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SOCIAL AND BIOPHYSICAL ASSESSMENT OF MARINE PROTECTED AREAS IN THE VISAYAS, PHILIPPINES

CONTENTS

Edited by

Angel C. Alcala, Imelda Flores, Celia Acedo and Gianani Gloria
SILLIMAN UNIVERSITY
Dumaguete City, Philippines

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Introduction

The eight papers in this volume discuss two basic aspects of marine protected area (MPA) establishment and management: (1) biophysical assessment and monitoring; and (2) social profiling of local communities and stakeholders who are dependent on coastal and marine resources and are responsible for the protection and management of these resources in the Visayas, Philippines.

The research project, as originally conceptualized, aims to provide the bio-physical and social baseline information for several MPAs in the Bohol Sea and the Visayan Sea, a major gap in the current nationwide effort in coastal/marine resource management (CRM). The baseline information is meant to serve as basis for future research and monitoring to assess the biodiversity and socio-economic impacts of marine protected areas. This way, the Commission on Higher Education (CHED), through its support for higher education faculty research, would contribute at least to food security in terms of potentially improved fisheries management, if not alleviation of poverty in coastal areas.

The eight papers are the result of the research collaboration of 16 higher education institutions (HEIs) faculty members, biologists, technical persons, and MPA managers. They are based on the research reports submitted earlier to the Silliman University CHED-Zonal Research Center under a GIA grant from the CHED by faculty-researchers and technical staff of five state universities and colleges and one city government. The five HEIs are Central Philippine University in Iloilo City (lead institution); Siquijor State College in Larena; Negros Oriental State University in Dumaguete City; Southern Leyte State University in Sogod; and Central Visayas State College of Agriculture, Forestry and Technology in Candijay. The lone local government unit is Sagay City, Negros Occidental. The Silliman University-Angelo King Center for Research and Environmental Management (SUAKCREM) provided technical services, as well as use of research facilities and library resources for the project.

The planning, data-gathering, and writing of the reports submitted to CHED and the preparation of manuscripts by the authors of the eight papers took more than one year, in 2005 through May 2006. The process of editing and final preparation of the manuscripts for publication, including the illustrations, required several months, ending in December 2006. The reader can appreciate the large amount of work both in the field and in the offices of the participating institutions that made possible this notable accomplishment.

We hope that the findings, conclusions, and recommendations in this volume will be useful to the faculty participants, local government units, nongovernment organizations (NGOs), people's organizations (POs), and MPA managers, especially in the Visayas.

As the initiator of the project and final editor of the eight papers, I wish to express my gratitude to those who contributed to this publication, particularly my CHED staff Jasper Maypa, Emily Layos, Geraldine Lopez, and Gianani Gloria.

Angel C. Alcala, Ph.D.
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December 26, 2006

PERSONAL AND HOUSEHOLD PROFILE, PERCEPTIONS AND ASPIRATIONS OF THE DEPENDENT POPULATIONS NEAR MARINE PROTECTED AREAS IN THE VISAYAS, PHILIPPINES

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ABSTRACT

This study was conducted in 2005 to determine the personal and household profile, perceptions, and aspirations of the dependent populations near Marine Protected Areas (MPAs) in the Visayas. Specifically, the study aims to (1) determine the personal background, primary and secondary work, and monthly income of the respondents; (2) determine their household size, number of children in school, number of working household members, total monthly income, and total monthly expenses; (3) determine the assets they owned, their type of housing, household facilities, and disposal of wastes; and (4) determine their perceptions on their household situation, changes in the community, their aspired prominence, general aspiration in life, and education of children.

The study is descriptive and used the one-shot survey design. The respondents are the local officials, officers and members of fisherfolk associations in the barangays where the marine protected areas (MPAs) are located. The researchers used stratified sampling to proportionately allocate the number of respondents from all the fisherfolk associations. Data collection was done through a structured interview. The respondents are generally in their middle ages, males, married, and reached elementary education. Most of them consider fishing as their primary income source and have an average income of P2,773.39 monthly.

Comparing their present household situation and their perceived situation in the next five years, more than half of the respondents said that they have a relatively better situation. The majority of the respondents also perceive the present condition of their communities to be relatively better than the situation five years before. Even with relatively positive perception of their present condition, they still want to be financially stable and hope that their children finish college. Three-fourths of the respondents do not want their children to become fisherfolk.

INTRODUCTION

A Marine Protected Area (MPA) is defined as any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which have been reserved by law or other effective means to protect part or all of the enclosed environment (Resolution 17.38 and 19.46 of the IUCN general assembly, as cited by Christie & McCay (2003). MPAs have emerged as popular tools for marine conservation and fisheries management. Although many types of MPAs exist (e.g., reserves, sanctuaries, and parks), each involves a group of people collectively engaged in deciding biological and social goals (Christie & McCay 2003).

Many organizations and government agencies are active nationwide in establishing protected areas like marine reserves, marine sanctuaries and marine parks. Marine reserves, or no-take marine areas, are areas of marine environment protected from various forms of human exploitation, especially fishing. Marine reserves are synonymous with marine protected areas, marine harvest refugia, and marine sanctuaries. The areas outside the reserves are referred to as non-reserves or fished areas, where fishers are allowed to fish using traditional and non-destructive fishing methods (Alcala and Russ 1990, Alcala 2001, Indab & Suarez-Aspilla 2004). Protected areas are fast gaining popularity as management tools for protecting and managing fisheries. They are also used as a conservation tool for preserving biodiversity (Alcala 2001). Developing a marine protected area is a complex process involving not only the meeting of technical requirements but also the soliciting of community recognition and support of MPA objectives through education and social empowerment (Russ & Alcala 1999). The success of this approach depends on the support and participation of the stakeholders and concerned government agencies (Oracion 2003).

The Philippines has more than two decades of experience with community-based coastal resource management initiatives in which marine sanctuaries play an important role (Crawford et al. 2000, as cited by Indab & Suarez-Aspilla 2004). Most marine protected areas in the country are coral reefs, although a few are mangroves and fewer still are seagrass beds. One aspect common to these areas is the high production of fisheries and other economically important species (Alcala 2001).

Marine reserves are considered key elements of Community-based Coastal Resource Management (CBCRM) in the country. Almost all CBCRM projects include a provision for the establishment of marine reserves as a strategy to allow recovery of degraded mangroves, coral reefs, and their resources (Alcala 1998). Generally, CBCRM projects in the Philippines include: (1) social preparation and community organizing; (2) environment education and capacity building; (3) resource management planning, including protective management; (4) support activities for livelihood and financial resource mobilization; (5) research and monitoring; and (6) networking activities. The effort and time allocation to these activities differ from project to project. In general, however, the social preparation, community organizing, and environmental education are given priority and importance in the early stages of project implementation.

From the late 1970s to the late 1990s, there were few fisheries or coastal resource-related programs and projects that either incorporate various degrees of community participation or were fully community-based in character (Alcala 1998). Some of these projects were small and limited to specific localities. There were also large projects whose coverage is regional or national in scope. At present, many of the 350 MPAs (SUAKCREM, unpublished manuscript) are probably community-based or are co-managed by local government units (LGUs). But many MPAs in this list are not well-managed (Alcala unpublished data). Indab and Suarez-Aspilla (2004) in their study on the status, direction, and management issues of marine protected areas of the Bohol (Mindanao) Sea, noted that much needs to be done on marine sanctuaries in the Philippines.

A recent report of Alcala et al. (2006) showed that MPAs cause the improvement of fisheries, marine biodiversity, and livelihood of stakeholders in 16 countries worldwide. These are managed primarily either by local governments and local communities; or by central governments and their agencies, many of which received financial support from international NGOs and international funding agencies. In this study, the authors confirmed that fisheries,

biodiversity and livelihoods are all improved in areas where MPAs are co-managed by local government units and local communities.

Oracion's study (2002) on the perceptions of stakeholders of the status of their MPA revealed that the stakeholders consider marine sanctuaries in better condition during the survey compared to five years ago. About 85% of those stakeholders who gave favorable rating to the present condition of marine sanctuaries said that these are not polluted, resulting in an improved condition of fishes and corals. Similarly, Pomeroy and co-authors (2003) confirmed the perceptions of fishing households that fisheries and marine resources are improved through effective management of marine sanctuaries.

Results of observations and experiments relating to coral reef fisheries in central Philippines have been presented by Alcala (1998). Coral reef fisheries were found in abundance and greater variety after 10 to 15 years of protection, depending on the species. There was also an increase in the quantity of fish caught from the non-reserve area during the period that the reserve was protected. However, fish abundance in the reserve was reduced after protection was lifted. When protection of the reserve was restored, fish abundance and density again increased.

Study Areas

Seven MPAs were covered by the study in 2005. Three of them are located on Siquijor Island, namely the Tulapos MPA in Tulapos, Enrique Villanueva; Tubod MPA in Tubod, San Juan; and Nonoc MPA in Nonoc, Larena. Two are in Southern Leyte, which are the Biasong MPA in Biasong, Libagon; and the Tomas Oppus MPA in San Antonio. The remaining two are the Panas MPA in Panas, Candijay, Bohol; and the Sagay Marine Reserve in Sagay City, Negros Occidental.

All of the MPAs were created through a municipal ordinance. As regards the Sagay Marine Reserve, the efforts to strengthen the establishment and management of it led to the passing of Republic Act No. 9106 (An Act for the Establishment and Management of Sagay Marine Reserve, Defining its Scope, Coverage and for other Purposes). The Senate and the House of Representatives passed this on February 8, 2001 and presented this to the President on March 15, 2001. Then President Joseph Estrada approved the law on April 14, 2001.

Records show that all the MPAs covered by this study were created in early 2000 to preserve and maintain productive, biologically diverse, and ecologically balanced ecosystems. It is important to determine whether after at least three years, the aims for establishing the MPAs have been achieved and whether or not the MPAs have benefited the fisherfolk and the entire community.

Toward this end, there is a need to establish baseline information for each of the MPAs. The baseline data would be the basis for improving management practices and for the long-term implementation of coastal resource management initiatives.

Objectives and Significance of the Study

The general objective of this study is to determine the personal and household profile, perceptions, and aspirations of the dependent population near the Marine Protected Areas in the Visayas. Specifically, the study aims to:

1. determine the personal profile of the dependent population in terms of background, primary and secondary work, and monthly income of the respondents;
2. determine their household size, number of children in school, number of working household members, total monthly income, and total monthly expenses; and
3. determine their perceptions on their household situation, changes in the community, their aspired prominence, general aspiration in life, and education of children.

Results of this study would be very helpful in determining the status of the MPAs, the community, and its people after at least three years of the MPAs' declaration and establishment. Specifically, results of the study would be significant to the following:

Fisherfolk. The study could provide information whether or not their living conditions improved as a result of the MPAs' declaration and establishment.

The study could also help identify policies that are detrimental or favorable to the economic activities of the people living near the MPAs.

MPA Managers/Leaders and Policy makers. MPA managers, leaders, and policy-makers would be made aware of the policies, rules, and regulations that need to be strengthened or changed so that future decisions would truly reflect the needs of the people, the community, and all stakeholders of MPAs.

Introduction. Knowing the status and needs of the people and identifying the policies, rules, and regulations that need to be strengthened will eventually lead to a productive community. Improving the living conditions of the people and strengthening the management of MPAs could help improve the economic condition of those who are directly dependent on their coastal and marine resources, as well as the whole community.

Overall, the results of the baseline study would be beneficial to the marine environment. The improvement in policies and approaches to MPA management would ensure a highly productive, biologically diverse, and ecologically balanced marine ecosystem. The data generated by this study could also serve as basis for future studies.

RESEARCH METHOD

Research Design

The study is descriptive and used the one-shot survey design. It aims to determine the personal and household profile of the dependent population; know their perceptions on their household situation and changes in the community including their aspired prominence or the extent to which the respondent would want to be known (i.e., within the barangay, municipality, province), general aspiration in life and education of children; describe the fishing practices of the dependent population, their problems encountered and perceptions of change in the fishing industry; and to know their awareness, perception, and reaction about the MPAs' declaration of their area.

Study Population and Sample

The total study population was composed of 192 local officials, officers, and members of fisherfolk association in the barangays (villages) where the MPA is located. Sample size was computed based on the list of officers and members of the fisherfolk organizations of all the target areas. The researchers used stratified sampling to proportionately determine the number of respondents from all the fisherfolk associations. Systematic sampling with random start was followed in identifying the survey respondents.

Data Collection and Survey

Data collection was done through Structured Interview. The interviewer used an Interview Schedule in asking and recording the answers of respondent. Prior to the conduct of the actual data collection, the interviewers were oriented on the content of the instrument and trained on how to conduct one-on-one interviews.

The research instrument was validated by an expert juror and was pre-tested in one MPA in the Municipality of Dauin, Negros Oriental. The instrument was modified and finalized after the pre-testing.

After the primary data collection was done through structured interview, secondary data were also obtained from Barangay and Municipal Resolutions and/or Ordinances.

Data Processing and Analysis

Data processing and generation of tables was done at the University Research Center of Central Philippine University using Statistical Package for Social Sciences (SPSS) Version 12. Since this is a descriptive study, frequency distribution tables and means were the main statistical measures used.

RESULTS

Personal and Household Profile of Respondents

Table 1 shows the personal background of the respondents. The mean age of the respondents is 44.72 years and 30.2% of them are 41 to 50 years old. Only 14.6% are 30 years or younger while 10.4% are more than 60 years old. More than 93% of the respondents were males; 6.3% are females. More than 93% of the males are married while the rest (9.9%) are single. About 58.9% had elementary-level education. Only 1.6% of them had no formal education and 14.1% had college-level education.

Since the respondents of this study are basically fisherfolk, 121 or 63.0% considered fishing as their primary work (Table 2). Other respondents are primarily farmers (10.4%), laborers (8.8%) and employees (6.3%). From their primary work, the respondents get an average income of P2,773.39 monthly. More than half of the respondents said that their monthly income ranges from P1,001 to P3,000, while 20.7% receive P1,000 and below and 8.9% receive more than P5,000 monthly. Aside from their primary work, 125 or 65.1% of the respondents had secondary sources of income. Of those having secondary work, almost half (49.6%) consider fishing as their secondary work. The rest included work as farmer/caretaker (28.8%), laborer (9.6%) and LGU official (6.4%).

From their secondary work, 54.4% get an additional income of P1,000 and below while 28.0% get additional income ranging from P1,001.00 to Php 2,000.00 monthly or an average of P1,583.80 monthly. As a whole, the respondents receive an average of P4,357.19 monthly (63.65% from primary and 36.35% from secondary income sources).

Data in Tables 2 and 3 also reveal that of the 192 respondents, 121 (63.0%) consider fishing as their primary income source while 32.3% consider fishing as their secondary income source. Ten respondents are into buying and selling fish. These indicate the direct involvement of the respondents in fishing in their respective areas.

The data in Table 4 show that most of the respondents' households have 3 to 4 members (40.6%) followed by those with 5 to 6 members (27.1%), those with less than 3 members (12%) and those with more than 8 members (5.7%). The average household size is 4.74 members. Of this household size distribution, the respondents' household has an average of 2.43 male members and 2.31 female members. About 6 out of 10 households (59.4%) have one or two male members and about the same proportion of households (62.0%) have the same number of female members. This indicates that there are more or less the same number of males and females in the respondents' households.

The data further show that the age of majority of household members ranged from 11 to 20 years old (29.7%), followed by those within 21 to 30 (28.6%), and from 31 to 40 (21.4%). About 5.2 % are 60 years old or below while less than 1% are 10 years old or below. The mean age of household members was 30.35 years old, indicating that the households have relatively younger members.

As shown in Table 5, 120 respondents or 62.5% have one to two children of school age while 72 or 37.5% have more than two children of school age. Results, however, show that 135 or 70.3.3% of the respondents have one or two children who are in school but only 57 or 29.7% of the respondents have more than two children in school. This means that not all children of school age are in school, particularly those of families with more than 2 children of school age. The households have an average of 2.09 children of school age but they have an average of only 1.7 children in school.

Table 6 shows that 86.5% of the households have one to two working members. The respondents' households have an average of 1.62 working members. Given the average household size of 4.74, a burden or dependency ratio of 2.93 was computed. This means that each working member is supporting almost 3 household members.

The data in Table 6 also show that the respondents' households are earning an average of P5,285.90 monthly. Considering the average income of the respondents from their primary and secondary income sources of P4,357.19, the figures

imply that other members of the household are able to contribute an average of P928.70 or 17.6% of the total household income. This also implies that the primary breadwinner is responsible for 82.4% of the total household revenues. Most of the respondents' households (43.8%) have a total household income of P3,001 to P6,000 monthly, 30.7% have Php 3,000 and below, and only 3.1% have more than P15,000.

On the other hand, Table 7 shows the estimated yearly household expenses of the respondents for the education of their children, medical expenses, food, clothing, recreation, utilities, and other household expenditures. For the education of their children, the respondents spent an average of P12,946.17. Although most of them (37.5%) have not spent any amount and 12% only spent P2,000 or less, 22.4% spent more than P10,000. Please note that the respondents' households have an average of 1.7 children who are in school.

Their medical expenditures show that the bulk of the respondents (66.1%) spend P2,000 or less and 26% spend from P2,001 to P6,000. Only 3.6% spend more than P10,000. The respondents spend an average of P2,762.88 for medicine.

In terms of their food expenditures, the respondents spend an average of P24,414.14 yearly, with 86.5% of them spending more than P10,000. The remaining proportion (13.5%) spend only P10,000 or less. For clothing, the majority of the respondents (69.3%) spend P2,000 or less yearly. Only 5.2% spend more than P10,000. On the average, the respondents spend P2,345.55 yearly for clothing alone.

Although one-third of the respondents did not give any answer regarding their recreation expenditures, 22.9% claimed that they spend P2,001 to P4,000 for recreation and 21.9% spend P2,000 or less. Only 4.2% spend more than P10,000 for recreation. The respondents spend an average of P4,092.16 for recreation yearly.

The data also show that 21.4% of respondents spend an average of P4,472.63 for utilities, with 5.2% spending P2,000 and below and 4.2% spending more than P10,000. There are 78.6% of respondents who did not report any expenditure for utilities. The same proportion of the respondents reported the same amount for other household expenditures.

For their total household expenditures, the respondents spend an average of P45,723.25 yearly. The greatest proportion of them (33.9%) spend more than P50,000, while 22.4% spend P30,001 to P40,000. Only 5.2% spend P10,000 and below (Table 8). Based on the average figures, the bulk of their household expenditures goes to food (42.42%), followed by education of children (22.49%), other expenditures include: (11.34%) utilities (7.77%), recreation (7.11%), medical (4.80%), and clothing (4.07%) and other expenditures (11.34%). With a mean household size of 4.74, it is estimated that each household member spend an average of P12,143.37 yearly or P1,011.95 monthly.

