Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7 – 11 July 2008
Session number 21

Towards Local Fishers Participation in Coral Reef Monitoring:A Case in Tingloy, Batangas, Philippines

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Abstract. The five-island municipality of Tingloy is a popular diving site known for its rich coral reefs. However, these reefs are being threatened by man-made stresses and natural disturbances. A monitoring framework was developed through the integration of scientific and indigenous knowledge in determining and assessing the present status of coral reef environment. One of the benefits of the developed monitoring framework is the empowerment of the fishermen. Institutions and fishermen in the area in cooperation with the academe provided the major backbone of the framework. The fishermen were interviewed, trained and participated in the whole year monitoring of the coral reef environment. The monitoring framework developed served as an overall guide for monitoring activities and the data gathered served as the baseline information of the coral reef environment in the area.

Key words: coral reefs, fishermen, monitoring framework, baseline information, Tingloy

Introduction

The Philippines is blessed with one of the most diverse coral reef ecosystems in the world as it lies in the region known as "The Coral Triangle". However, Philippine coral reefs are increasingly threatened ecosystems. Coral cover is rapidly declining, fish populations are low and reef productivity dropped by one-third during the last decades (Jameson et al. 1995). The damage that occurs to coral reefs is usually the result of natural and man-made interference.

In Luzon, one of the most extensive coral reef ecosystems which is a favorite destination of scuba divers is found along the municipality of Tingloy, Mabini and its vicinity. Tingloy is located in Maricaban Island, Batangas, 120 km south of Manila. Tingloy is situated in the southern coast, and the coral reefs are found along Batangas Bay and Maricaban Strait . The western side of Tingloy (e.g. Sepoc point., Sombrero and Caban islands), is considered one of the best diving sites in the area (Uychiaoco and Aliño 1995). The coral communities of Mabini and Tingloy are said to have traditionally supported rich near-shore fishing and in recent years, a growing tourism industry. In the early 80's however, increased fishing effort using destructive methods, uncontrolled development of the land, increased visitation by scuba divers and day-trippers and increased pollution (solid and liquid waste), began to threaten the coral reef ecosystems of these areas *(*White and Vogt 2000).

The WWF-Philippines (World Wide Fund for Nature) has been implementing conservation activities in Mabini and Tingloy since 1998. It started by setting up community-based, multi-sector inter-municipal council (MATINGCADC), which it envisions will eventually manage the area's rich marine resources. To further ensure this, the project strengthened the coastal law enforcers, "Bantay Dagat" that the local council has organized. With the success in the enforcement efforts of Tingloy to curb illegal and destructive fishing activities, members of the municipal council, Sangguniang Bayan who are also members of the local council, MATINGCADC, are now considering on identifying and declaring certain areas within their political jurisdiction as community-managed municipal marine reserves (Dumaop 2000).

For the past 20 years, much has been done on coastal and reef management in the country, involving government, non-government organizations, local communities and resource users with emphasis on communities' participation in the rehabilitation and conservation programs (White and Vogt 2000; Gutierrez et al. 1996; Fernandez, Matsuda and Subade 2000). There has been an increasing level of participation by local communities and resource users, particularly the fishermen in coastal management across the

country, as evidenced by several cases such as the stories of Apo Island, Banate Bay (Fernandez et al. 2000) and others. In most of those projects, coastal management and monitoring has been done mainly by scientists, and focused on biophysical and chemical aspects. Moreover, most of the monitoring guidelines and techniques were determined by the scientists. This situation makes it difficult for fishermen to be actually involved in monitoring activities. Thus, local participation would usually be limited to patrolling while monitoring would be largely done by the scientists.

There is therefore a need of encouraging participation down to the grassroots level for monitoring and assessment since it is through this that one could determine the status of the coral reef ecosystem and the effectiveness of a policy, a program, or management activity being implemented. This study aimed to facilitate and encourage community participation in the development process of the integrated methodological framework for environmental monitoring of coral reefs in Tingloy, Batangas. It also integrated scientific and indigenous knowledge in determining and assessing the present status of coral reef, reef fish and water quality in the area. The framework developed could also serve as an overall guide for the monitoring activities that was undertaken by the coastal community. The development of methodological framework for environmental monitoring of coral reefs in Tingloy, Batangas, provided a good venue for the expression of community's knowledge and participation in the formulation of monitoring plan for the management of their marine resources.

