see some results of their efforts to continue a management program aiming to improve their marine resources (POMEROY and CARLOS 1997, WHITE and VOGT 2000) which is not true in Kamanga MPA. This case may indicate effective conservation but it does not meet the other purpose of the

MPA in sustainable fisheries for the local people.

Tuka MPA shows a sustainable fishery as indicated in the increased CPUE from 0.91 kg/man-hours to 2.14 kg/man-hours or 135% increase after five years. A further increase of 2.20 CPUE when this research was conducted in December 2010 was noted, showing a total of 142%. Continuous protection will lead to a consistent build-up of fish in the reserve which was shown by an increase in local fish yields as a result of continuous protection of Apo Island, Philippines, from 1982 to 1993 (RUSS and ALCALA 1999). ROBERTS *et al.* (2001) also reported that the marine reserves in Soufriere Marine Management Area in Sta. Lucia had a rapid impact on reef fish populations. Visual censuses of reserves and adjacent fishing areas revealed that combined biomass of five commercially important fish families tripled in reserves in three years. HARPEN and WARNER (2002) also stated that successful marine protected areas, including no-take reserves, can help restore degraded coral reefs and improve the livelihoods of coastal communities by increasing fish size and abundance in adjacent areas.

One of the basic premises of MPAs is that by protecting the coral reef from human intrusion and extraction, coral cover and fish abundance inside the MPA can be maintained or increased, which leads to an increase in fish abundance outside the MPA and thus higher catches for fishermen. In this manner, MPAs are used both for habitat protection and as a fishery management tool (GJERTSEN 2004).

Statistical analysis using two-way ANOVA revealed that there is significant difference on the CPUE of the fishermen in three different MPAs P -value <0.01 . It is shown that Glan Padidu and Kapatan MPAs have no significant difference from each other with P -value = 0.930. These two MPAs have significantly lower CPUE than the rest of the MPAs. The CPUEs increased after five years of MPA establishment, and significant decline was observed after MPA management collapsed and MPA protection ceased, resulting in the opening of the protected areas to the public. This increase and subsequent decrease of fish catch is the usual trend as a result of MPA management failure. Sumilon Island Reserve provided some of the best evidence to date for the efficacy of protective management. Prior to the collapse of protection in 1984, the overall density of fish in the reserve parts of the island remained unchanged. When the protection of the marine reserve in Sumilon Island collapsed after 9.5 years of restrictions on fishing, its opening to fishing led to a significant decline in reef fisheries yields in areas adjacent to the reserve, which suggested that the reserve had previously supported fisheries in the surrounding areas (RUSS and ALCALA 1999). Kamanga MPA has a CPUE significantly higher than the Glan Padidu and Kapatan MPA (P -value <0.01). There was an increase in CPUE in December 2010 when this research was conducted. However, this figure is not a measure of the effect of MPA establishment because fishermen were fishing in far areas and not in the area adjacent to the established MPA because of a management problem.

Tuka had CPUE significantly higher than Kamanga MPA (P -value <0.01). This MPA has CPUE significantly higher than the other MPAs. This is attributed to the continuous protection of the area from the time of MPA establishment. When the

breeding place is not subject to disturbance from the entry of fishermen, it means that fish can breed successfully without stress and small fishes can grow to their maximum maturity. This was followed by the increase of the fish population which conformed with the “spill-over effect” of ALCALA (2001). Similar studies conducted by RUSS and ALCALA (2004) revealed that after a considerable period of protection, there was an increase in the fish population in the protected areas which will result in the increase of the fish population available to the fishermen and an increase of fish catch. In addition, as protected stocks build-up, reserves are predicted to supply local fisheries through the density-dependent spillover of juveniles and adults into fishing grounds. Because reserves contain more and larger fish, protected populations can potentially produce many times more offspring than exploited populations (ROBERTS *et al.* 2001).

Tukey’s test (Table 5) revealed that there was a significant difference among the CPUE of the fishermen in three different management periods. The fish catch significantly increased after five years of MPA establishment. However, in December 2010, CPUE significantly declined because of the management failure of Glan Padidu and Kapatan MPA (P-value <0.01). The significant decline supports the idea that protection increased the CPUE of the adjacent fishermen, thus MPA establishment is beneficial to them.

Table 5. The output obtained from Tukey’s (HSD) test for different management periods.