Considering the average monthly household income of the respondents of P5,285.89 monthly or P63,430.68 yearly, the respondents' households could save an average of P17,707.43 yearly or 27.9% of their total household income.

Perceptions and Aspirations

In the study, the respondents were asked about the situation of their respective households five years ago, as well as the situation at present and five years hence. Majority of the respondents (60.9%) consider their household situation to be at the minimum subsistence level five years ago. About one-fifth (20.3%) are at the health and decency level, 16.1% at the poverty level, and 2.6% at the comfort level (Table 9).

Comparing their present condition with that five years ago, the majority (63.5%) perceive it to be similar. About 18.2% claim that they are either relatively poorer or relatively better (Table 10). Data in Table 11, however, show that 75.0% of the respondents perceive themselves to be at the minimum subsistence level, 14.1% at the health and decency level, 10.4% at the poverty level and only 0.5% at the comfort level. The data in Table 10 and Table 12 indicate that the proportion of those in the minimum subsistence level increased by 14.1% because 5.7% and 8.3% of the respondents said that their household situation has improved and declined, respectively.

Comparing their present household situation and their perceived situation five years after, 53.6%

of respondents said that they have relatively better situation, 40.1% see a similar situation, and 6.3% see a relatively poorer situation (Table 11). This perceived change in their household situation is manifested in Table 11 by the decrease in the proportion of those at the lower two levels by 28.7% and the increase in the proportion of those at the higher levels by the same proportion of the respondents. The respondents who perceive that they are at the poverty level at present declined from 10.4% to 3.1% and those at the minimum subsistence level declined from 75.0% to 53.6 percent. On the other hand, those at the health and decency level and at the comfort level increased from 14.1% to 33.3% and from 0.5% to 9.9%, respectively.

The respondents were also asked about their perception of the situation of their communities five years ago, at present and five years after. Their comparison is reflected in Table 12 and Table 13. About 54.7% of the respondents perceive the present condition of their communities to be relatively better than its situation five years ago. There are 71.3% of respondents who said that their communities will be relatively better five years after.

On the other hand, 31.8% and 25.0% of the respondents perceive the situation of their communities to be relatively the same five years ago and five years after, respectively; while 13.5% and 3.6% of the respondents perceive the situation of their communities to be relatively poorer five years ago and five years after, respectively.

Presented in Tables 14, 15, and 17 are the aspirations of the respondents. As shown in Table 14, 65.6% of respondents want to be known only in their respective barangays. Meanwhile, 19.8% of respondents do not want to be known, while 12.5%, 1.6%, and 0.5% want to be known in their municipality/city, province and throughout the country, respectively.

About 50.5% of respondents want to be financially stable, 33.9% want to remain fisherfolk but successful ones, 9.4% want to own business enterprises and the rest have other general aspirations in life (Table 15). With regard to their aspired education for their children, 76.6% of the respondents want their children to finish college while 13.5% and 4.2% want their children to finish high school and elementary, respectively. Moreover, 2.1% and 0.5% want their children to earn master's and doctoral degrees, respectively (Table 16).

When respondents were asked if they want their children to become fisherfolk like them, 75.0% answered in the negative and only 19.3% want their children to be one (Table 17). Those who do not want their children to become fisherfolk like them said that they want their children to finish their studies (36.1%), they consider fishing to be a difficult and risky job (12.5%) , and they do not want their children to experience what they have experienced (10.4%). Those who want their children to be fisherfolk like them said that they need help in fishing (35.1%), their children should follow in their footsteps (19.0%), they could help increase their household income (16.2%), the children themselves want to be fisherfolk (13.5%), and that they cannot do anything else but go into fishing (10.8%).

DISCUSSION

The estimated annual average household income of the respondents which is P63,430.68 is very low compared to the estimated average income of Filipino families which is P144,039 (NSCB, 2000). According to the National Statistics Coordination Board (NSCB), the average savings of Filipino families in the year 2000 was P26,037 yearly, higher than the average household savings of the fisherfolk covered by this study, which is only P17,707.43. If the average family income and savings of the fisherfolk are further compared with the average income and savings of the families in Central Visayas (Region VII), the data show that their average family income is lower than that of Region VII, but their average savings are higher than those of the families in Region VII.

The computed average monthly and annual incomes of the respondents are based on the assumption that they are regularly doing fishing and other income generating activities. It should be noted that oftentimes, they have also encountered problems like low fish catch, destroyed or lost accessories and bad weather conditions. Considering these factors and a high dependency ratio of 1:3, it is justifiable that the respondents will view their present condition

to be at the minimum subsistence level. This is also the main reason there is a discrepancy between the average number of school age children and the mean number of children who are in school. It is therefore very important that the social preparation and community organizing stages, as well as the support activities for livelihood and financial resources mobilization, be given importance during the MPA establishment. As mentioned in the study of Alcala (1998), and Alcala and Russ (2000), a community should be given the opportunity to identify its own needs and the problems it must solve to improve the socio-economic well-being.

The perception of the majority of the respondents that the present condition of their communities is relatively better than its situation five years before and that their communities will also be relatively better five years from now (assuming MPAs are successful) supports the findings of Alcala (2005) which indicate that the MPAs have caused the improvement of fisheries, marine biodiversity, and livelihood of stakeholders in a number of cases.

The majority of the respondents aspire to have a better future for their family. They want their children to finish college or even acquire advanced degrees and do not want them to become fisherfolk. These findings are also consistent with the result of the study conducted in Dauin municipality and Apo Island (Negros Oriental) by Oracion et al. (2005) which revealed that the fisherfolk want their children to become nurses and work outside the country in order to receive higher salaries. They also hope that their children would become seafarers overseas, draftsmen, police officers, electricians, artists, and government workers.

The findings of the study which show an increase in the fisherfolk population, improvement in fish catch, and control of illegal fishing support that of Oracion (2002) and Pomeroy et al. (2003). These studies revealed that the sanctuaries are in better conditions and the majority of stakeholders gave favorable rating to the present condition of marine sanctuaries. These positive perceptions are attributed to the effective management of marine sanctuaries.

Like other people, fisherfolk have their own aspirations in life, as well as for their children. In two MPA areas, Dauin municipality and Apo island, Negros Oriental, Oracion et al. (2005) found that 33 % of the children preferred to work outside Dauin or Dumaguete. In fact, three out of 21 of them dream of becoming nurses and working outside the country in order to receive higher salary. Less than one-third of them want to become seafarers overseas, draftsmen, police officers, electricians, artists and government workers. But there are males who are just contented with fishing, farming, carpentry, or being a *Bantay Dagat*. In contrast to their children's aspiration to work outside Dauin, 95% of the parents do not have any plans to migrate. Half of them are already contented with their livelihood and have no better place to go. Moreover, they consider their community peaceful.

On Apo Island, the work aspirations of the children vary. Almost one-third of the children want to become teachers while the rest of the females want to become computer experts, doctors, stewardesses, midwives, journalists, and office workers. Three out of seven males want to become engineers, while two want to become police officers, and one wants to be a dive guide. Only one of them said he wanted to become a fisherfolk like his father. The number of children who prefer to work in other countries was smaller than half of the interviewees. More females prefer to stay on the island, which is two-fifths of the total number of children who were participants of the study. Higher pay or more job opportunities are the reasons for their aspiration to work outside their island or go abroad. None of the households plan to move out of the island since they have been enticed by its fishing potential.

SUMMARY

Personal and Household Profile of Respondents

The mean age of the respondents is 44.94 years and most of them are in the age range of 41 to 50 years old. About 9 out of 10 respondents are males. Majority of the respondents have elementary level of education. The respondents in the study are generally

in their middle ages, males, married and elementary educated.

Majority of the respondents consider fishing as their primary work and from their primary work, the respondents get an average income of P2,773.39 monthly. Aside from their primary work, 125 of the respondents have secondary sources of income that give them an average income of P1,583.80 monthly. As a whole, the respondents receive an average income of P4,357.19 monthly, with 63.65% from primary and 36.35% from secondary income sources.

Most of the respondents have households with 3 to 4 members. Their average household size is 4.74 members with an average of 2.44 male members and 2.30 female members or a sex ratio of 1.06. About 6 out of 10 households have 1 to 2 male members and about the same proportion of households have also the same number of female members, indicating more or less the same number of males and females in the respondents' households. The mean average age of household members is 30.35 years, indicating that the households have relatively younger members. The households have an average of 2.09 children of school age but they have only an average of 1.67 children in school. This means that not all of the children of the respondents who are of school age are in school.

The respondents' households have an average of 1.62 working members with more than 8 of 10 respondents having households with 1 to 2 working members. Given the average household size of 4.74, a burden or dependency ratio of 2.93 was computed which means that each working member is supporting almost 3 household members. The respondents' households earn an average of P5,285.89 monthly. Given the average income of the respondents from their primary and secondary income sources of P4,357.19, the figures imply that other working members of the household are able to contribute an average of P928.70 or 17.6% of the total household income. This also implies that the primary breadwinner is responsible for 82.4% of the total household revenues.

The respondents spend an average of P12,945.17 for the education of their children, P2,762.88 for medicine, P24,414.14 for food, P2,345.55 for clothing, P4,092.16 for recreation, P4,472.63 for utilities and the same amount for other household expenditures yearly. As a whole, the respondents spend an average of P45,723.25 yearly. Based on average figures, the bulk of their household expenditures goes to food, followed by education of children, utilities, recreation, medical, clothing and other expenditures. With the average monthly household income of the respondents of P5,264.30 or P63,171.60 yearly, the respondents' households are capable of saving an average of P17,448.35 yearly, or 27.5% of their total household income.

Perceptions and Aspirations

The study reveals that majority of the respondents consider their household situation five years ago at the minimum subsistence level. The majority of them also perceive that their current household is still at the minimum subsistence level. Comparing their present household situation and their perceived situation five years from now, more than half of the respondents claimed to have a relatively better situation. The study also shows that majority of the respondents perceive the present condition of their communities to be relatively better than its situation five years ago. The majority of the respondents further perceive their communities to be relatively better five years from now.

Majority of the respondents want to be known locally only in their respective barangays. About half of them want to be economically stable and more than three-fourths of the respondents want their children to finish college. Consequently, about the same proportion of the respondents do not want their children to become fisherfolk like them.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn from the study. Recommendations are underlined.

1. The stakeholder-respondents have shown a high level of awareness of the importance of MPAs as a means to improve the status of fisheries resources and the quality of human life. <u>There is a need to develop more commitment to protection and management of the coastal and marine resources.</u>

2. The households, consisting basically of young people involved in fishing and are characterized by a high dependency ratio of 2.93, earn only a low income of P5,000 to P6,000 monthly. There is an urgent need for coastal communities to protect their coastal and marine resources, including fisheries, to allow recovery of the resources to the point where exploitation would be sustainable. MPA establishment is one of the management options.
3. The respondents are optimistic about the future, despite the low incomes. Comparing their present household situation with their perceived situation five years from now, more than half of them project a relatively better situation. The majority of the respondents also perceive the present condition of their communities to be relatively better compared to that five years ago. This optimism will only come true if their major source of livelihood, that is, coastal and marine resources, are safeguarded and managed well.
4. Part of the optimism could be due to the wish of the respondents (75% of total) that their children would become skilled workers and professionals, no longer fishers. If this aspiration comes true, then less exploitation pressure would be exerted on coastal and marine resources, allowing these depleted resources to recover over time.
5. Majority of the respondents want to be economically stable and known locally only in their respective barangays.
6. The results of this study should be presented to the different stakeholders of the MPAs studied for their appreciation and use.
7. Government and non-government agencies responsible for MPA establishment should use indicators for evaluation as to whether or not MPA goals and objectives are achieved. These indicators shall cover governance, biophysical and socioeconomic aspects.

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Table 1. Personal background of the respondents (N = 192).

Categories		Frequency	Percent
Age			
30 years old and below		28	14.6
31 – 40		49	25.5
41 – 50		58	30.2
51 – 60		37	19.3
61 years old and above		20	10.4
	Total	**192**	**100.0**
Mean Age = 44.94 years old			SD = 13.18
Sex			
Male		180	93.8
Female		12	6.3
	Total	**192**	**100.0**
Marital Status			
Single		19	9.9
Married		173	90.1
	Total	**192**	**100.0**
Educational Attainment			
No formal education		3	1.6
Elementary		113	58.9
High School		49	25.5
College		27	14.1
	Total	**192**	**100.0**

Table 2. Distribution of respondents according to their primary work and monthly income (N = 192).

Categories		Frequency	Percent
Primary Work			
Fish buying and Selling		8	4.2
Fishing		121	63.0
Farming		20	10.4
Small Business/Sari-Sari Store		3	1.6
Laborer		17	8.8
Employee		12	6.3
Driver		5	2.6
LGU Official		6	3.1
	Total	**192**	**100.0**
Monthly Income			
P1000 and below		40	20.7
P1001 – P2000		54	28.1
P2001 – P3000		46	24.0
P3001 – P4000		22	11.5
P4001 – P5000		13	6.8
P5001 and above		17	8.9
	Total	**192**	**100.0**
Mean Income = P2773.39			SD = P1718.39

Table 3. Distribution of respondents according to their secondary work and monthly income (N = 125).

Categories		Frequency	Percent
Secondary Work			
Fish buying and Selling		2	1.6
Fisherfolk		62	49.6
Farmer/Caretaker		36	28.8
Small Business/Sari-Sari Store		3	2.4
Laborer		12	9.6
Escort		1	0.8
Driver		1	0.8
LGU Official		8	6.4
	Total	**125**	**100.0**
Monthly Income			
P1000 and below		68	54.4
P1001 – P2000		35	28.0
P2001 – P3000		11	8.8
P3001 – P4000		1	0.8
P4001 – P5000		2	1.6
P5001 and above		4	3.2
No Data		4	3.2
	Total	**125**	**100.0**
Mean Income = P1583.80			SD = P2154.74

Table 4. Distribution of respondents according to their household size, average age of household members, and number of male and female household members (N = 192).

Categories		Frequency	Percent
Household Size			
2 and below		23	12.0
3 – 4		78	40.6
5 – 6		52	27.1
7 – 8		28	14.6
9 and above		11	5.7
	Total	**192**	**100.0**
Mean = 4.74			SD = 2.15
Average Age			
10 years old and below		1	0.5
11 – 20		57	29.7
21 – 30		55	28.6
31 – 40		41	21.4
41 – 50		18	9.4
51 – 60		10	5.2
More than 60		10	5.2
Total		**192**	**100.0**
Mean = 30.35 y.o.			SE of Mean = 1.08
Number of Male Members			
2 and below		114	59.4
3 – 4		64	33.3
5 – 6		11	5.7
7 – 8		3	1.6
	Total	**192**	**100.0**
Mean = 2.43			SD = 1.36
Number of Female Members			
2 and below		119	62.0
3 – 4		55	28.6
5 – 6		18	9.4
	Total	**192**	**100.0**
Mean = 2.31			SD = 1.40

Table 5. Distribution of respondents according to number of school age children and the number who are presently in school (N = 192).

Categories	Frequency	Percent
No. of School Age Children		
2 and below	120	62.5
3 – 4	51	26.6
5 – 6	14	7.3
7 – 8	7	3.6
Total	**192**	**100.0**
Mean = 2.09		SD = 1.97
No. of School Age Children in School		
2 and below	135	70.3
3 – 4	45	23.4
5 – 6	10	5.2
7 – 8	2	1.0
Total	**192**	**100.0**
Mean = 1.67		SD = 1.67

Table 6. Distribution of respondents according to their number of working household members and total household income (N = 192).

Categories	Frequency	Percent
No. of Working Household Members		
None	4	2.1
1 - 2	166	86.5
3 – 4	17	8.9
5 – 6	5	2.6
Total	**192**	**100.0**
Mean = 1.62		SD = 0.93
Total Household Monthly Income (PhP)		
P3000 and below	59	30.7
P3001 – P6000	84	43.8
P6001 - P9000	24	12.5
P9001 - P12000	13	6.8
P12001 - P15000	1	.5
More than P15000	6	3.1
No answer	5	2.6
Total	**192**	**100.0**
Mean = P5285.9		SD = 5981.04

Table 7. Distribution of respondents according to their estimated household expenses per year (N = 192).

Categories		Frequency	Percent
Education of Children			
P2000 and below		23	12.0
P2001 – P4000		18	9.4
P4001 – P6000		17	8.8
P6001 – P8000		12	6.3
P8001 - P10000		7	3.6
P10001 and above		43	22.4
None		72	37.5
	Total	**192**	**100.0**
Mean = P12945.17			SD = P16733.83
Medical Expenses			
P2000 and below		127	66.1
P2001 - P4000		31	16.1
P4001 - P6000		19	9.9
P6001 - P8000		3	1.6
P8001 - P10000		1	.5
P10001 and above		7	3.6
None		4	2.1
	Total	**192**	**100.0**
Mean = P2762.88			SD = P8261.06
Food			
P2000 and below		10	5.2
P2001 – P4000		6	3.1
P4001 – P6000		7	3.6
P8001 – P10000		3	1.6
P10001 and above		166	86.5
	Total	**192**	**100.0**
Mean = P24414.14			SD = P17248.55
Clothing			
P2000 and below		133	69.3
P2001 - P4000		16	8.3
P4001 - P6000		23	12.0
P6001 - P8000		1	.5
P10001 and above		10	5.2
No Answer		9	4.7
Total		192	100.0
Mean = P2345.55			SD = P3620.22

Table 7. Distribution of respondents according to their estimated household expenses per year (continued).

Categories		Frequency	Percent
Recreation			
P2000 and below		42	21.9
P2001 - P4000		44	22.9
P4001 - P6000		23	12.0
P6001 - P8000		7	3.6
P8001 - P10000		4	2.1
P10001 and above		8	4.2
No Answer		64	33.3
	Total	**192**	**100.0**
Mean = P4092.16			SD = P4524.92
Utilities		**Frequency**	**Percent**
P2000 and below		10	5.2
P2001 - P4000		7	3.6
P4001 - P6000		8	4.2
P6001 - P8000		5	2.6
P8001 - P10000		3	1.6
P10001 and above		8	4.2
No Answer		151	78.6
	Total	**192**	**100.0**
Mean = P4472.63			SD = P6455.26
Other HH Expenditures			
P2000 and below		10	5.2
P2001 - P4000		7	3.6
P4001 - P6000		8	4.2
P6001 - P8000		5	2.6
P8001 - P10000		3	1.6
P10001 and above		8	4.2
No Answer		151	78.6
	Total	**192**	**100.0**
Mean = P6526.05			SD = P5932.44

Table 8. Distribution of respondents according to their estimated total household expenses per year (N =192).