The Research Process

This study was conducted in the five islands of Tingloy, Batangas involving the community and different institutions for the rehabilitation and conservation of marine resources. Figure 1 shows the conceptual framework of the study. The first component is the community which composed of the fishermen, who are the main residents, and the local government unit (LGU) in the area. The second component is the organization of institutions that were equally important such as the Provincial Government Environment and Natural Resources Office (PGENRO), the academic institution and the Kabang Kalikasan ng Pilipinas or the WWF-Philippines. The PGENRO and the academe provided the scientific knowledge in the environmental assessment while the role of KKP-WWF was measured through its past and present efforts as well as future plans for the sustainable management of the aquatic ecosystem. The third component is the coastal environment specifically the extensive coral reef ecosystem of Tingloy.

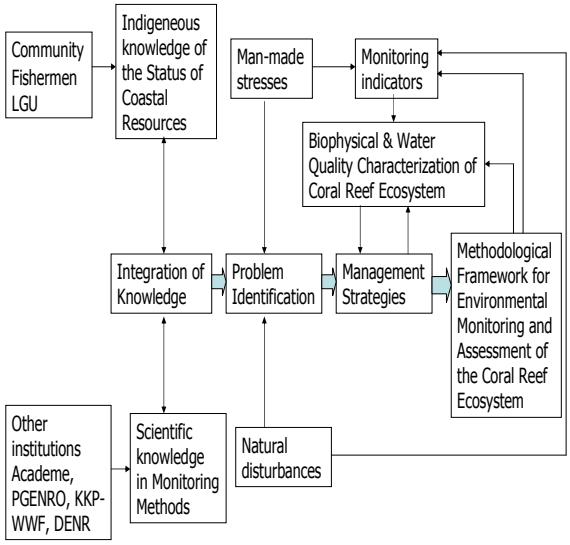

Figure 1. Conceptual framework of the Study.

The framework could be viewed as a system with several components, interacting to come up with an integrated methodological framework for environmental monitoring. The methodological processes for the development of the said framework were shown in Figure 2.

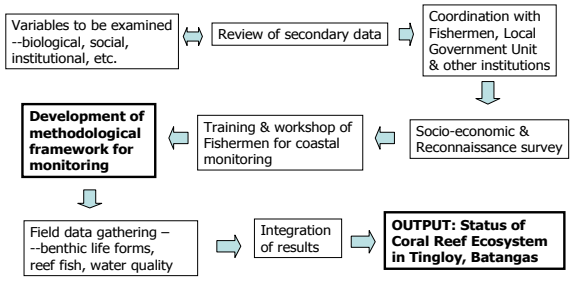

Figure 2. The research process for the development of the framework.

The individual survey was conducted over a 5-week period from June to July 2001 in Tingloy, Batangas. To gather the needed data, a structured and open-ended interview schedule was administered to the fishermen after it was translated to Tagalog and pre-tested in Barangay Sulo, Mabini. The questionnaire consisted of 10 pages divided into the following five sections: 1) demographic and socio-economic characteristics of

fishermen, 2) fishing and resource management practices including fishing effort and catch, 3) knowledge, 4) perception, and 5) attitude. In the last part of the questionnaire, the fishermen were asked if he is willing to participate in monitoring of coastal resources and the reason for his answer.

A two-day training on coastal monitoring was conducted for the fishermen. Out of the 109 fishermen interviewed, eight participated in the training-workshop. The five criteria for the selection of participants in fishermen's training were: 1) his willingness to volunteer without payment in the monitoring, 2) have at least a total score of 100 out of 128 points (on the perception, attitude and knowledge questions), 3) must agree or strongly agree to the establishment of marine reserves, 4) physically fit, and 5) able to read and write. One of the limitations in the number of participants is the limited funds considering that the activity only provided food and transportation expenses and no extra allowance was given.

The data from the social survey provided input in the identification of the major problems to be addressed in monitoring. Out of the 26 problems identified, six major problems were identified with the fishermen for environmental monitoring The six major problems identified were poverty or low income among the municipal fisherfolks, overfishing or overexploitation of resources, habitat degradation due to dynamite and cyanide fishing, pollution due to the presence of considerable amount of garbage and oil in the coastal waters, and storms or typhoon.