Management periods	Management periods	Mean difference	Std. error	P-value
Before MPA	After 5 years	-1.2643*	.04203	<0.01
	December 2010	-.3401*	.03976	<0.01
After 5 years	Before MPA	1.2643*	.04203	<0.01
	December 2010	.9242*	.04053	<0.01
December 2010	Before MPA	.3401*	.03976	<0.01
	After 5 years	-.9242*	.04053	<0.01

Non-compliance with marine protected area regulations is a problem worldwide, and this is being addressed through community programs (MCLANAHAN *et al.* 2005). Community-based coastal resource management programs have been widely applied within the Philippines. However, small-scale community-based reserves are often inefficient owing to management inadequacies arising from a lack of local support or enforcement or poor design (BEGER *et al.* 2005). It was also stated by RIVERA and NEWKIRK (1997) and ALCALA (1998) that many projects related to the establishment of MPAs such as resource assessment and scientific monitoring, community preparation and organizing, capacity building, provision of alternative livelihoods, and conservation education were not sustainable especially when external intervention and funding cease. This indicates the importance of the acceptance of MPA establishment by the locals and strong support from the local government in MPA establishment. This is true in Glan Padidu MPA where there was no financial support from the local government. MPAs have been created as a favored conservation strategy. However, in

many countries insufficient government funds for the enforcement and management of MPAs and poor support from local communities have limited the effectiveness of many reserves (ALCALA 1998, WHITE *et al.* 2002, MORA *et al.* 2006, SAMOILYS *et al.* 2007).

In developing countries, a lack of effectiveness can occur because of limited acceptance and support by adjacent communities that are always required for the establishment of sustainable MPAs (WHITE and VOGT 2000). The acceptance of MPA establishment by the locals as an important factor in MPA success (ALCALA 1998, YASUE *et al.* 2010) had no strong influence in the case of Glan Padidu and Kapatan MPA. The survey on the perception of the adjacent residents regarding the establishment of these MPAs revealed that 79% (26 out of 33 respondents) in Glan Padidu and 100% (41 respondents) in Kapatan MPAs were in favor of the establishment of a protected area. However, it was found out that management of these MPAs collapsed in 2009, hence the area is not protected anymore and now open to fishing activities. Reasons of the collapsed were the lack of support from the local government, as stated by the people during the interview.

The majority of the local residents adjacent to Kamanga were not satisfied with the establishment of the MPA in their locality as 81% (22 out of 28 respondents) were not in favor of Kamanga MPA. This was the result of the perception of the local people that only the private resort adjacent to the MPA benefitted and made money out of their guests. People had less participation in the management. However, it was found out that Kamanga MPA is well protected. The increase in the CPUE of the fishermen cannot be a measure of the positive effect of the MPA because fishermen were fishing in other places and not adjacent to the MPA.

Conclusions and Recommendations

Conclusions

1. Successful marine protected areas, including no-take reserves, can help restore degraded coral reefs and improve the livelihoods of coastal communities by increasing fish abundance in adjacent areas which will eventually result in an increase in the fish catch.

2. Government support to the marine protected areas particularly the financial aspect is very necessary to continue the protection effort. In the case of Glan Padidu MPA, the absence of a government budget for the fish wardens was one factor mentioned by the MPA manager that caused the withdrawal of the fish warden from doing the surveillance activity. Wardens need to be compensated for the time they devoted for this activity since this disrupts their economic activities for their families.

3. Cooperation by all stakeholders is necessary for the success of the MPA protection. In the case of Kapatan MPA, local people showed strong support for the establishment of the MPA, however, non-support of the Barangay government in the imposition of a penalty on fishing violations resulted in the collapse of the protection

effort. In the case of Kamanga MPA, the area was well protected, however, non-involvement of the local people in the MPA management created a negative perception of the local people towards MPA establishment. Conflict between the stakeholders may arise sooner or later and this situation will not favor successful long term MPA management.

4. Tuka MPA is relatively well-managed among the four MPAs studied and the government support was an important factor to this, such as the allocation of a budget for the surveillance of the protected area and maintenance of the physical features of the MPA, e.g., maintenance of mooring buoys to identify boundaries by the adjacent fishermen and the cooperation of the local people.

Recommendations

1. Marine resources protection, conservation and fishery management with the active participation of the local communities has been the core concept of establishing marine protected areas throughout the Philippines. Establishing a MPA does not end in the approval of the ordinance. The local government concerned should implement the laws pertaining to marine resource protection and fishery management for the sustainable supply of fishery resources. According to CHRISTIE and WHITE (1997) an essential ingredient in the effective management of coral reefs involving the various groups is the active and committed participation and stewardship of the resource users, the fishermen, resort owners, coastal residents, scuba divers and others.

2. Any coastal management project needs to consider linkages among all potential participants - fishermen associations, community leaders, town mayor and council, Barangay Chairman and council, law enforcement officers, private business with local interests, the academe, NGOs, provincial and national government organizations like the Department of Environment and Natural Resources and Department of Tourism.

3. Agreements made between the community and the authorities should be legalized, respected and fulfilled.

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