Total Expenses	Frequency	Percent
P10,000 and below	10	5.2
P10001 – P20000	18	9.4
P20001 – P30000	31	16.1
P30001 – P40000	43	22.4
P40001 – P50000	25	13.0
P50001 and above	65	33.9
Total	**192**	**100.0**
Mean = P45,723.25		SD = 30,332.02

Table 9. Distribution of respondents according to their perceived household situation level five years ago (N =192).

Household Situation	Frequency	Percent
Poverty level	31	16.1
Minimum subsistence level	117	60.9
Health and decency level	39	20.3
Comfort level	5	2.6
Total	**192**	**100.0**

Table 10. Distribution of respondents according to their comparison of their household condition five years ago with their present condition (N = 192).

Category	Frequency	Percent
Relatively the same	122	63.5
Relatively poorer	35	18.2
Relatively better	35	18.2
Total	**192**	**100.0**

Table 11. Distribution of respondents according to their perception of their household situation level (N = 192).

Category		Frequency	Percent
Household Situation			
Poverty level		20	10.4
Minimum subsistence level		144	75.0
Health and decency level		27	14.1
Comfort level		1	.5
	Total	**192**	**100.0**
Perceived Household Situation Five Years from Now			
Relatively the same		77	40.1
Relatively poorer		12	6.3
Relatively better		103	53.6
	Total	**192**	**100.0**
Aspired Household Situation Level Five Years from Now			
Poverty level		6	3.1
Minimum subsistence level		103	53.6
Health and decency level		64	33.3
Comfort level		19	9.9
	Total	**192**	**100.0**

Table 12. Distribution of respondents according to their comparison of their community situation five years ago with the present (N = 192).

Category		Frequency	Percent
Relatively the same		61	31.8
Relatively poorer		26	13.5
Relatively better		105	54.7
	Total	**192**	**100.0**

Table 13. Distribution of respondents according to their aspired community situation five years from now (N = 192).

Category		Frequency	Percent
Relatively the same		48	25.0
Relatively poorer		7	3.6
Relatively better		137	71.3
	Total	**192**	**100.0**

Table 14. Distribution of respondents according to how prominent they want themselves to be (N = 192).

Prominence	Frequency	Percent
Not known	38	19.8
Known in the barangay	126	65.6
Known in the municipality/city	24	12.5
Known in the province	3	1.6
Known throughout the country	1	0.5
Total	**192**	**100.0**

Table 15. Distribution of respondents according to their general aspirations in life (N = 192)

General Aspirations	Frequency	Percent
To be economically stable	97	50.5
To own a business enterprise	18	9.4
To travel and become successful in business	3	1.6
To remain a fisherfolk but a successful one	65	33.9
Others	9	4.7
Total	**192**	**100.0**

Table 16. Distribution of respondents according to the level of education they want their children to attain (N = 192).

Aspired Education for Children	Frequency	Percent
Elementary graduates	8	4.2
High school graduates	26	13.5
College graduates	147	76.6
Master's degree graduates	4	2.1
Doctoral degree graduates	1	0.5
Others	6	3.1
Total	**192**	**100.0**

Table 17. Distribution of respondents as to whether or not they want their children to become fisherfolk (N = 192).

Category	Frequency	Percent
Yes	37	19.3
No	144	75.0
No answer	11	5.7
Total	**192**	**100.0**
Reasons for Wanting their Children to become Fisherfolk (N = 37)		
To help me in fishing	13	35.1
To follow in our footsteps	7	19.0
To add income	6	16.2
They want to be fisherfolk	5	13.5
They can't do anything	4	10.8
They are used to fishing	1	2.7
Nothing wrong with fishing	1	2.7
Total	**37**	**100.0**
Reasons for not Wanting their Children to become Fisherfolk (N = 144)		
They should have a stable job	9	6.3
They should work in office	3	2.1
It is tiring to do fishing	4	2.8
No permanent income	5	3.5
They should finish their studies	52	36.1
They should engage in business	1	0.7
They should not experience what we have experienced	15	10.4
Risky and difficult to go fishing	18	12.5
Fish is becoming scarce	7	4.9
Children are girls	2	1.4
They are not interested	7	4.9
More fisherfolk than fish	1	0.7
Depends on their decision	4	2.8
No answer	16	11.1
Total	**144**	**100.0**

STAKEHOLDERS' AWARENESS OF MARINE PROTECTED AREAS (MPAS) AND THEIR PERCEIVED EFFECTS OF MPA DECLARATION IN THE VISAYAS, PHILIPPINES

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ABSTRACT

This study was conducted to determine the respondents' (N=192) awareness of the MPAs in the Visayas and their perception of the effects of the MPAs' declaration and their subsequent establishment. Specifically, it aimed to determine (1) the respondents' awareness of the MPAs and the major effects of the MPA declaration on their fishing activities; (2) whether or not they are fishing in the MPA and, if they are, the reasons for fishing there; (3) what the respondents thought would be the major effects of the MPA declaration in the fishing industry; (4) the respondents' expectations from the MPA declaration; (5) the respondents' observation of the positive and negative changes after the MPA declaration; (6) the respondents' perception of improvement on the quality of life from the MPA; (7) respondents' familiarity of the MPA and the processes involved in the declaration; and (8) the problems encountered and the respondents' recommendations to solve these problems.

The study included seven MPAs in the Visayas, namely the Tulapos MPA, Nonoc MPA, and Tubod MPA in Siquijor Province; Panas MPA and Cogtong MPA in Bohol Province; Biasong MPA in Southern Leyte; and Sagay MPA in Sagay City, Negros Occidental. These MPAs were created through municipal resolutions and ordinances.

The research project used the descriptive, one-shot-design survey method and was conducted in 2005. The respondents are the local government officials and the officers and members of fisherfolk associations in the baranggays (villages) where the MPAs are located. They are selected for this study using the stratified sampling technique. The interview schedule was used in collecting data and data were processed using the Statistical Package for Social Sciences Version 12.

About 97.9% of respondents are aware of the declaration of MPAs in their fishing areas. There are 71.4% who were familiar with the MPA boundaries. Around 63% of respondents have perceptions on the positive effects of the MPA declaration to their fishing activity. These positive perceptions included "improved catch of fish, shells, and seaweeds" (23.4%); "protection of the fishing area resulting to sustainable fishing" (19.8%); and "strict guarding of the area by the Bantay Dagat" (9.6%). About two-thirds of the respondents favor the declaration of MPAs.

The respondents' expectations on the MPA declaration are high, including "increase in fish density " (39.69%); "improved fish catch", "improved livelihood" (10.9%), and "illegal fishing would be controlled" (7.3%). However, the fish catch after the MPA declaration do not show the expected increase. These are similar to the findings of Valle et al. (2000) on the coastal resources of Hagonoy and Sta. Maria, Davao del Sur, which are also beset by a decline of fish catch and lack of law enforcement. This study shows that some fisherfolk still lack an appreciation of the benefits they can get from the MPAs.

About 24% of respondents identified some of the problems as "few fish catch," "unfair Bantay Dagat," "conflict among fisherfolk," and "others are not cooperating." Nevertheless, 58.3% of the respondents said that their quality of life had improve after the declaration of the MPAs. However, this is somewhat negated by the low fish catch, indicating the need to improve the management of the MPAs.

INTRODUCTION

The marine protected areas (MPAs) that are included in the study are Tulapos MPA, Nonoc MPA and Tubod MPA in Siquijor Province; Panas MPA and Cogtong MPA in Bohol Province; Biasong MPA in Southern Leyte; and Sagay MPA in Sagay City, Negros Occidental (Figure 1). Another MPA in Southern Leyte, Tomas Oppus MPA, was not included in the social survey but its corals and reef fish were surveyed.

Tulapos MPA was created through Resolution No. 2002-27 and Ordinance No. 05- 2002. These were approved by the Sangguniang Bayan of the Municipality of Enrique Villanueva in August, 2002, and were subsequently approved by the Municipal Mayor. Tubod MPA was created through Resolution No. 65-2003 and Ordinance No. 15-2003 which were approved by the Sangguniang Bayan of San Juan, Siquijor on June 18, 2003. Nonoc MPA was created through Barangay Resolution No. 14-2002 for the adoption of the three-year MPA Management Plan and was approved by the Barangay Council of Nonoc, Laren, Siquijor.

Municipal Ordinance No.9 dated December 19, 2001, established and declared portions of Pasil Reef in Barangay Panas, Candijay, Bohol, to be a Marine Reserve. It is jointly managed by the Panas-Cambuyao-Pangpang Fisherfolks Association (PCPFA), and the local governments of Bgy. Panas and Candijay municipality. A management plan for this MPA was approved and implemented in 2002. The area has a total of 18 hectares core zone and 6 hectares buffer zone. The establishment of the sanctuary started with the request of the community and the assistance of the local government units.

Biasong MPA in Libagon, Southern Leyte, was started in 1990 but is assumed to be formally created in 2001 or early 2002. Records show that on February 23, 2002, the Barangay Council approved Barangay Ordinance No. 2-2002, amending Fish Sanctuary Ordinance No. 1-2002. The amendment provides for the expansion of prohibited acts in the protected area.

Sagay MPA was formally created in 1983 through Municipal Ordinance No. 2. On June 1, 1995, President Fidel V. Ramos also issued Proclamation No. 592 declaring the islands of Molocaboc, Diutay, Matabas and Suyac, as well as their surrounding reefs and the reefs of Carbin and Macahulom, as protected landscape/seascape. The whole area is 28,300 hectares. The managing organization is the Protected Area Management Board for Sagay Marine Reserve.

METHODS AND MATERIALS

Method Used

The study was purely descriptive and utilized the one-shot survey design. The study population was composed of the local government officials and the officers and members of fisherfolk associations in the barangays where the Marine Protected Areas (MPAs) are located. Sample size was computed, based on the list of officers and members of the fisherfolk organizations of all the target areas. Stratified sampling was subsequently made, proportionately drawing from the number of respondents from all the fisherfolk associations. The total number of respondents was 192.

Data collection was done through structured interview in October 2005 and was part of the Visayan social survey reported by Dusaran et al. (this study). The interviewer used an interview schedule in asking and recording the answers of respondents. Prior to the conduct of the actual interview, the interviewers were briefed on the contents of the interview instrument and trained on how to conduct a one-on-one interview. This instrument was validated by an expert juror and was pre-tested in one of the MPAs in the Municipality of Dauin, Negros Oriental. Secondary data were also obtained from Barangay and Municipal Resolutions and/or Ordinances.

Data processing was done using the Statistical Package for Social Sciences (SPSS) Version 12. Frequency distribution tables and means were the main statistical tools used.

Study Sites

The four provinces in the Visayas selected for the present baseline survey are Siquijor Island, Northern Negros Island, Bohol Island, and Southern Leyte. Figure 1 shows the six MPAs covered in this study. Three MPAs are located at Siquijor Island, namely: the Tulapos MPA in Tulapos, Enrique Villanueva; Tubod MPA in Tubod, San Juan; and Nonoc MPA in Nonoc, Larena. The other MPAs are Panas MPA in Panas, Candijay, Bohol; Biasong MPA in Biasong, Libagon, Southern Leyte; and the Sagay Marine Reserve in Sagay City, Negros Occidental.

RESULTS AND DISCUSSION

Respondents' Awareness of the MPAs and Their Perception of the Major Effects of the MPA Declaration on their Fishing Activity

All except four of the fisherfolk-respondents (97.9%) are aware that part of their fishing areas was declared as a marine protected area (Table 1, Figure 2).

With the declaration, the respondents perceive both the positive and negative effects (Figure 3). The positive effects, according to 63% of the respondents, include "improved catch of fish, shells and seaweeds" (23.4%), "protection of the fishing area resulting in sustainable fishing" (19.8%), and "strict guarding of the area by the Bantay Dagat" (9.9%). Although "improved fish catch" is one of the identified positive effects of the MPA declaration, it was also found to be one of the unmet expectations from the MPAs (see Carumbana, this study). While 63% of the respondents know of the positive effects of the MPA declaration, 37% of them identified negative effects. It is possible that the perception by the respondents of an "improved fish catch" is based only on what they hear or understand from seminars and lectures conducted by the concerned government agencies and NGOs, not necessarily on what is really happening in their MPAs.

Most of those who view the effects as negative (37%) said there is no improvement at all in the area with the MPA declaration (22.9%). A small number of the respondents apparently have not yet experienced the favorable outcomes of the declaration, in terms of "improved fish catch". One reason for this situation could be the unfair dealing (including possible sanctuary violation) of the Bantay Dagat with fisherfolk (2.1%). The implementation then of the MPA regulations should be an important concern of the stakeholders.

Fishing in the MPA and the Reasons for Fishing

In as much as part of their fishing areas is now declared MPAs, many of the fisherfolk-respondents (89.6%) reported that they are not fishing in the MPAs. However, 10.4% claim that they are fishing in the areas. (Table 2, Figure 4).

Of those fishing in the MPAs, 45% claim that they are allowed to fish but not inside the sanctuary; 30% reported that they are in the sanctuary; and 25% fished because there are plenty of fish in the sanctuary (Table 2).

Even a few of those who are aware of the MPA declaration still fish in the sanctuary. They, together with those who are unaware of the declaration, said

that they are allowed to fish within the boundaries (45%); allowed to use small fishing boats (10%); attracted by the abundance of fish in the MPA (25%); and already in the sanctuary area, hence their decision to fish (30%). These results show that the fisherfolks who fish in the MPAs lack the commitment and the political will to strictly observe the rules related to the establishment of the MPAs. Furthermore, they show that the implementation of the MPA law is weak.

Respondents' Perception of the Major Effects of the MPA Declaration on the Fishing Activity of Fisherfolk from Other Areas

About 22.4% of the respondents believe that fisherfolk from other areas would not anymore fish in the MPAs. Another 8.3% said that fishing would no longer be allowed in the MPAs. Others said those who violate the prohibition would be arrested by the Bantay Dagat (13.5%). A few said that there could be an increase of fish catch (1.6%) as a result of the limited fishing activity of fisherfolk from the other areas, and that could be favorable to the fisherfolk living nearby or managing the sanctuaries (Table 3).

However, about 20.9% of the respondents have no idea as to the effect of the MPA declaration on the fishing activity of the fisherfolk from the other areas, and 21.3% said there is no effect at all. Putting these two groups together would mean that a bigger number of respondents (42.2%) still could not see any effect of the MPA declaration on the fishing activity of fisherfolk from the other areas. This could mean that the fisherfolk from the other areas would still continue with their usual practice of fishing in the area. It is evident from the results that the fisherfolk lack full understanding of proper planning and management of their MPAs.

Respondents' Perception on the Major Effects of the MPA Declaration on the Fishing Industry

Although 23.4% of the respondents claim that the MPAs would improve the fish catch, a bigger percentage (28.7%) of the respondents still view no effect of the MPA declaration on the fishing industry (Table 4). The other perceived effects of the MPAs are: "decreased illegal fishing" (1%), "learned different methods" (1.6%), "limited fishing activity" (1.6%), "improved fish density" (2.6%), and "favorable/ positive effects of the MPAs on the local fishing industry" (21.3%).

On the other hand, about 4.7% have no idea and 12.5% had no answer regarding the effects of the MPAs on the fishing industry. Those who view no effect (28.7%), no idea at all (4.7%), and no answer (12.5%) constituted 45.9 % of the respondents. This means that the respondents lack appreciation of the benefits that MPAs offer to their lives.

Respondents' Expectations from the MPA Declaration

With the declaration of their fishing areas as MPAs, 39.6% of respondents expect an increase in the fish population (Table 5). They also expect that their fish catch would increase and that their livelihood would improve (29.7%); their fishing areas would be rehabilitated and protected (10.9%), and illegal fishing would be controlled (7.3%).

Respondents' Observation of the Positive and Negative Changes After the MPAs Declaration

About 39.6% of the surveyed fisherfolk expect fish abundance in the areas (Table 6). However, a smaller percentage (16.7%) observed positive changes than those who expect increased fish catch (29.7%). The findings show that there is a difference in the number of responses for the expected and observed positive changes after the declaration of MPAs.

It must be stressed that despite the increase in fish population in the MPAs, the fish catch has actually decreased. This may be due to the negative changes observed by the fisherfolk. Although 30.7% claim no negative changes and 31.8% had no answer on the negative changes by the MPA declaration, about 35.4% cited negative changes (Table 7). Foremost of these are the "unfair dealing of the Bantay Dagat in the law's implementation" (11.5%), "decrease in

the fishing area" (8.3%), "presence of illegal fishing" (6.8%), and "limited fishing activity in the areas" (3.6%).

Again, the above results show a lack of proper planning, monitoring and evaluation to improve the management of the MPAs. They also suggest that the local officials and fisherfolk should be guided by the implementation of MPA laws, rules and regulations, and that they be given alternative livelihood activities while they are still developing the MPAs.

Respondents' Perception on the Improvement in the Quality of Life

The majority of the respondents observe positive changes in their fishing areas and improvement in their quality of life (58.3%). (Table 8, Figure 5)

The perceived improvement in the quality of their life due to the MPA was indicated by the "increase in their income" (7.8%), "sustainable fishing activity" (12.5%), and "improved fish catch" (37.5%). The increase in income could be due to higher prices of fish and not to increased volume of catch. The perceived increase in fish catch is consistent only with the fishing areas outside of Tulapos MPA, not with other MPAs.

Knowledge of the MPA Boundaries and Area Size, Who Established the MPAs, and Membership in Fisherfolk Organization

In order to know where fishing is allowed and not allowed, the fisherfolk in the MPAs have to be familiar with the latter's boundaries. About 71.4% of respondents (71.4%, are familiar with the boundaries of their MPAs, while the remaining 28.6% are not. (Table 9, Figure 6). Of those who are familiar with the size of the area, 68.6% claim that the area of their MPA is not more than 2 sq. kms. while 31.4% reported that it is more than 2 sq kms. The mean area of their MPAs is 1.76 sq km.

According to 54.2% respondents, their MPAs were established by the government (Table 10). On the other hand, 21.4% and 10.4% of the respondents believe that their MPAs were established by the local politicians/mayor and the NGOs, respectively. With the establishment of the MPAs, 98.4% of respondents claim that the fisherfolk in the area were organized into local fisherfolk organizations or associations (Table 11). The same percentage of respondents (98.4%) also reported that they are members of their local fisherfolk organizations. Only three or 1.6% of the respondents reported that they are not members of such organizations (Table12).

Problems Encountered in the MPA Declaration Processing.