Based on the results of the reconnaisance conducted, five (5) sampling sites were identified for coral cover, reef fish and water quality assessment of the study. The five sites selected can give a representative estimate of the status of the coral reef ecosystem in Tingloy, Batangas. The criteria for the selection of the sites are as follows: 1) serve as a site of baseline data of the status of coral reefs in Tingloy 2) will serve as one of the major sites for future monitoring activities 3) serve as one of the possible sites for the establishment of marine reserve and 4) serve as one of the possible sites for protection and rehabilitation programs. Fishermen preferences of the sites as a fishing ground and where oil spill was observed were also considered. The results of manta tow survey was integrated in the focus group discussion to finalize the selection of sampling sites and appropriate sampling time for the wet and dry season of various physical, biological and chemical parameters of the study.

Coral and reef fish surveys were done during the month of March. Two fishermen were assigned for each site for the coral and reef fish survey. A line-intercept technique and snorkel survey were used by the divers and fishermen, respectively in the assessment of coral reef and reef fish. Based on Gomez and Alcala (1978) studies, coral cover was categorized as Excellent (75-100%), Good (50-74.9%), Fair (25-49.9%), and Poor (0-24.9%).

Water sampling of coastal waters was quarterly scheduled in the months of August, November, February and June. Sample collection for each month was carried out by two fishermen for all the five sites over a one day period. Microbial, physical and chemical attributes of the coastal water were determined with assistance from PGENRO.

Methodological Framework for Monitoring

The framework was developed through the participation of the community particularly the fishermen and various institutions (Table 1).

Status of Coral Reef Ecosystem

The methodological framework was then applied to determine the status of the coral reef ecosystem in Tingloy, Batangas. Five sites were monitored for coral cover, reef fish and water quality.

Coral Cover

Sites chosen for the survey were the Caban reef, Macawayan Reef, Bonito Reef, Pisa Reef and Sto Tomas Reef. A coral reef assessment using the LIT by divers and snorkel survey by fishermen. Gomez and Alcala (1978) categorization was used.

All five sites were categorized in fair condition by the fishermen survey. On the other hand, diver's survey showed only two sites, Caban reef and Makawayan reef in good condition while the rest of the sites were in fair condition. Both sites had high live hard coral cover among the selected sites thus it can be said that areas in Caban and Makawayan are recommended sites for establishment of marine reserves.

Fish Biomass

Among the five sites, Caban reef (59428.21g) has the highest fish biomass while Pisa reef (12,372.34g) has the lowest. Other reef areas are as follows; Bonito reef (49900.34g), Makawayan reef (36222.93g) and Sto. Tomas reef (25183.46g). Fish biomass could not be determined from the fishermen survey because it requires that fish be identified at the species level.

Table 1. Integrated methodological framework for environmental monitoring of coral reefs ecosystem and social system in Tingloy, Batangas.

ISSUE OR PROBLEM	CAUSES	POSSIBLE INDICATORS	MANAGEMENT STRATEGIES	WHERE TO MONITOR	WHEN TO MONITOR	MONITORING METHOD	PERSON(S)/ INSTITUTION INVOLVED
Poverty or low income of municipal fisherfolk*	Too many fishermen, overexploited resources, low catch, management practices	Income*, no. of fishers*, health condition	Alternative livelihood*, fishing regulation through licensing	Per municipal barangay	Once a year	Social survey	LGU, Academe, NGO, DENR
Overfishing*	Changes in fishing effort, natural disturbances, changes in coral cover, management practices	Fish sizes and abundance	Harvest regulations (MPA/Zoning, seasonal closure, gear restriction, species restriction), patrolling and enforrcement*	Inside and outside MPA, representative sites of the Tingloy	Wet and dry season	Fish visual census	Fishermen, Academe, NGO
	Increase in fishing effort, management practices like MPA enforcement	Fishing effort; catch per unit effort*		Per municipal barangay	At least once a month	Fish catch monitoring	Fishermen, Academe, LGU, NGO
Habitat Degradation*	Destructive fishing methods, natural disturbances, management practices like MPA	Coral cover*	Education campaign, patrolling & enforcement*, harvest regulations (MPA, seasonal closure, gear restriction, species restriction)	Inside and outside MPA, representative sites of Tingloy	Once a year	Manta tow, snorkel survey	Fishermen, Academe, NGO
Pollution (solid waste and sewage)*	Waste disposal practices, management practices	Garbage*	Waste management (proper disposal system), Patrolling and enforcement*, Information campaign for proper sanitation	Representative sites of Tingloy	Every quarter of the year	Water quality analysis particularly on ammonia, nitrogen, phosphate, DO and BOD	Fishermen, PGENRO, Academe, NGO
	Lack of toilet facilities, management practices	Cases of diarrhea		Representative sites of Tingloy especially Sto. Tomas site.	Every quarter of the year	Water quality analysis particularly on Total and Fecal Coliforms	Fishermen, PGENRO, Academe, NGO
Pollution (oil spill)*	Industry and ships oil spill, management practices	Oil spill*	Lobbying for waste reduction from oil refineries and ships*, patrolling and enforcement	Representative sites of Tingloy especially Sto. Tomas	Every quarter of the year	Water quality analysis particularly on Oil and Grease	Fishermen, PGENRO, Academe, NGO
Pollution (sedimentation)	Loss of mangrove areas, deforestation, management practices	Coral cover	Mangrove reforestation, replanting of trees or vegetation in the upland	Representative sites of Tingloy especially Sto. Tomas	Once a year	Manta tow, snorkel survey	Fishermen, Academe, NGO
	Same as above	Siltation		Same as above	Every quarter of the year	Water quality analysis especially TSS	Fishermen, PGENRO, Academe, NGO
Storms and/or global warming*	Natural disturbances, increasing CO_2 level	Coral cover*	Reduce man-made stress to enable the environment to recover more easily	Representative sites of Tingloy particularly Bonito	Once a year	Manta tow, snorkel survey	Fishermen, Academe, NGO