In the process of getting the declaration of their fishing areas as MPAs, 32.3% of the respondents said that they have not encountered any problems. About 26.6% of respondents said that the only major problem is the lack of cooperation among some fisherfolks.

Acceptance of the MPA Declaration

About 92.7% of the respondents said that they are in favor of the establishment of MPAs in their fishing areas (Table 14, Figure 7). The most common reasons cited by the respondents for favoring MPA establishment in their areas include "increase in fish population" (48.3%), "improvement of the fishing area" (10.7%), "to help and support small fisherfolk" (9.6%), and "to help improve income "(7.9%). Of the 10 respondents who are not in favor, four claim that they are not allowed to fish near the sanctuary. Another four did not give any response. Two respondents said that the MPA bring no benefit or improvement in the area.

Problems Encountered and Recommendations

About 76% of the respondents have not encountered any problem as a result of the declaration of their fishing areas as MPAs (Table 15). However, 24% of respondents have encountered problems, including "few fish catch" (4.7%), "unfair Bantay Dagat" (3.6%), "conflict among fisherfolk" (3.1%), "uncooperative fisherfolk" (2.6%), and "conflict regarding illegal fishing" (2.6%). The problems identified in this survey like "few fish catch" and "illegal fishing" by the fisherfolk in the Visayas region correlate with the findings of the

study on the coastal environment of Hagonoy and Sta. Maria in Davao del Sur, Philippines, which show that their coastal resources are also beset by problems like declining fish catch and poor law enforcement (Valle et al. 2000).

These findings coincide with the findings (Table 6), which show that only 32 respondents (16.7 %) observe improved fish catch after the MPA declaration, as compared to the 57 (29.7 %) who expect an improved fish catch because of the MPA (Table 5). The fact still remains that fish catch decline becomes an observable phenomenon after an MPA declaration. This observed problem might have been caused by other problems like the "unfairness of the Bantay Dagat in their dealings with the fisherfolk" (3.6%) and presence of illegal fishing (0.5%) (Table 15).

Respondents' Recommendations/ Suggestions to Solve the Problems Encountered

About 58.9% of respondents did not give recommendations to solve the identified problems (Table 16). However, 41.1% of them had some recommendations, foremost of which are to "control/ stop illegal fishing" (15.1%), "determine exact boundaries of MPAs" (12.5%) for fisherfolk "to help the *Bantay Dagat* in controlling illegal fishing" (4.7%), "conduct more information and education campaigns" (2.6%), and "identify safe location of fishing nets" (2.1.%). The respondents also recommended that the *Bantay Dagat* be fair in their dealings with fisherfolk (2.1%); the *Bantay Dagat* who are unfair be replaced (2.1%); support be given to small and legal fisherfolk (0.5%); and the MPAs be better managed (0.5%).

The findings show that proper management of MPAs in Southern Leyte, Bohol, Negros Occidental, and Siquijor is lacking. Strategic planning should have been vital and urgent for their success.

SUMMARY AND CONCLUSIONS

Summary

About 97.9% of fisherfolk-respondents are aware that part of their fishing areas was declared a marine protected area. Sixty-three percent (63%) of the respondents perceive positive effects, while 37% perceive the negative effects of the MPA declaration on their fishing activity. Among the perceived positive effects are: "improved catch of fish, shells and seaweeds" (23.4%), "protection of the fishing area resulting in sustainable fishing" (19.8%), and "strict guarding of the area by the *Bantay Dagat*" (9.9%). A major negative effect, among others, is "no improvement at all in the area" (22.9%).

Around 89.6% of fisherfolk-respondents reported that they do not fish in the MPAs. However, 10.4% admitted fishing in the areas for the following reasons: (1) they are allowed, but not inside the MPA (45%); (2) they are in the sanctuary (30%); and (3) there are plenty of fish in the sanctuary (25%).

Many respondents believe that fisherfolk from the other areas would not anymore fish in the MPAs because they would not be allowed (8.30%), if they fish, they would be arrested by the *Bantay Dagat* (13.5%). As disclosed, there could be an increase of fish catch (1.6%) as a result of the limited fishing activity of fisherfolk from the other areas, and that would be favorable to the fisherfolk managing the sanctuaries. However, 20.9% of the respondents have no idea about the effects of the MPA declaration on the fishing activity of those from the other areas. About 21.3% of respondents claim there is no effect at all. About 23.4% of the respondents claim that the MPAs would improve the fish catch, decrease illegal fishing activity (1%), and limit the fishing activity of fisherfolk from other areas (1.6%). All of these could improve fish density (2.6%) and therefore help contribute to the positive effects of the MPAs on the local fishing industry. However, about 45.9% of the respondents do not see any effect at all of the MPAs on the fishing industry.

Most of the respondents (39.6%) expect that fish population would increase. They also expect that their fish catch and/or livelihood would be improved (29.7%); their fishing areas would be rehabilitated and protected (10.9%); and illegal fishing would be controlled (7.3%).

Only a few respondents observe an increase in fish catch (16.7%) compared to those who expect it (39.6%). The difference in number between the

expected and observed may be due to the negative changes observed by the respondents like unfair dealing of the *Bantay Dagat* in the implementation of the rules (11.5%), decrease in the fishing area (8.3%), presence of illegal fishing (6.8%), and limited fishing activity (3.6%) in the areas.

Around 58.3% of respondents perceive that their quality of life has improved with the declaration of the MPA.

There are 71.4% of respondents who are familiar with the boundaries of their MPAs The mean area of their MPAs was pegged at 1.76 sq. km. Fifty-four percent (54.2%) of them know that their MPAs were established by the government; 21.4% by the local politicians/mayors, and 10.4% by the NGOs. Around 98.4% of surveyed fisherfolk said that they were members of their local fisherfolk organizations.

About 32.3% of the respondents said that they have not encountered any problems. The only major problem identified was that some fisherfolks are uncooperative (26.6%). Other problems are deemed minor.

Almost all of the respondents are in favor of the establishment of MPAs in their fishing areas (92.7%). Their reasons are "to increase fish population," "to improve the fishing area," "to help and support the small fisherfolk," and to "help improve their income." One reason why others do not favor the MPA declaration is because they would not be allowed anymore to fish in the protected areas.

Seventy-six percent of the respondents have not encountered problems as a result of the declaration of their fishing areas as MPAs. Of the 24% who said they have some problems, the following were mentioned: "few fish catch," "unfair *Bantay Dagat*," "conflict among fisherfolk," "uncooperative fisherfolk," and "conflict with illegal fishing."

Fifty-seven percent of the respondents did not give any suggestion at all to solve the problems encountered. However, 44.2% of them have some recommendations, which are 1) control/stop illegal fishing; 2) determine exact boundaries of MPAs; 3) help the *Bantay Dagat* control illegal fishing; 4) conduct information drive; 5) identify safe locations for fishing nets; 6) the *Bantay Dagat* to be fair or replace those who are unfair; 7) give support to small fisherfolk; and 8) good management of MPAs.

Conclusions

Based on the findings of the study, the following conclusions are drawn:

1. Awareness of the declaration of the fishing areas as marine protected areas in the Visayas region is high. Almost all of the respondents who are in favor of the MPA declaration expect to improve their fishing activity and increase income. Most of them therefore ha e high expectations based on positive perceptions on the effects of the declaration and establishment of MPAs.

2. There is a lack of commitment by the implementers and fisherfolk of the MPAs even if almost all of the fisherfolk are members of the local fisherfolk organizations.

3. The expectations of the respondents from the MPA declaration include, among others, *increase in fish density, improvement of fish catch and livelihood activities*, and *control of illegal fishing*. However, the observed fish catch was lower than the expected increase of fish catch as a result of the MPA declaration and establishment. Therefore, it appears that many local officials and fisherfolk still lack an appreciation of the benefits from MPAs.

4. Most of the respondents have not encountered any problem as a result of the declaration of their fishing areas as MPAs, although some of them identified "few fish catch, unfair *Bantay Dagat*, and conflict among fisherfolk" as the few problems encountered in the MPAs.

5. Majority of the respondents perceive that their quality of life has improved with the declaration of the MPAs. However, they recognize that there is still a need to enhance the management of the MPAs in order to improve the fish catch and to increase incomes.

Recommendations

The following are highly recommended measures based on the conclusions:

1. There is a need to conduct wide dissemination of information regarding MPAs. This can be done by the state colleges and universities in the region in coordination with the DENR, BFAR, and the local government units, not only to the fisherfolk associations in the locality, but to the students and pupils as well.

2. Training on Values Education relating to the establishment of MPAs may be conducted in order to improve the commitment and the "political will" of the people.

3. There is a need for the review or reformulation of the plans and programs of the MPAs and to include the participation of the different stakeholders.

4. Regular monitoring and evaluation should be done and the government and non-government agencies responsible for the MPA establishment should come up with indicators for MPA evaluation to know whether or not the goals and objectives are achieved. These indicators shall cover the governance, biophysical, and socio-economic aspects of MPAs.

5. More MPAs should be established, considering their observed positive effects.

Acknowledgment

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List of Figures and Tables

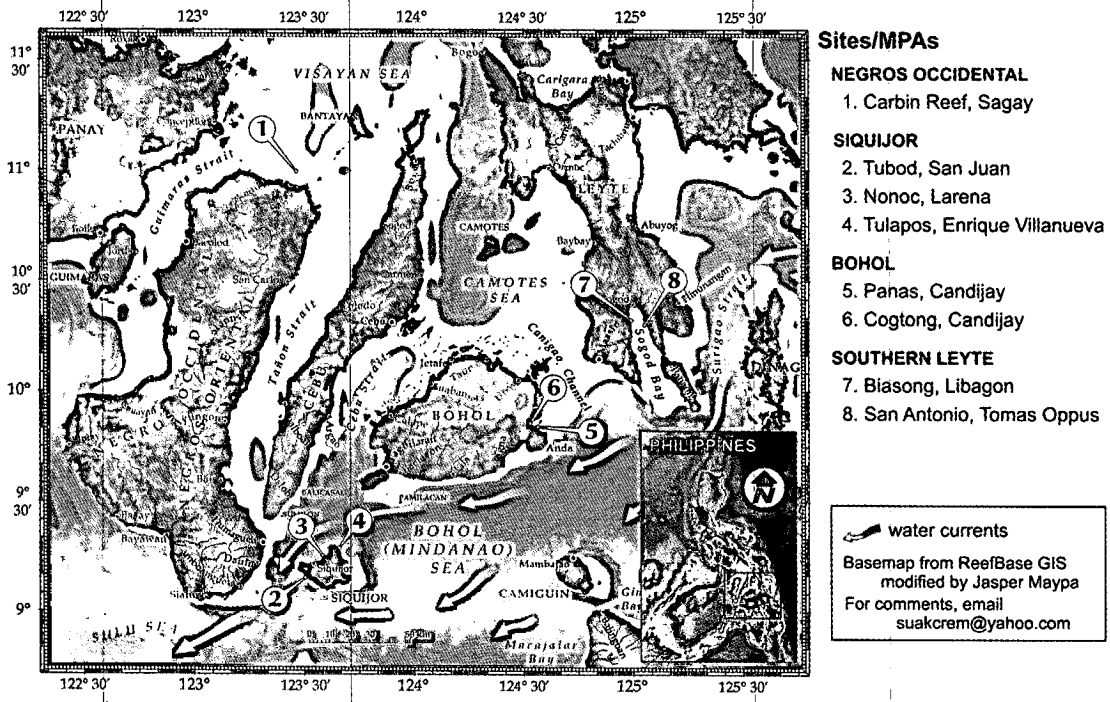

Figure 1. Map of the MPA study sites in the Visayas, Philippines.

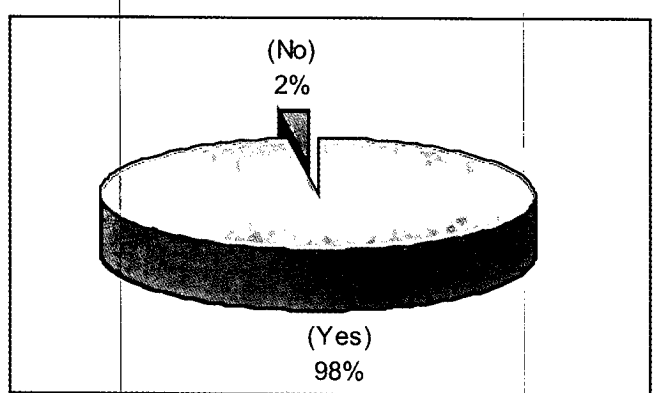

Figure 2. Percentage of stakeholders aware of MPA declaration.

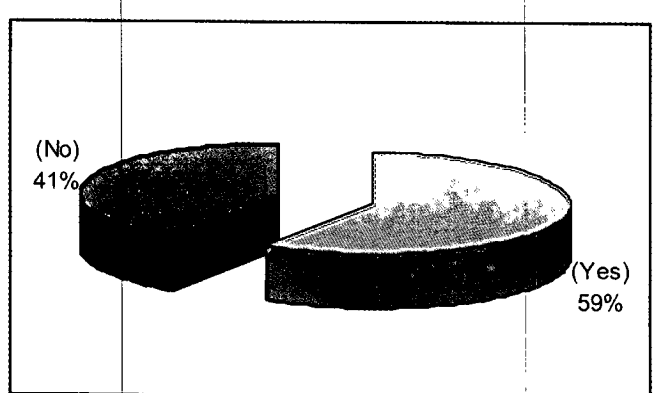

Figure 3. Respondents' perception of the major effects of MPA declaration.

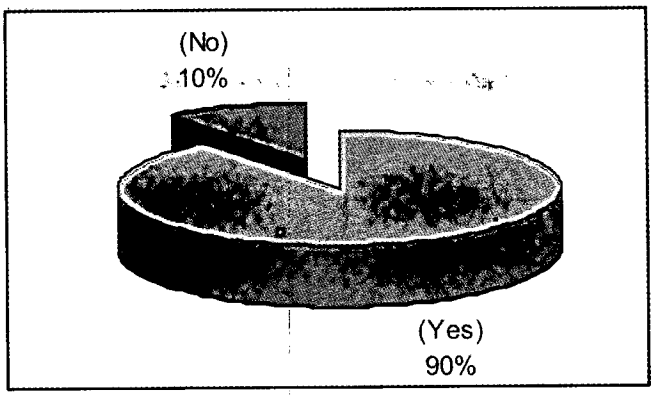

Figure 4. Percentage of respondents who are fishing or not fishing in MPAs.

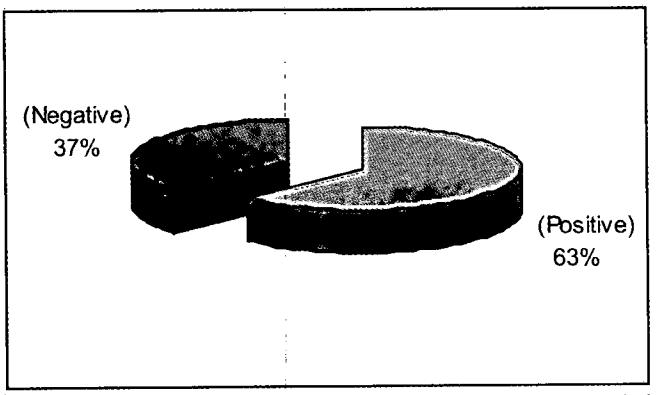

Figure 5. Respondents' perception on whether or not MPAs improved their quality of life.

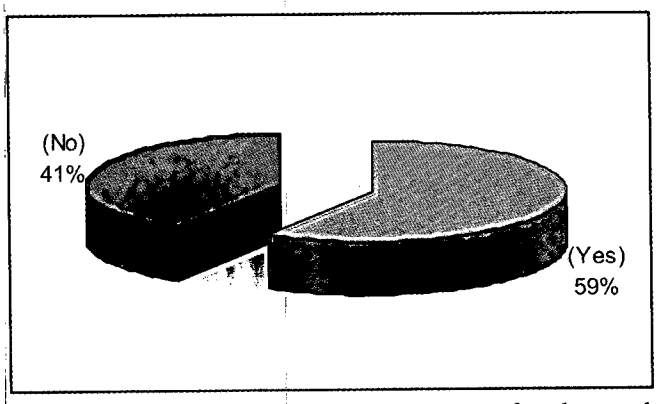

Figure 6. Percentage of respondents who are familiar or not familiar with MPA boundaries.

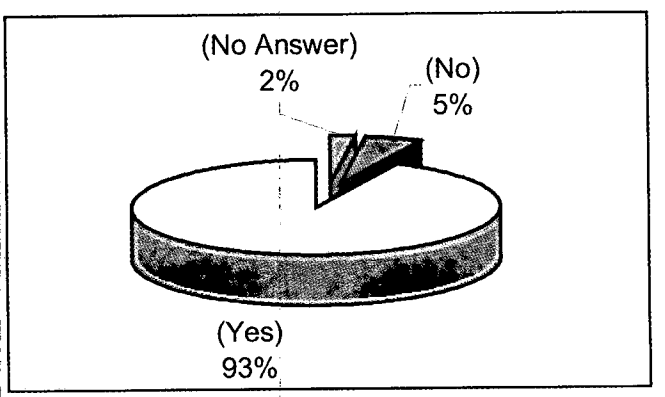

Figure 7. Percentage of respondents who are familiar or not familiar with MPA declaration.

Table 1. Distribution of respondents according to their awareness that part of their fishing area was declared as a Marine Protected Area and their perception of the major effect of the MPA declaration on their fishing activity (N = 192).

Awareness	Frequency	Percent
Yes	188	97.9
No	4	2.1
Total	**192**	**100.0**
Major Effects		
A. Positive Effects		**63**
Improved catch of fish, shells and seaweeds	45	23.4
Fishing area is protected/ sustainable fishing	38	19.8
Bantay Dagat strictly guard the Area	19	9.9
More fish near the shore/protected area	7	3.6
Many engaged in legal fishing	6	3.1
Opportunity to catch different kinds of fish	3	1.6
Peaceful fishing activity	3	1.6
B. Negative Effects		**37**
No improvement in the area	44	22.9
Limited fishing activity/there are prohibitions	11	5.7
Bantay Dagat are unfair in dealing with fisherfolk	4	2.1
We have to do distant fishing	3	1.6
No answer	9	4.7
Total	**192**	**100.0**

Table 2. Distribution of respondents as to whether or not they are fishing in the MPA and their reasons for fishing in the MPAs (N = 192).

Fishing in MPA	Frequency	Percent
Yes	20	10.4
No	172	89.6
Total	**192**	**100.0**
Reasons for Fishing (Multiple Response, N = 20)		
We are allowed but not inside	9	45.0
We are in the sanctuary	6	30.0
Plenty of fish in the sanctuary	5	25.0
Increase catch	2	10.0
Small fishing boats are allowed	1	5.0
Size of fish net is legal/allowed	1	5.0

Table 3. Distribution of respondents according to their perception of the major effect of the MPA declaration on the fishing activity of fisherfolk from other areas (N = 192).

Major Effect	Frequency	Percent
Limited fishing activity to them and it is favorable to us	43	22.4
No effect	41	21.3
Illegal fishers are arrested by *Bantay Dagat*	26	13.5
Not allowed to fish in our area	16	8.3
Positive effect	12	6.3
Occasional illegal fishing in the area	11	5.7
Increase fish catch	3	1.6
No idea	40	20.9
Total	**192**	**100.0**

Table 4. Distribution of respondents according to their perception of the major effect of the MPA declaration on the fishing industry (N = 192).

Major Effect	Frequency	Percent
No effect	55	28.7
Improved fish catch	45	23.4
Positive/favorable to local fishing industry	41	21.3
Decreased illegal fishing	2	1.0
Learned different fishing methods	3	1.6
Limited fishing activity	3	1.6
There are still illegal fishers	5	2.6
No idea	9	4.7
Improved fish density	5	2.6
No answer	24	12.5
Total	**192**	**100.0**

Table 5. Distribution of respondents according to their expectations from the declaration of their fishing areas as MPAs (N = 192).

Expectations	Frequency	Percent
Fish population will increase	76	39.6
Increased fish catch/ livelihood will improve	57	29.7
Will rehabilitate and protect the fishing area	21	10.9
Illegal fishing will be controlled	14	7.3
Active *Bantay Dagat*	6	3.1
Peaceful fishing activity	3	1.6
There will be MPA boundary	1	0.5
None	3	1.6
No answer	11	5.7
Total	**192**	**100.0**

Table 6. Distribution of respondents according to the positive changes they have observed after the declaration of their fishing areas as MPAs (N = 192).

Positive Changes Observed	Frequency	Percent
Increased fish population	81	42.2
Improved fish catch	32	16.7
Illegal fishing was controlled	31	16.1
Bantay Dagat strictly guard fishing area	11	5.7
Can catch fish even near the shore	3	1.6
Registration of pump boats	2	1.0
Spawning area was Protected	2	1.0
No positive changes	25	13.0
No answer	5	2.7
Total	**192**	**100.0**

Table 7. Distribution of respondents according to the negative changes they have observed after the declaration of their fishing areas as MPAs (N = 192).

Negative Changes Observed	Frequency	Percent
No negative changes	**59**	**30.7**
Negative Changes	**68**	**35.4**
Bantay Dagat is unfair in implementing the law	22	11.5
Decreases fishing area	16	8.3
There were still illegal fisherfolk	13	6.8
Decreased income/low fish catch	5	2.6
Limited fishing activity	7	3.6
Conflict between legal and illegal fisherfolk	3	1.6
Increased number of fisherfolk	2	1.0
Bantay Dagat were very strict	**4**	**2.1**
No answer	**61**	**31.8**
Total	**192**	**100.0**

Table 8. Distribution of respondents as to whether or not their quality of life has improved because of the MPA and their perceived quality of life improvements (N = 192).

Improved Quality of Life	Frequency	Percent
Yes	112	58.3
No	78	40.6
No answer	2	1.0
Total	**192**	**100.0**
Perceived Improvement in their Quality of Life	**Frequency**	**Percent**
Improved catch of fish and other sea foods	72	37.5
Sustainable fishing activity	24	12.5
Sustained income	15	7.8
It improves our life	10	5.2
Can catch fish and other sea food even near the shore	8	4.2
Controlled illegal fishing	8	4.2
Not afraid to go fishing because there is *Bantay Dagat*	5	2.6
Can buy food and send children to school	2	1.0
Decreased number of violators	2	1.0
No answer	46	24.0
Total	**192**	**100.0**

Table 9. Distribution of respondents as to their knowledge of the boundaries of their MPAs and areas covered (N = 192).

Familiar with Boundaries	Frequency	Percent
Yes	137	71.4
No	55	28.6
Total	**192**	**100.0**
Knowledge of the Area (N = 137)		
2 sq km. and below	94	68.6
More than 2 sq km.	43	31.4
Total	**137**	**100.0**
Mean = 1.76 sq km.		

Table 10. Distribution of respondents according to who they think established their MPAs (N = 192).

Responsible for MPA Establishment	Frequency	Percent
Government	104	54.2
Local politician/mayor	41	21.4
NGO	20	10.4
Bantay Dagat	1	0.5
BFAR	1	0.5
Sagay Marine Reserve	1	0.5
Don't know	11	5.7
No answer	13	6.8
Total	**192**	**100.0**

Table 11. Distribution of respondents as to reported membership in fisherfolk organization and name of organization (N = 192).

Whether or Not Fisherfolk are Organized	Frequency	Percent
Yes	189	98.4
No	3	1.6
Total	**192**	**100.0**
Fisherfolk Organization		
FARMC	6	3.2
Panalsagan FA	16	8.5
Punta Roma	24	12.7
PAGAMACO	4	2.1
PCPFA	10	5.3
Nonoc FA	21	11.1
Tubod FA	44	23.3
KAYUD	28	14.8
PMPC	10	5.3
PMC	1	0.5
RRDP	1	0.5
PAGAMAPA	19	10.1
No Answer	5	2.6
Total	**189**	**100.0**

Table 12. Distribution of respondents as to their reasons for non-membership in fisherfolk organization (N = 192).

Member of Organization	Frequency	Percent
Yes	189	98.4
No	3	1.6
Total	192	100.0
Reasons for Not Being a Member (Multiple Response, N = 3)		
No time to attend meeting	1	33.3
Not present during organization meeting	1	33.3
Lack of information dissemination	3	100.0

Table 13. Distribution of respondents according to the problems encountered in the process/mechanics in the declaration of their fishing areas as MPAs (N = 192).

Problems on Process/Mechanics	Frequency	Percent
No problem	62	32.3
Uncooperative fisherfolk	51	26.6
Encourages illegal fishing	11	5.7
Unfair *Bantay Dagat*	5	2.6
Strict implementation	5	2.6
Boundary of MPA	3	1.6
Cost of registering pumpboat	3	1.6
Cannot stop intrusion of other fisherfolk in our area	2	1.0
Violation of law	2	1.0
Inadequate information Dissemination	2	1.0
Conflict between local and outside fisherfolk	1	0.5
No answer	45	23.5
Total	**192**	**100.0**

Table 14. Distribution of respondents as to whether or not they are in favor of the declaration of their fishing areas as MPAs (N = 192).

Favor MPA Declaration	Frequency	Percent
Yes	178	92.7
No	10	5.2
No answer	4	2.1
Total	**192**	**100.0**
Reasons for Favoring MPA Declaration (N = 178)		
Will increase fish population	86	48.3
Will improve fishing area	19	10.7
Can help and support small fisherfolk	17	9.6
Can help improve income	14	7.9
Good result	12	6.7
Helps control illegal fishing	10	5.6
Peaceful and sustainable Fishing	8	4.5
Favorable to fisherfolk	8	4.5
Bantay Dagat can help during emergency rescue	3	1.7
It is a government project	1	0.6
Total	**178**	**100.0**
Reasons for Not Favoring MPA Declaration (N = 10)		
We are not allowed to fish near the sanctuary	4	40.0
No benefit	1	10.0
No improvement in the area	1	10.0
No answer	4	40.0
Total	**10**	**100.0**

Table 15. Distribution of respondents according to the problems encountered as a result of the declaration of their fishing areas as MPAs (N = 192).

Problems on Effects	Frequency	Percent
Few fish catch	9	4.7
Unfair *Bantay Dagat*	7	3.6
Conflict with other fisherfolk	6	3.1
Uncooperative fisherfolk	5	2.6
Conflict between legal and illegal fisherfolk	5	2.6
Destruction of nets	4	2.1
Other fisherfolk fish inside the sanctuary	4	2.1
Fear of arrest if pumpboat is not registered	2	1.0
Can speed up fish extinction	1	0.5
Could not easily fish near the shore	1	0.5
Cannot sustain expenses	1	0.5
Unfair to those who engage in legal fishing	1	0.5
No problem	69	35.9
No answer	77	40.1
Total	**192**	**100.0**

Table 16. Distribution of respondents according to their recommendations/suggestions for the problems they have encountered in the declaration of their fishing area as MPAs (N = 192).

Recommendations/ Suggestions	Frequency	Percent
Control/stop illegal fishing	29	15.1
Identify exact boundary of the MPA	24	12.5
Fisherfolk should help *Bantay Dagat* in controlling illegal Fishing	9	4.7
Proper information and education campaign	5	2.6
Identify safe location of fishing nets	4	2.1
Bantay Dagat should be fair	4	2.1
Replace irresponsible *Bantay Dagat*	2	1.0
Support small and legal fisherfolk	1	0.5
Good management of MPA	1	0.5
No suggestion	113	58.9
Total	**192**	**100.0**

BIOPHYSICAL ASSESSMENT OF CARBIN REEF, SAGAY, NEGROS OCCIDENTAL, PHILIPPINES

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ABSTRACT

The researchers conducted a biophysical survey of Carbin Reef off Sagay City, Negros Occidental from October 11 to 12, 2005. The objectives were to assess reef fish stocks (diversity, abundance, and biomass), assess corals and associated benthos, and make recommendations for management based on the findings. Survey sites included the reef flat (2-3 m.) and the reef slope (10 m.) at both the northeast and northwest sectors of the reef, while using the basic fish visual census method and the line intercept method for the corals. Reef fish densities are greater in the northeast sector than the northwest (1033 vs 600 fish / 500 sq.m.) while fish biomass is also greater in the northeast sector (49 vs. 26 kg. / 500 sq.m.). Ten-year trends from a previous survey conducted by the Silliman University Marine Laboratory show a decline in total fish density from 1433 to 817 fish / 500 sq.m. but a substantial increase in target fish biomass from 2.6 to 34.4 kg. / 500 sq. m. In spite of this increase, target fish biomass is still relatively low, considering its more than 20 years of protection. The slower rate of recovery may be the result of the lack of deep reef refuges in the Visayan Sea to which Carbin Reef belongs.

INTRODUCTION

The Sagay Marine Sanctuary includes approximately 32,000 hectares of Sagay's territorial waters including four major reef systems (Carbin Reef, Panal Reef, Maca Reef and Shoal, and the fringing reefs of Molocaboc Island). Formal protection began with Carbin Reef in 1983, but was extended to include the surrounding reefs in 1992. Sagay's territorial waters were later declared a Protected Seascape under the National Integrated Protected Areas System (NIPAS) in 1995. The Silliman University Marine Laboratory has supplied technical assistance and scientific advice to the local government of Sagay since the 1980s through surveys of its reefs.

An assessment of fish stocks and the benthic habitat of the north portion of Carbin Reef was conducted on October 11 and 12, 2005. The project was supported by the Commission on Higher Education (CHED) to promote research in the region. The goals of the project were to:

1. Assess reef fish stocks (diversity, abundance, and biomass)
2. Assess corals and associated benthos
3. Make recommendations for management based on findings

METHODOLOGY

Quantitative estimates of abundance of coral reef fishes were made using a modified visual census technique described in English et al. (1994). The abundance of large numbers of numerically dominant and visually obvious fish species from the following families/sub-families were documented using the cumulative log4 abundance category (developed

by the Great Barrier Reef Marine Park Authority): Anthiinae, Labridae, and Pomacentridae. Counts of individuals were made for commercially important species or target species (TS): larger Acanthuridae, Caesionidae, Haemulidae, Mullidae, Lethrinidae, Lutjanidae, Nemipteridae, Scaridae, Epinepheliinae, and other numerically few species. Biomass of TS was computed using known length-weight relationships in Samolys (1997) and Froese and Pauly (2000).

An individual census area was demarcated by laying out a 50-m. tape parallel to the reef crest to a depth of 10-12 m. (reef slope) and 3-5 m. (reef flat). Visual census was carried out by a single observer (Brian Stockwell) swimming along the length of the tape. The abundances of all species were estimated or counted and sizes of TS were estimated within 5 m. of either side of and above the observer. Six replicates (deep=3N, shallow=3N), 10-20 m. apart censuses were made at each station.

For the substrate analysis, the same transects as the above were used. Along each transect a 20-m. line intercept method was used. Basic life form and substrate categories were recorded to the nearest centimeter. Recordings were made by one observer (M. Inocencio).

The northern portion of Carbin Reef was chosen for the survey since the southern portion is mostly sand. The northwestern and northeastern sectors of the reef were the two sites chosen (Figure 1).

RESULTS

Reef Fish Diversity

The total number of reef fish species recorded during the survey of Carbin reef is 151. These belong to 26 families (Table 1). These species are illustrated in Allen et al (2003) and Lieske and Myers (2001).

The most abundant families in terms of species are the Damsels (Pomacentridae), Wrasses (Labridae), Butterflyfish (Chaetodontidae), Groupers (Serranidae), Parrotfish (Scaridae), Cardinalfish (Apogonidae), Gobies (Gobiidae), Spinecheeks (Nemipteridae), Snappers (Lutjanidae), and Puffers (Tetraodontidae). These 10 families collectively account for 81.5% of the total number of species observed (Table 2). The relatively high diversity of Spinecheeks (Nemipteridae) may be the result of the large patches of sand and rubble recorded in the benthic surveys. It is also important to note that the relatively diverse Surgeonfish/Unicornfish family (Acanthuridae) is practically absent from the reef (only one individual was observed). The northeast sector has a greater density of species (Table 3)

Reef Fish Abundance

Dominant fish families in terms of abundance mostly vary, depending on reef zone and less so, on site. The reef slope of the northwest and northeast sectors are both dominated by Damsels (Pomacentrids) and Fusiliers (Caesionidae) (Figure 3). The remaining families vary slightly in abundance with Butterflyfish and Parrotfish being more abundant on the northwest slope than on the northeast slope, and Cardinalfish (Apogonidae) and Snappers (Lutjanidae) being more abundant along the northeast slope than on the northwest (Figure 3). Along the reef flat, Damselfish are clearly the dominant fish in terms of abundance. The sites vary, however, in that the northeast flat has a greater abundance of parrotfish and snappers.

Total reef fish density is greater along the northeast portion of Carbin Reef (Figure 2). The target fish density (those with commercial value), is high for both sites, but density at the northeast was more than twice that of the northwest site. The most abundant target fish are the Fusiliers (Caesionidae) along the reef slope, and Parrotfish (Scaridae) along the reef flat. Top predatory fish (piscivores) density is very high for the northeast site, almost six times greater than the northwest site. This is due to the large number of Snappers (Lutjanus carponotatus and Lutjanus russelli) observed in the northeast site.

Reef Fish Biomass

Mean total and target fish biomass along the northeast sector is twice that of the northwest sector (Figure 4). This is mainly due to the greater number of fusiliers. Predator fish biomass is far greater in the northeast sector.

When compared with marine reserves in southern Negros (Dauin), target fish biomass levels are similar (Figure 5A). The northeast sector is

comparable with the older reserves of Masaplod Sur and Norte, while the northwest sector is comparable with the newer reserves of Dauin. Predator fish biomass of the northeast sector of Carbin is equal to the older reserves of Dauin (Poblacion, Masaplod Sur and Norte). However, the northwest sector is comparably low (Figure 5B). This is due to the small species of groupers (Cephalopholis boenack and C. microprion) observed at this site.

Benthic Survey

Living Substrate

The live hard coral cover is higher at the northwest sector, while the reef flat has more coral than the reef slope (Figure 6). Live coral cover was the dominant substrate type along the reef flat at the northwest sector. Soft coral cover is very low for all sites with 0% cover along the reef slopes and 1% cover along the reef flats. Algae cover is low along the slopes but relatively high along the reef flats. The northwest sector has greater algae cover than the northeast sector. Sponge cover is moderate for all sites ranging from 2% to 4%.

Non-Living Substrate

The dominant non-living substrate for the northwest sector is coral rubble, which is the major substrate for the slope (Figure 6). Coral rubble is also a major substrate at the northeast sector; however, sand cover appears to be co-dominant with coral rubble. Coral rubble cover is far greater along the reef slopes.

Coral Growth Forms

Massive coral is the dominant growth form for all sites, with encrusting corals coming in second (Figure 7). Thus in general, the reefs have a low profile. Branching corals have their greatest cover along the reef flats, with the northwest sector having a wider variety of growth forms.

DISCUSSION

Reef fish diversity is high, despite the lack of two major families, the Acanthuridae and the Balistidae. It is not known whether these families are naturally absent or are very slow to recover from previous disturbances. Surgeonfish (Acanthuridae) are important herbivores on the reef, which may account for the moderate levels of algae along the reef flats. Triggerfish (Balistidae) are important predators of hard-shelled invertebrates such as sea urchins. At present, there does not appear to be an overabundance of sea urchins, but if an outbreak does occur, the results could be devastating.

Reef fish abundance is moderate, mostly due to the lack of large schools of *Anthias*, typical of central Philippine reefs. Target fish density is high, especially for the northeast sector in which large schools of Fusiliers (*Caesio teres*) appear. Top predatory fish densities are very high along the northeast sector. The dominant predators are the large Snappers (Lutjanidae), as only small groupers were observed. It is possible that this habitat is preferred by Snappers over large Groupers, or that the recovery rate of Groupers is much slower than Snappers.

Fish biomass is high, and comparable to marine reserves in southern Negros. However, these reserves are newer, ranging from 5 to 10 years of full protection. There are several possible explanations for the slower rate of recovery at Carbin Reef. First, the surrounding sea is very shallow and reefs do not appear to extend below 15 m., where they are replaced by sand flats. It is possible that deep reef habitats act as a refuge during times of severe overfishing. Thus, recovery is not enhanced through the remnant populations found in this habitat. In effect, the reefs of Sagay started from zero. Secondly, aside from the Sagay Marine Sanctuary, very few other MPAs exist in the area. Marine conservation efforts in the Visayan Sea have been found lacking when compared with the Bohol Sea. This lack of marine conservation in the area may have led to more degraded reef systems. Thus, there may be fewer good source reefs to replenish stocks.

Despite the slower recovery in reference to southern Negros, recovery has occurred. Significant changes have occurred since the reef was surveyed by Luchavez and Luchavez (1995). Total reef fish density may have slightly decreased, but species diversity has increased substantially 10 years hence (Table 4). However, most impressive is the more than 10-fold increase in target fish biomass.

Live coral cover is moderate for all sites surveyed in Carbin Reef. The dominant substrate type for

most sites is coral rubble. This is likely the result of previous disturbances both natural (storms) and man-made (blast fishing). Coral larvae that settle on coral rubble are quickly abraded and killed, once heavy wave action occurs, as already known. Thus, even after decades of protection, rubble patches remain. In this case, coral rehabilitation through substrate stabilization may be possible.