Legend: * - identified by fishermen

Fish Abundance

About 31 families were recorded by the divers in all the five sites while the fishermen identified 25 families. Survey showed that Makawayan reef has the highest fish abundance, followed by Caban reef. Pisa reef and Sto. Tomas reef has the lowest fish abundance. By family, Pomacentridae had the largest contribution to the mean biomass, accounting for more than 30% of the total biomass for each site. It is also the most numerous fish group per individual counts for all sites. Fishermen's survey on fish abundance per individual counts was also highest for Pomacentridae.

Fishing Effort and Species Caught

Most common fishing gear used was hook and line, aboard small and mostly non-motorized boats. Fishing was done almost everyday averaging 3-5 hours. Fish caught were mostly small pelagics such as skipjack tuna, mackerels and scads.

Coastal Waters of Tingloy, Batangas

In general, the water quality of coastal waters of Tingloy was still within the DENR standard for Class SA coastal and marine waters except for some areas in the total and fecal coliforms standard. Bonito and Sto Tomas are way beyond the maximum DENR standard for coliforms. All sites have high total suspended solids value for all quarters which indicate the degree of sedimentation in Tingloy. Among the five sites, the coastal waters in Sto. Tomas exceeds the allowable limit for Class SA marine water. Sto. Tomas has the highest readings in oil and grease, BOD, and fecal coliforms. It also has a high reading in total suspended solids and total coliforms. The level of oil and grease in Sto. Tomas showed that Tingloy is not spared from oil spill in Batangas. With these results, resort establishment is not advisable along the coast of Sto. Tomas.

Conclusion and Recommendations

The development of methodological framework for environmental monitoring involved the participation of coastal communities (i.e. fishermen) and institutions. However it appears that the fishermen need more practice for biological survey of benthic lifeforms as well familiarization with the scientific description of these substrate cover. In addition, consultation with the fishermen are necessary to improve the existing method or in trying another method like the point-intercept transect, whichever suits their capability.

In retrospect, the benefits in the development of the methodological framework are the following: (1) The community and institutions are given a chance to participate and share their indigenous and scientific knowledge; (2)The fishermen are empowered in the development process of the framework; (3)The baseline characterization of the coral reef ecosystem is determined through the combined efforts of the community; (4) The framework could serve as a guide that can be applied by other coastal communities. Modifications may be made due to differences in human activities in the area.

Limitations are as follows: (1) Its application in other areas may be limited by the capacity of the fishers in the area. Thus training of these fishermen should be considered; (2) Its application would require going into the different components of the framework and this would entail time and money. However, this framework could give a starting point for the development of other methodological framework in other communities.

(3) Not all indicators were monitored due to time and financial constraint; (4). In this study, some local names of reef fishes were not identified. It is therefore recommended that a study be conducted for a uniform identification of reef fishes with its local name, English name, and scientific name.

Acknowledgement

The authors would like to acknowledge the following: ICRS for the travel support, Kabang Kalikasan ng Pilipinas (WWF-Philippines) for the research grant, Dr. Ida M. Siason, former UPVisayas Chancellor, PGENRO Batangas, SESAM-UP Los Banos, LGU-Tingloy and the fishermen of Tingloy, Batangas.

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