During the survey of Carbin reef, a side trip to the neighboring Panal Reef was taken. An exploratory dive was conducted, revealing high coral cover and diversity. It is not known why such a reef should vary so much from Carbin Reef. Reef fish density and biomass, however, appeared to be less despite the excellent habitat. Along with Panal Reef, Maca Reef and Shoal are also a part of the Sagay Marine Sanctuary. The Sagay Marine Sanctuary encompasses large diverse reefs which will need regular monitoring. Information gained from the surveys of these other reefs will be vital in the conservation of the Sagay Marine Sanctuary.

CONCLUSIONS

The reef appear to be in good condition resulting from protection. It is generally healthy. The hard coral cover is low to moderate. Reef fish density and species diversity have increased since 10 years ago. Although the target reef fish biomass at Carbin has also substantially increased, it is lower than that at Dauin marine sanctuaries with similar years of protection. This could be due to slower recovery of reef fish in the Visayan Sea compared with the Bohol Sea, where the Dauin sanctuaries are located, but other reasons cannot be discounted.

Acknowledgment

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List of Tables and Figures

Figure 5. Comparison of mean target and predator fish biomass of four marine reserves in Dauin, Negros Oriental and Two Sites on Carbin Reef, Sagay, Negros Occidental.

Figure 6. Mean percent cover of major substrate categories for the reef slope and flat of the northwest and northeast sectors of Carbin Reef.

Figure 7. Mean percent cover of live coral growth forms for the reef slope and flat of the northwest and northeast sectors of Carbin Reef.

Figure 8. A "Skull-faced Damsel," an unidentified Pomacentrid, which lives in small groups among coral patches along the reef flat.

Table 1. Species list and abundance of reef fish observed during the survey of Carbin Reef, Sagay, Negros Occidental

Fish Species	Abundance
DASYATIDAE	
Dasyatis kuhlii	Moderately Common on reef flat
PLOTOSIDAE	
Plotosus lineatus	Common
SYNODONTIDAE	
Synodus variegates	Common
HOLOCENTRIDAE	
Myripristis berndti	Occasional
M. murdjan	Occasional
Sargocentron cornutum	Occasional
S. diadema	Occasional
SERRANIDAE	
Anyperodon leucogrammicus	Rare, one adult seen
Cephalopholis boenak	Common
C. cyanostigma	rare, two adults seen
C. microprion	Occasional
Epinephelus fasciatus	Occasional
E. merra	Occasional
E. ongus	Occasional
Plectropomus leopardus	Rare, one adult seen
Diplorion bifasciatum	Rare, two adults seen
PSEUDOCHROMIDAE	
Labracinus cyclophthalmus	Common
Pseudochromis perspicillatus	Occasional
APOGONIDAE	
Apogon chrysopomus	Occasional

Fish Species	Abundance
A. griffini	Occasional, solitary
A. frenatus	Occasional
A. notatus	Occasional
A. parvulus	Occasional, in large schools
A. seali	Occasional
Cheliodipterus macrodon	Occasional
C. quinquelineatus	Common
CARANGIDAE	
Carangoides bajad	Rare, two juveniles seen
LUTJANIDAE	
Lutjanus argentimaculatus	Rare, one adult seen
L. carponotatus	Common
L. decussates	Rare, two adults seen
L. fulviflamma	Occasional
L. lutjanus	Abundant on artificial reef
L. russellii	Common
CAESIONIDAE	
Casesio caerularea	Occasional
C. teres	Occasional
HAEMULIDAE	
Diagrammus pictus	Occasional juveniles seen
Plectorhinchus chaetodonoides	Rare, one adult seen
P. lessoni	Rare, two adults seen
NEMIPTERIDAE	
Scolopsis bilienata	Common
S. ciliate	Common
S. margaritifer	Occasional
S. taeniopterus	Occasional
S. temporalis	Occasional
S. trivittatus	Occasional
Pentapodus caninus	Common
MULLIDAE	
Parupeneus barberinus	Occasional
Upeneus tragula	Common in sand
CHAETODONTIDAE	
Chaetodon adiergastos	Common, dominant butterfly

Fish Species	Abundance
C. baronessa	Occasional
C. melanotus	rare, two adults seen
C. octofasciatus	Common, dominant butterfly
Chelmon rostratus	Occasional
Coradion chrysozonus	Rare, one adult seen
Henichus accuminatus	Rare, one adult seen
H. chrysostomus	Occasional
H. varius	Occasional
Parachaetodon ocellatus	Rare, school of four seen
POMACANTHIDAE	
Chaetodontoplus mesoluecus	Common
Centropyge tibicen	Occasional
POMACENTRIDAE	
Abudefduf bengalensis	Common
A. sexfasciatus	Occasional, but in large schools
A. vaigiensis	Occasional, but in large schools
Amblyglyphidodon aureus	Occasional
A. curacao	Common in shallows
A. leucogaster	Occasional
Amphiprion clarkia	Occasional
A. frenatus	Occasional
Chromis ternatensis	Occasional
C. viridis	Occasional, but in large schools
C. weberi	Occasional
C. xanthura	Rare
Crysiptera rollandi	Occasional
C. talboti	Occasional
Dacyllus reticulates	Occasional
Dischistodus prosopotaenia	Common in shallows
N. azysron	Common in shallows
N. cyanomos	Abundant on A.R.
Plectroglyphidodon lacrymatus	Occasional
Pomacentrus adelus	Occasional
P. alexanderae	Common
P. amboinensis	Common

Fish Species	Abundance
P. bankanensis	Occasional
P. brachialis	Abundant
P. burroughi	Rare
P. chrysus	Rare
P. coelestis	Common
P. cuneata	Occasional in shallows
P. lepidogenys	Occasional in shallows
P. mollecensis	Abundant
P. nagasakiensis	Occasional at reef base
P. nigromarginatus	Occasional on slope
P. stigma	Occasional
Premnas biaculeatus	Rare
Pomacentrid sp.1	Common in shallows (see photo)
LABRIDAE	
Bodianus Diana	Rare
B. mesothorax	Occasional
Cheilinus chlorosus	Common
C. fasciatus	Occasional
Choerodon anchorago	Common
C. schoenleinii	Rare, two adults seen
Cirrhilabrus cyanopluera	Occasional in small schools
Coris batuensis	Occasional
C. pictoides	Rare, one juvenile seen
Diproctacanthus xanthurus	Common
Epibulus insidiator	Occasional
Halichoerus chloropterus	Occasional
H. melanurus	Common
H. ornatus	Rare
H. richmondi	Occasional
H. scapularis	Common in sand
Hemigymnus fasciatus	Occasional
H. melapterus	Occasional
Labrichthys unilineatus	Occasional
Labroides bicolor	Rare, one adult seen
L. dimmidiatus	Common
Oxycheilinus diagramus	Occasional
O. rhodochrous	Rare
O. unifasciatus	Occasional
Paracheilinus sp.1	Rare, small school in rubble patch
Pseudochelinus hexatania	Occasional

Fish Species	Abundance
Thalassoma lunare	Common
SCARIDAE	
Chlorurus bleekeri	Common
C. bowersi	Rare, one adult seen
Scarus dimidiatus	Occasional
S. ghobban	Occasional
S. niger	Occasional
S. quoyi	Occasional
S. rivulatus	Common
S. tricolor	Common
PINGUIPEDIDAE	
Parapercis clathrata	Common
BLENNIIDAE	
Meiacanthus atrodorsalis	Occasional
M. grammistes	Occasional
PHOLIDICHTHYIDAE	
Pholidichthys leucotaenia	Two large schools of juveniles
PTERELEOTRIDAE	
Ptereleotris evides	Rare
GOBIIDAE	
Amblyeleotris guttata	Occasional
A. steinitzi	Rare
Amblyeleotris sp. (red-fin)	Rare
Amblygobius hectori	Rare
Cryptocentrus fasciatus	Rare
C. strigilliceps	Rare
Exyrias bellissimus	Occasional
Valenscinea puellaris	Occasional
ACANTHURIDAE	
Acanthurus xanthopterus	Rare, one adult seen
SIGANIDAE	
Siganus guttatus	Rare
S. punctatissimus	Rare
S. virgatus	Occasional
TETRAODONTIDAE	
Arothron hispidus	Occasional
A. manilensis	Occasional
A. mappa	Occasional
Canthigaster papua	Occasional
Total Species	**151**
Total Families	**26**

Table 2. Top 10 families in terms of species diversity for Carbin Reef.

Rank	Family	No. Species	% Total Spp.
1	Pomacentridae	36	23.8%
2	Labridae	27	17.9%
3	Chaetodontidae	10	6.6%
4	Serranidae	9	6.0%
5	Scaridae	8	5.3%
6	Apogonidae	8	5.3%
7	Gobiidae	8	5.3%
8	Nemipteridae	7	4.6%
9	Lutjanidae	6	4.0%
10	Tetraodontidae	4	2.6%

Table 3. Species density (species per 500 m^2) for two reef sites on Carbin Reef (± 1 standard error, n = 6).

Site	Species Density
Northwest Sector	34.5 ± 0.8
Northeast Sector	39.5 ± 1.3

Table 4. Ten-year trends in reef fish density, species richness, and biomass of Carbin Reef.

	1995*	2005
Total Density (fish/500m^2)	1433 ± 368	817 ± 130
Species Richness (species/500m^2)	23 ± 2	37 ± 1.0
Target Biomass (Kg/500m^2)	2.59	34.39 ± 6.91

(* data from Luchavez and Luchavez, 1995)

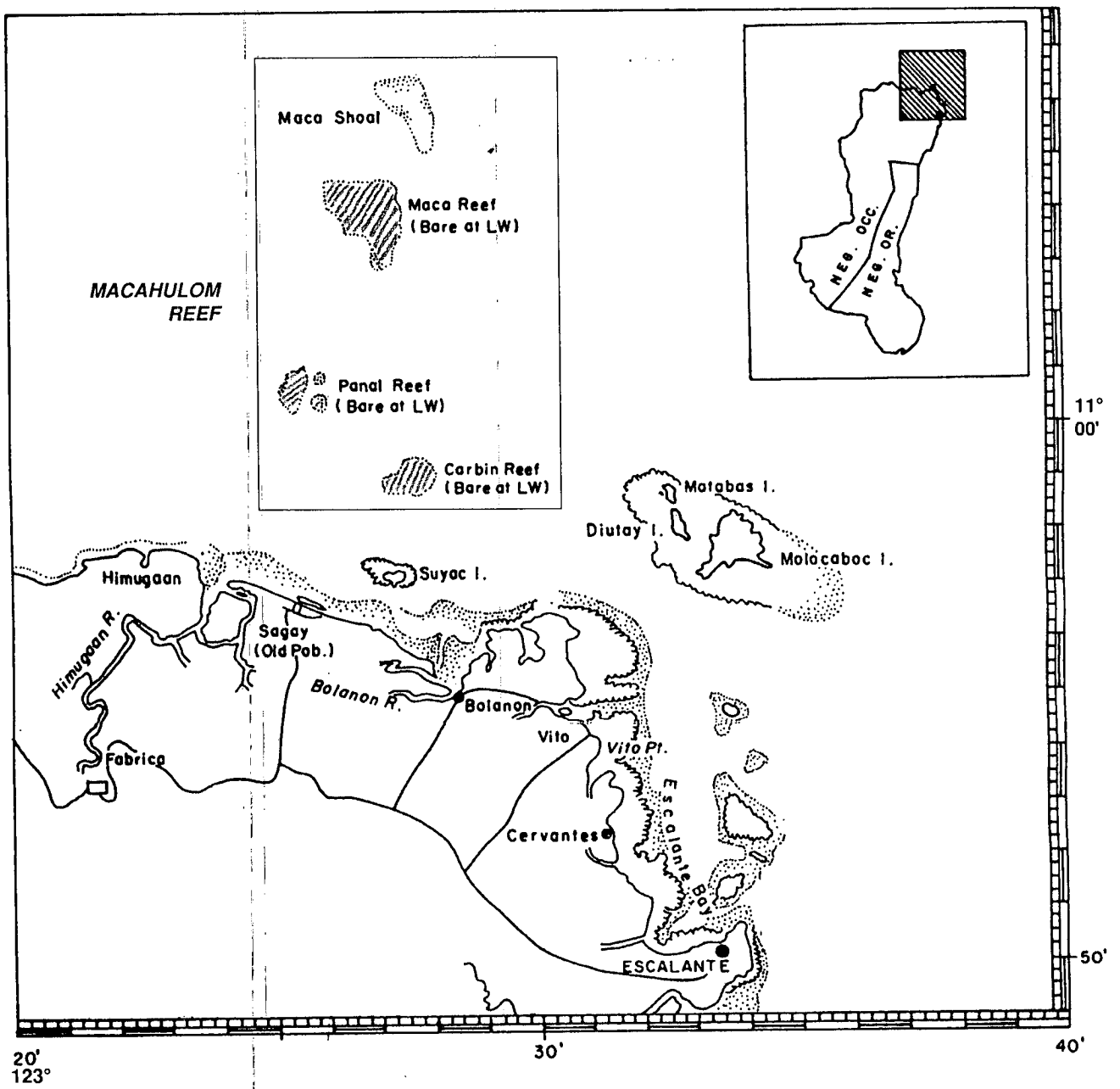

Figure 1. Survey sites on Carbin Reef (NW = northwest sector NE = northeast sector)

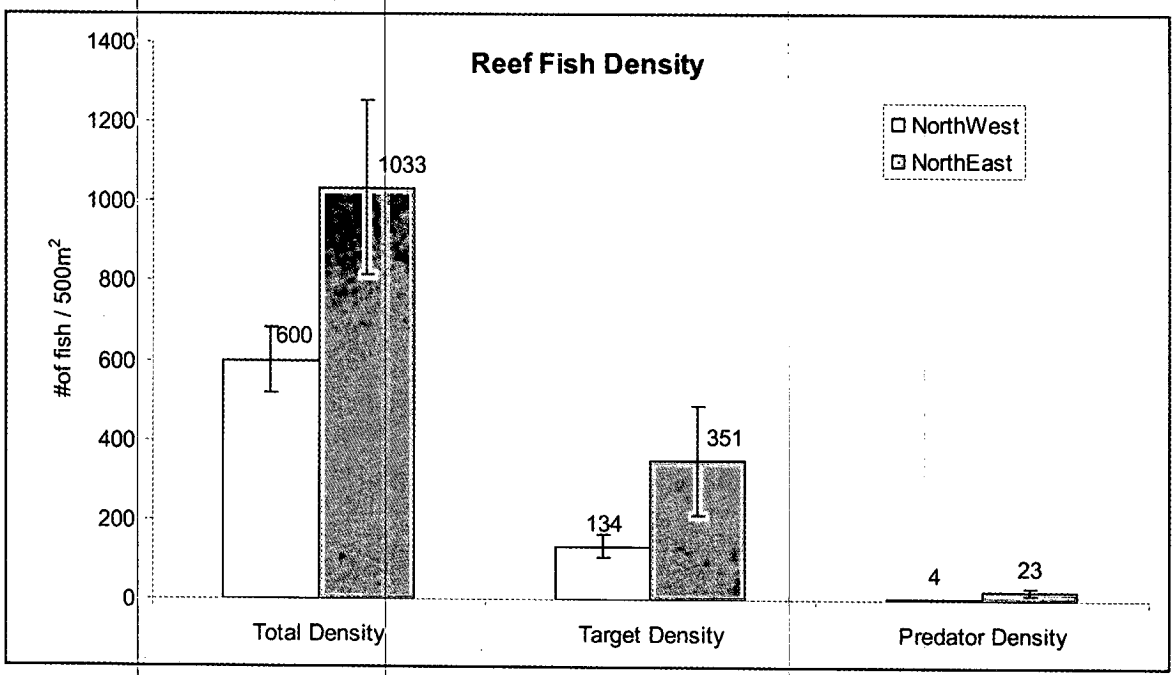

Figure 2. Mean total, target, and predatory reef fish density for the northwest and northeast sectors of Carbin Reef (error bars ± 1 standard error, n=6)

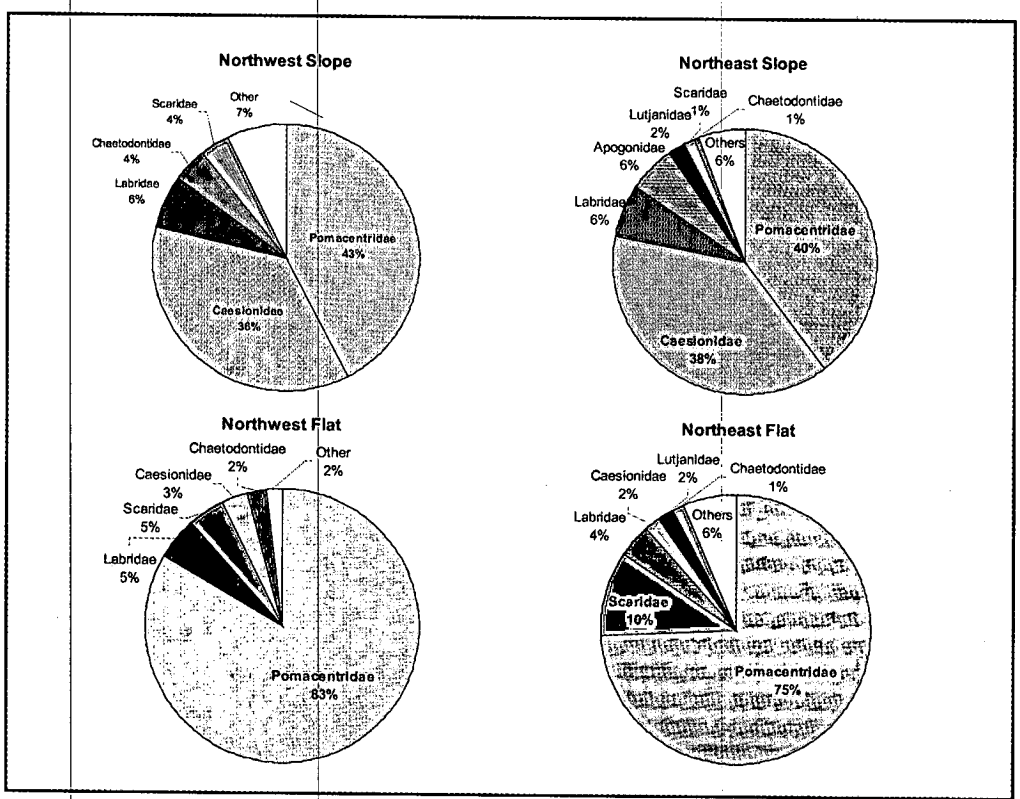

Figure 3. Comparison of percent composition of fish abundance by family between sites (northwest and northeast sectors) and reef zones (reef slope and flat)

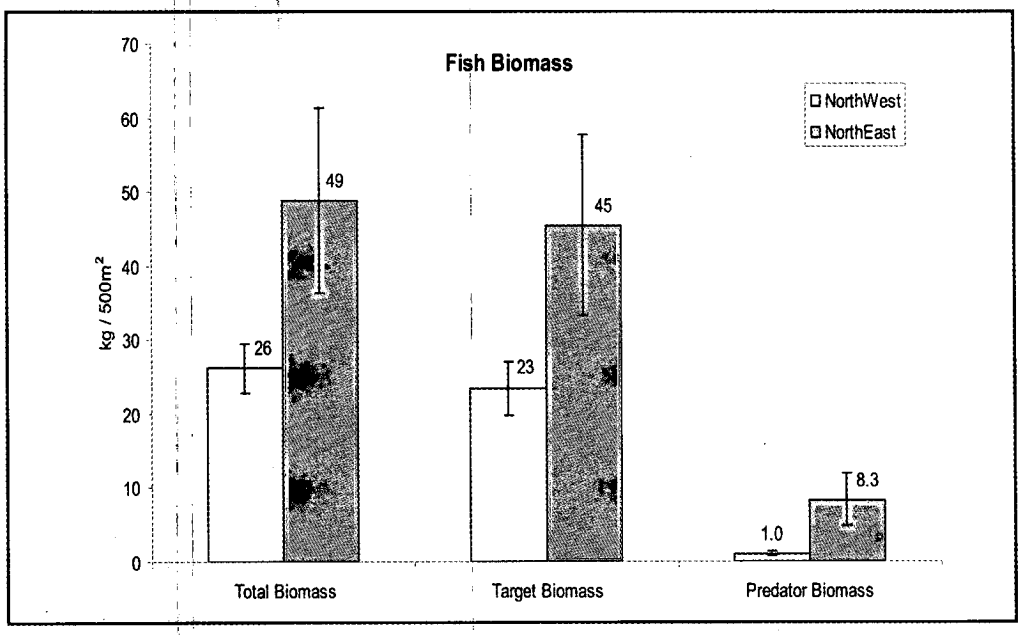

Figure 4. Mean total, target and predator fish biomass for the northwest and northeast sectors of Carbin Reef (error bars ± 1 standard error, n=6).

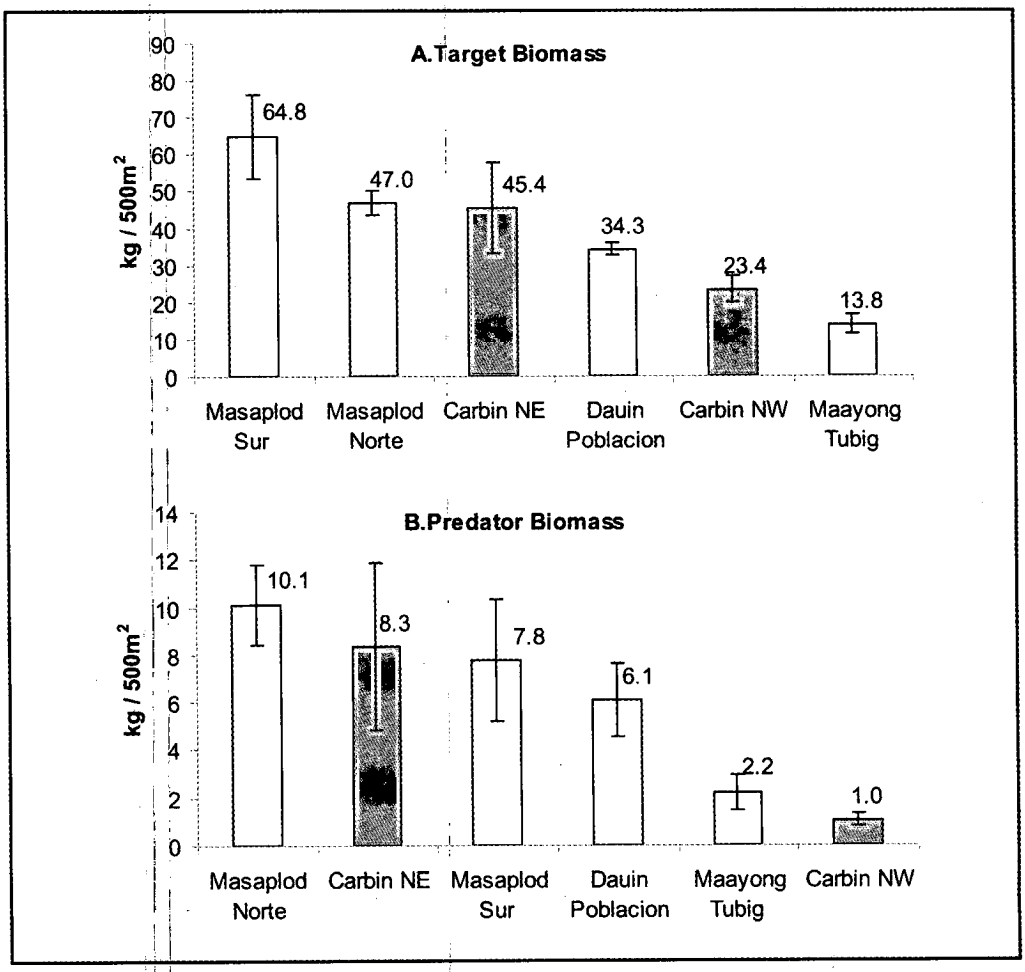

Figure 5. A comparison of mean target and predator fish biomass of four marine reserves in Dauin, Negros Oriental and two Sites on Carbin Reef, Sagay, Negros Occidental (error bars ± 1 standard error, n=6).

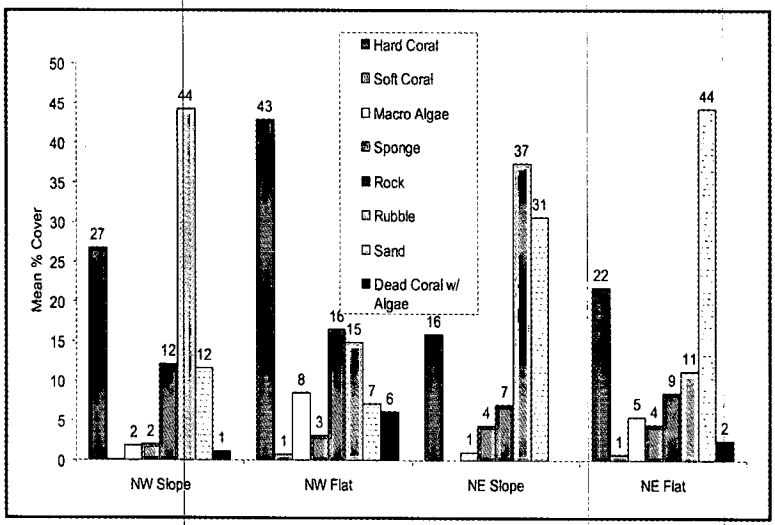

Figure 6. Mean percent cover of major substrate categories for the reef slope and flat of the northwest and northeast sectors of Carbin Reef

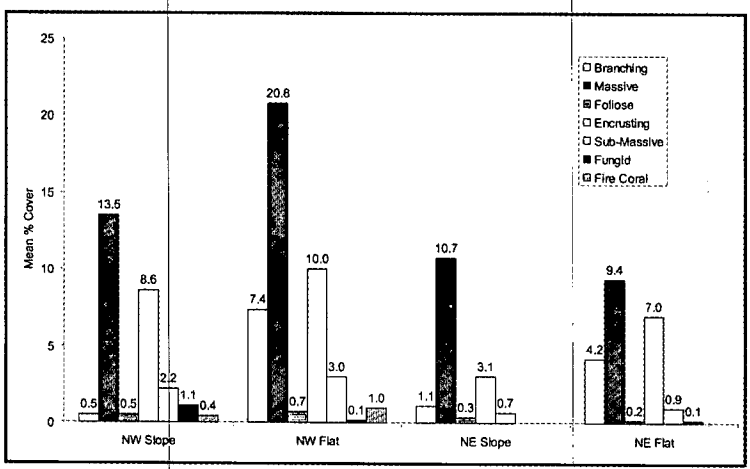

Figure 7. Mean percent cover of live coral growth forms for the reef slope and flat of the northwest and northeast sectors of Carbin Reef.

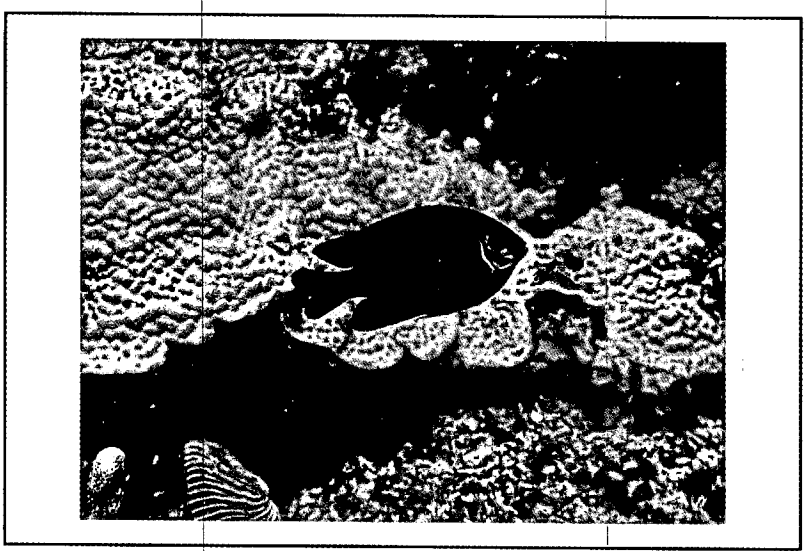

Figure 8. A "Skull-faced Damsel," an unidentified Pomacentrid, which lives in small groups among coral patches along the reef flat (2-3 m).

BASELINE SURVEY OF THREE MARINE PROTECTED AREAS IN THE PROVINCE OF SIQUIJOR, PHILIPPINES, WITH MANAGEMENT RECOMMENDATIONS

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ABSTRACT

A baseline survey was conducted in late 2005 in three marine protected areas (MPAs) along Siquijor Island, namely Tubod, Nonoc, and Tulapos. These MPAs have been reportedly protected for 16, 9, and 18 years, respectively. Live hard coral (LHC) cover is relatively low in all stations except in the no-take zone of Tulapos MPA, which has more than 50% LHC cover. Fish species count is low, with Tubod MPA registering the highest abundance, with 51 species distributed in 16 families. Observed biomass of target species in the deeper stations of the "no-take zones" of the MPAs range from 15.06 kg./750 m2 (20.08 kg./1000 m2) to 81.58 kg./750 m2 (108.77 kg./1000 m2), with a mean of 59.40±26.09 (SE) kg./1000 m2. The upper estimates are moderately high, indicating some degree of protection and management. However, they are lower than those of Sumilon and Apo Marine Reserves for comparable number of years of protection. Since all of these marine reserves are found in the Bohol Sea, presumably with similar marine and oceanographic features, it is likely that a certain degree of disturbance (fishing activities) could have occurred inside and outside the no-take zones. It is therefore recommended that (1) data be gathered through regular monitoring of species and biomass in these MPAs; (2) education be periodically conducted to maintain community awareness of the importance of MPAs; and (3) community empowerment be also done to strengthen commitment to sustainable management.

INTRODUCTION

The general objective of an MPA consisting of no-take and fished zones is to allow the recovery of damaged marine environments and the development of fish assemblages that are high in biomass and rich in species in the no-take zone, so that there is a net export of fish biomass to adjacent fished areas (Alcala and Russ 1990). MPAs serve as management tools for a system as complex as a coral reef (Roberts and Polunin 1993).

In the Philippines as elsewhere, coral reefs provide coastal communities with food and other basic necessities. However, most reefs all over the country are experiencing over exploitation. Destructive fishing methods are still being used, resulting in the destruction of this ecosystem and the depletion of important fisheries resources. In the context of coral reef protection and conservation, the most viable solution available to developing countries is the establishment of marine protected areas (MPAs). The establishment of such protected areas has become, since the 1980s, the most common option to effectively address the problem of overexploitation, biodiversity conservation, sustainable supply of fish, and preservation of coral reef and other marine habitats. MPAs have subsequently grown in number to about 350 (SUAKCREM unpubl. list) throughout the country, but with varied levels of management, ranging from highly effective to ineffective. Periodic monitoring and evaluation of these MPAs are therefore crucial to their sustained management.

This paper reports on the results of a baseline survey conducted to document and evaluate the density of target and indicator fish species, and to assess the condition of the fish habitat (coral reef) in the no-take and fished zones of three MPAs in the province of Siquijor, Philippines. The survey is part of a larger-scale monitoring effort of establishing baseline information on MPAs in the Visayas regions. The survey was implemented with the cooperation of various higher education institutions in these regions in late 2005. Funding came from the Commission on Higher Education (CHED) through the Zonal Research Center (ZRC) for Region VII (part) and Region VI Grants in Aid (GIA), for which the authors are grateful. They are also thankful to Dr. A.C. Alcala for help in editing an earlier draft of the manuscript.

Site Description

This study was conducted in the following MPAs in the province of Siquijor: Tubod MPA, Barangay Tubod, Municipality of San Juan; Nonoc MPA, Barangay Nonoc, Municipality of Larena; and Tulapos MPA, Barangay Tulapos, Municipality of Enrique Villanueva (Table 1, Figure 1). The selection of these MPAs was based on two criteria: (1) complete legal instruments on the establishment (e.g., ordinances), and (2) high level of local community participation in the implementation and management as reported to the researchers.

METHODS AND MATERIALS

The Line Intercept Transect (LIT) method, as designed and recommended by English et al (1994), was used to determine the coral condition and the species composition of the reefs. A 20-m. transect was laid at two coral communities separated by depth gradients (3 m. and 10 m.). Three non-overlapping transects were laid at the 3-m. and the 10-m. depths at each of the three MPA sites both inside and outside of the no-take zone. Benthic life-forms (e.g. corals, invertebrates etc.) intercepted by the transect line were identified and recorded in situ. From the LIT data, percentage coral cover as well as a coral species checklist for species identification was generated. Large invertebrates such as sea cucumbers, giant clams, etc. were also recorded.

Coral reef fishes in the reserve or no-take zone and non-reserve or fished areas were assessed using the fish visual census recommended in English et al. (1994). This survey was carried out in conjunction with, but prior to, the LIT for corals to minimize disturbance of the fish. Three 50-m. transect lines were laid at 10 m. (deep) and 5 m. (shallow) depth zones, parallel to the shore, each with a survey area of 250 sq. m. Target food fishes (favored by fisherfolk) and visually obvious fish species found along the 50-m. transect line and within 2.5 m. on either side of the transect line, as well as 5 m. above, were identified. Species identification, length and abundance estimates were made in situ. Identification of fish species was confirmed using field guides (Randal et al 1990, Meyers 1991, Debelius 1993, Kuiter et al. 1994, Lieske and Myers 1994, Allen and Steene 1994). The data for the three transects in the no-take and fished

zones of the three MPAs were combined to estimate the species' richness, abundance, and target fish biomass. The formula used to compute fish biomass in this study was adopted from Froese and Pauly (2000).

RESULTS

Tubod Marine Protected Area

Corals and coral reef

There are 173 species of scleractinian and non-scleractinian corals (belonging to 16 families and 57 genera) identified in Tubod MPA. The dominant coral growth forms found in the MPA sites are the massive, branching, foliose, and encrusting types of corals. The common species of massive corals observed are Porites, Lobophyllia, Goniopora, and some species of Favia. Branching species of Acropora, Pocillopora, and Seriatopora as well as encrusting and foliose species of Montipora were also observed.

A high percentage cover of live hard coral (Figure 2) was observed within the boundaries of the no-take zone of the Tubod MPA. A high percentage of coral cover (mean 41.83 ±5.07% [SE]) was also observed in the deeper areas (transect) outside the boundaries of the Tubod MPA.

The substrate indicator category consists of sand, rock and coral rubble. These substrate indicators cover less than 50% of the areas surveyed for both inside and outside of the no-take zones of the MPA. Substrate in all sites is mostly composed of sand and loose coral rubble. Loose substrate inhibits coral growth and colonization due to instability. Dead coral cover falls within the percentage range of 0-40%.

Macro-invertebrates

Twenty-eight (28) species of macro-invertebrates (including 4 unidentified species) were found during the survey. Macro-invertebrate indicator species, such as giant clams, crown-of-thorns starfish and sea urchins were identified and counted both inside and outside the transects. The most common macro-invertebrate based on counts is the feather star (Commanthina sp.), with over a thousand individuals counted per site. The presence or absence of macro-invertebrates in these reef areas is a significant indicator of reef health, thus periodic survey and inventory of their populations are also important aspects of monitoring and evaluating MPA sites.

Fish species richness

The number of fish species and families is summarized in Table 3. Higher fish diversity were observed inside the no-take zone of Tubod MPA with 61 species distributed in 16 families, compared to the adjacent reef outside the MPA, which have 43 species and belonging to 16 families. Pomacentrids, serranids (Anthiinae: Fairy basslets), acanthurids, scarids, and chaetodontids were among the most represented groups inside the reserve. The most common species outside the no-take zone of the MPA are the pomacentrids, lutjanids, mullids and chaetodontids. Groupers (serranids) and jacks (carangids) are the least represented groups at both sites. There is also a low number of indicator chaetodontids inside and outside the no-take zone (5-10 species), with Chaetodon baronessa and C. kleinii being the most common species.

Target fish biomass and abundance

In the no-take zone of Tubod MPA, the biomass of target fish species in the shallow portion was 9.133 kg./750 m2 (12.77 kg./1000 m2). Higher biomass at 37.019 kg./750 m2 (49.36 kg./1000 m2) was observed in the deeper part of the reserve (Figure 3). The biomass of target species in the fished zone outside the reserve is lower, with the deeper station registering 34.16 kg./750 m2 (45.55 kg./1000 m2), while the shallow station has a very low biomass, 0.306 kg./750 m2 (0.48 kg./1000 m2).

The estimated sizes and abundance of some target species inside and outside the no-take zone of the MPA are shown in Figure 4. Of the larger target fish species inside the no-take zone, acanthurids and scarids were the most dominant species. Lutjanids and mullids are relatively abundant in the 10-m. deep zone, but were not found in the shallow portion of the no-take zone.

Comparing the deeper portions of the no-take zone and the adjacent fished reef outside, the latter has a relatively higher abundance of large fish species

(more than 20 cm.), with lutjanids comprising the bigger proportion (Figure 4). This could be due to the mobile behavior of lutjanids, which were noted moving towards the transect belt during the survey. They may have come from the no-take zone of the MPA. Aurellado et al (2002), in the preliminary results of their study, reported that lutjanids and scarids are able to move over long distances.

Figure 4 further illustrates that more scarids of smaller sizes (less than 20 cm.) appear in relatively higher abundance inside the no-take zone of the MPA with 43 individuals, compared to only 11 individuals outside the no-take zone.

The significantly low fish counts (and hence biomass) at the shallow stations inside and outside the no-take zone of the MPA could be due to the big waves and strong currents during the survey. Still, chaetodontids were observed to have higher numbers inside the reserve (no-take zone) with 73 individuals, compared to the adjacent reef outside which had only 39 individuals.

Nonoc Marine Protected Area

Corals and coral reef

One-hundred thirty-three (133) species (scleractinian and non-scleractinian corals), belonging to 50 genera and 16 families were identified in the Nonoc MPA. Low percentages of live hard coral cover (LHC) were observed inside the no-take zone of the Nonoc MPA, 15.83% (at 10-m. depth) and 12.17% (at 5-m. depth), as well as outside, 22.17% (at 10-m. depth) and 15.83% (at 5-m. depth).

Fish Species Richness

A summary of fish species counts in the two depth zones of the no-take zone of the MPA as well as the adjacent reef outside the no-take area is presented in Table 3. The richness of species was observed to be higher inside the no-take zone, with 46 species representing 14 families, than at the adjacent reef outside, which has only 29 species distributed to 10 families. Pomacentrids are the most abundant species observed in all zones of both sites. Mullids are common inside and outside the no-take zone, while lutjanids and haemulids are only found inside. Serranids (Epinephelinae and Anthiinae) were only found at deeper zones inside and outside of the no-take zone.

Six species of chaetodontids were noted inside the no-take zone, while 4 were noted outside. Chaetodon barronessa is common in all the transects (inside and outside the no-take zone), except in the shallow part outside.

Target fish biomass and abundance

The average biomass of target species inside the deeper portion of the no-take zone of the MPA was 15.06 kg./750 m2 (20.08 kg./1000 m2), while it was very low, 1.309 kg./750 m2 (1.745 kg./1000 m2) at the shallower station. Biomass outside the no-take zone was very low at 1.13 kg./750 m2 (1.51 kg./1000 m2) and 0.048 kg./750 m2 (0.064 kg./1000 m2) at the deep and shallow stations respectively.

Mullids are found in all the transects but in relatively low numbers, while scarids are relatively more abundant inside the protected area than outside. Labrids, particularly Cirrhilabrus species abound outside the no-take zone of the MPA and are found associated with coral rubble. Russ and Alcala (1989) reported that the increase in density of Cirrhilabrus and Thalassoma spp. may have been related to the increase in abundance of coral rubble. Twelve chaetodontids are found inside the no-take zone, while 14 individuals (chaetodontids) are found at the deeper portion outside of the Nonoc MPA.

Figure 5 shows the estimated fish abundance and length distribution of some target species inside and outside the no-take zone of Nonoc MPA. Results indicate a significant difference in the number of large individuals (more than 20 cm.) between inside and outside of the no-take zone area, with relatively higher counts inside the no-take zone, particularly of lutjanids and scarids.

Tulapos Marine Protected Area

Corals and coral reef

In the Tulapos MPA, 126 species of scleractinian and non-scleractinian corals belonging to 45 genera

and 16 families were identified. Like the Nonoc MPA, the Tulapos MPA has low percentages of live hard coral cover for both inside and outside the no-take zone (Figure 2).

Fish species richness

A summary of fish species richness and abundance is presented in Table 3. There is an obvious difference in species richness inside and outside the no-take zone of Tulapos MPA. The no-take zone has 62 species belonging to 19 families, while outside the zone, only 28 species in 9 families are found. The no-take zone is inhabited mainly by scarids, acanthurids, caesionids, and pomacentrids. Outside the no-take zone, the most dominant species are pomacentrids, anthiids, and labrids. Some large target fish species (acanthurids, caesionids, and lutjanids) are only found inside the boundaries of the no-take zone. Two large mangrove jacks, Lutjanus argentimaculatus (about 30 cm. and 40 cm.), are also found at the shallow portion of the no-take zone of the MPA.

Approximately 8 species of chaetodontids were noted inside, while only 2 species were observed outside the no-take zone. Chaetodon baronessa and C. kleinii are the dominant species inside and the only species observed outside the no-take zone of the MPA. There are 34 chaetodontid individuals inside and only 7 outside of the no-take zone. This could be correlated to differences in habitat structure of the reef inside and outside the no-take zone of the MPA.

Target fish biomass and abundance

The Tulapos MPA has the highest target fish biomass observed among the 3 MPAs surveyed (Figure 3). The deeper portion inside the no-take zone has a recorded biomass of 81.58 kg./750 m2 (108.77 kg./1000 m2), while the shallow portion of the no-take zone had 17.19 kg./750 m2 (22.92 kg./1000 m2). The adjacent reef outside the no-take zone of the MPA has about the same biomass as the adjacent reefs of the 2 other MPAs in the present study.

In the Tulapos MPA, as with the other two MPAs, there is a significant difference in fish abundance of large target fish between the no-take zone and the fished zone outside the no-take zone: more abundant inside than outside (Figure 6). The density of smaller size (less than 20 cm.) scarids is also higher inside compared to that in the adjacent reef outside the no-take zone of MPA. This could be due to habitat selection; smaller parrotfishes prefer the shallower areas inside the MPA. However, the low count of bigger sized fish outside could also be attributed to fishing, as indicated by the presence of 8 large fish traps at the deep portion outside the no-take zone of the MPA.

DISCUSSION

Corals, coral reef, and macro-invertebrates

Among the three surveyed MPAs, Tubod has the highest live hard coral (LHC) cover, while Tulapos has the lowest. LHC cover showed little difference between stations (deep vs. shallow, inside vs. outside), with the exception of the Tubod MPA, where the shallow station outside the no-take zone had significantly low coral cover compared to the other stations (Figure 2). A relatively high LHC cover is important for maintaining a healthy MPA.

Giant clams, crown-of-thorns starfish, and sea urchins were observed in most of the sites, although they are not numerous.

Target Fish

The deeper portions of the three MPAs appear to have higher fish biomass compared to the shallower portions, and this indicates poorer environmental quality and occurrence of disturbance such as fishing. The Tulapos MPA appears to have the highest observed target fish species richness (32 species) and fish biomass (108.77 kg./1000 m2), among the 3 MPAs studied, followed by the Tubod MPA (29 species) and fish biomass (49.36 kg./1000 m2) and by the Nonoc MPA (24 species) and biomass (15.06 kg./1000m2) (mean, 59.40±26.09 [SE] kg./1000 m2) in the deeper stations. The highest biomass, 108.77 kg./1000 m2, found in one of the three Siquijor MPAs fell short of the expected size by 50-70 kg., based on findings from Sumilon and Apo marine reserves (Alcala et al 2005).

However, live hard coral cover was highest at the

Tubod MPA. The high fish biomass at Tulapos, despite the relatively low live hard coral cover, indicates that other factors (e.g., years of full protection) aside from coral cover, influence the biomass of fish found in a particular reef. The three MPAs studied were established at different times in the past: Tulapos in 1987, Tubod in 1989, and Nonoc in 1996. Their fish biomass roughly correlates with the number of years of protection, as shown by the findings of Russ and Alcala (2003).

The fish biomass in the three Siquijor MPAs is lower than that of the two marine reserves in the same body of water (Bohol Sea), namely Sumilon Marine Reserve and Apo Marine Reserve, which have 150-170 kg./1000 m2 after 10-20 years of protection (Alcala et al. 2005). Tulapos and Tubod have been protected for 18 and 16 years, respectively. There are reasons to suggest that these two marine reserves may not have been given full protection from fishing. Moreover, a look at the number of species in these three MPAs of top predatory fish species in the Families Serranidae, Carangidae, Lethrinidae and Lutjanidae, which are indicators of recovery, show fewer species than expected. Tulapos has 6 species, Tubod has 9, and Nonoc has 4, all below the number expected (20) of well-protected MPAs in the Bohol Sea (Unpublished data at SUAKCREM). Again, this suggests that the three Siquijor MPAs have not recovered as fast as the others that have been known to be given full protection. One of these reasons is probably inadequate protection. However, this still needs to be verified.

CONCLUSION AND RECOMMENDATIONS

The researchers conclude that the managers and implementers of the three Siquijor MPAs may need to increase their protection efforts in order to fully benefit from the MPAs. Accordingly, the following recommendations are presented:

1. Continue monitoring Marine Protected Areas (MPAs)

Rehabilitating coral reef areas with the active participation and commitment of local communities has been the core concept of establishing marine protected areas throughout the Philippines (Ablong and Waltemath 1995). Reef rehabilitation does not end in the approval and implementation of an ordinance; it is a continuous process. A scientific monitoring of an area should be conducted at regular intervals to generate a database that can be used for a variety of purposes. Monitoring includes assessment of physico-chemical conditions of reefs, invertebrate populations and fish populations. The lack of periodic monitoring and assessment often becomes a weak link between implementation and sustainability of MPAs.

2. Continue community education to sustain MPAs

The information gathered through monitoring should be presented to the local dependent community as part of a strategy to encourage support and sustainable management of MPAs. Community education is an essential activity to sustain MPAs and can be a tool for successful management with the help of line government agencies. It should include activities that increase environmental awareness among community members. As experience shows, communities with a good understanding of the importance of their marine environment have actively protected their MPAs and have maintained their commitment to sustainable MPA management.

3. Continue community empowerment and capacity-building

Empowering and building the capacity of local communities are essential in sustaining management initiatives. Enforcing coastal laws by local enforcers (Bantay Dagat) will greatly help in the proper and efficient enforcement of coastal laws in relation to MPAs. Training on environment-friendly enterprise development and land-based livelihood can serve to empower enforcers among local communities, thereby facilitating compliance with MPA rules and regulations, and thus help alleviate pressures on coastal resources.

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List of Figures and Tables

Table 1. MPA site description and information on the three MPA sites (Source: Actual Survey/Interview and CEP of Siquijor Province, Philippines, 2004).

MPA Site	Area (ha)	General MPA Description/Information	Legal Basis
Tubod MPA, Barangay Tubod, San Juan, Siquijor	8.1	MPA area includes sandy area, seagrass beds. Shallow areas dominated by massive and soft corals. Management of MPA: not properly managed due to lack of funds. MPA management was turned over to LGU from Fisherfolk Association (FA).	Established in 1989. Municipal Ordinance No. 7 through the technical and financial initiative of CVRP. MPA is now supported by Municipal Ordinance No. 15.
Nonoc MPA, Barangay Nonoc, Larena, Siquijor	4.13	Reef flat area is covered with algae (*Sargassum*) and substrate is sandy Reef area is patchy, i.e., coral and seagrass patches. Corals in deeper areas are growing on large patches of dead corals. MPA is exposed to northeast monsoon winds. Management of MPA: Strong MPA commitment among locals with plans for ecotourism, creation of a marine management committee in progress.	MPA established in 1996 and protected under Municipal Ordinance No. 18 through the technical and financial support of CVRP. Re-established in 2003 through Municipal Ordinance No. 4 by SCORE (an NGO).
Tulapos MPA, Barangay Tulapos, Enrique Villanueva, Siquijor	27.22	MPA is the oldest and largest MPA in the province, established in the 1980's by CVRP. Reef flat exhibits surge channels Strong wave action during the northeast monsoon MPA has extensive mangrove area that extends to cover two barangays. Reef area is dominated by Acroporid and Favid corals. Also has a wide seagrass area and mudflats near mangrove area. Managed cooperatively by the local community, local government and people's organizations in the area.	Established as a fish sanctuary in 1987 under the auspices of CVRP (Municipal Ordinance No. 11). Now supported and protected by Ordinance No. 5 of 2002.

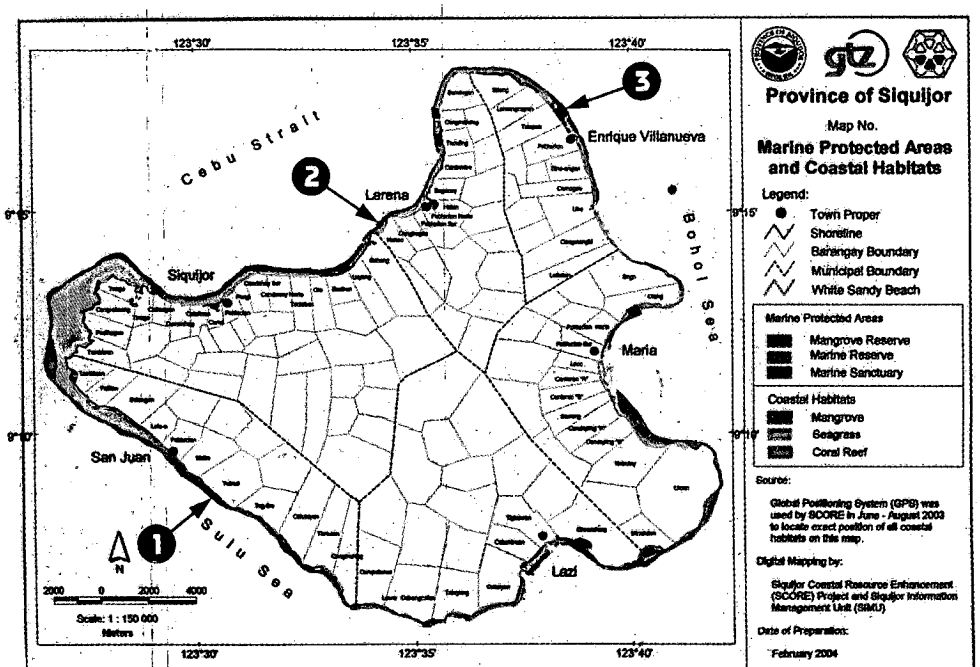
Table 2. Summary of coral species, genera and families identified in the study sites (includes non-scleractinian corals)

MPA Sites	Number of Corals Identified		
	Families	Genera	Species
Tubod	16	57	173
Nonoc	16	50	133
Tulapos	16	45	126

Table 3. Summary of fish abundance and diversity inside and outside the Tubod, Nonoc, and Tulapos MPAs

Areas	MPA Zones					
	Inside			Outside		
	Deep [10m]	Shallow [5m]	Total Combined Transects [1500m²]	Deep [10m]	Shallow [5m]	Total Combined Transects [1500m²]
TUBOD MPA						
Total No. of Individuals	975	292	1267	608	71	679
Total No. of Species	51	31	61	38	13	43
Total No. of Families	14	13	16	15	8	16
NONOC MPA						
Total No. of Individuals	352	76	428	324	84	408
Total No. of Species	41	15	46	28	10	29
Total No. of Families	14	8	14	10	6	10
TULAPOS MPA						
Total No. of Individuals	598	254	852	403	109	512
Total No. of Species	50	36	62	25	17	28
Total No. of Families	16	16	19	9	8	9

Figure 1. Map of Siquijor Island showing the locations of the MPAs in this study: 1 - Tubod, San Juan MPA, 2 - Nonoc, Larena MPA, 3 -Tulapos, Enrique Villanueva MPA



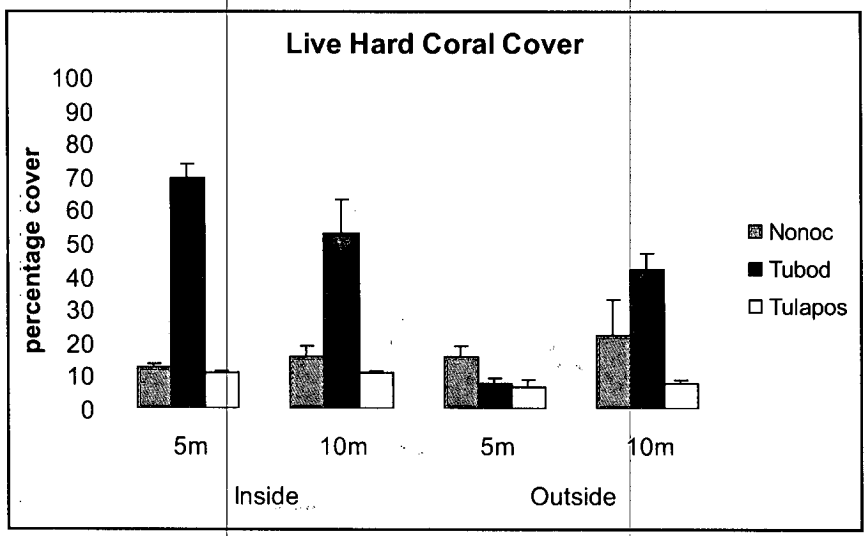


Figure 2. Comparison of live hard coral (LHC) cover among the three MPAs (Error bars are ±S.E.)

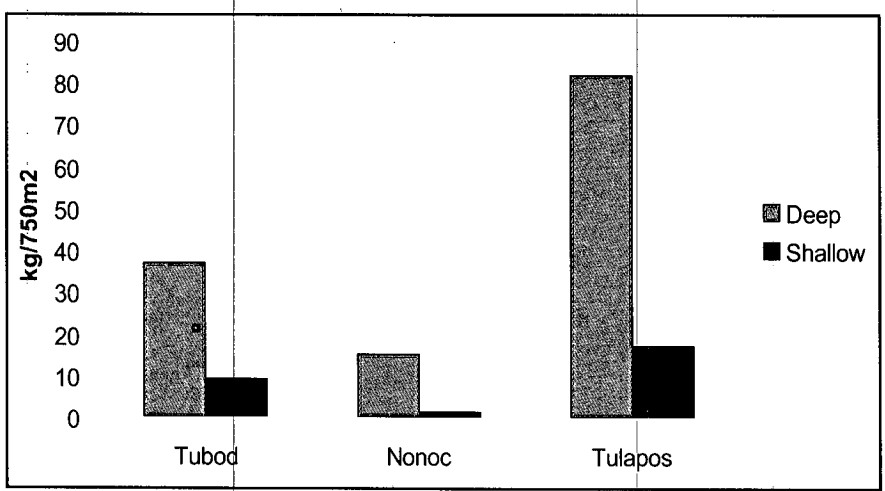


Figure 3. Comparison of fish biomass observed inside the three MPAs (figures are in kg/750m^2).

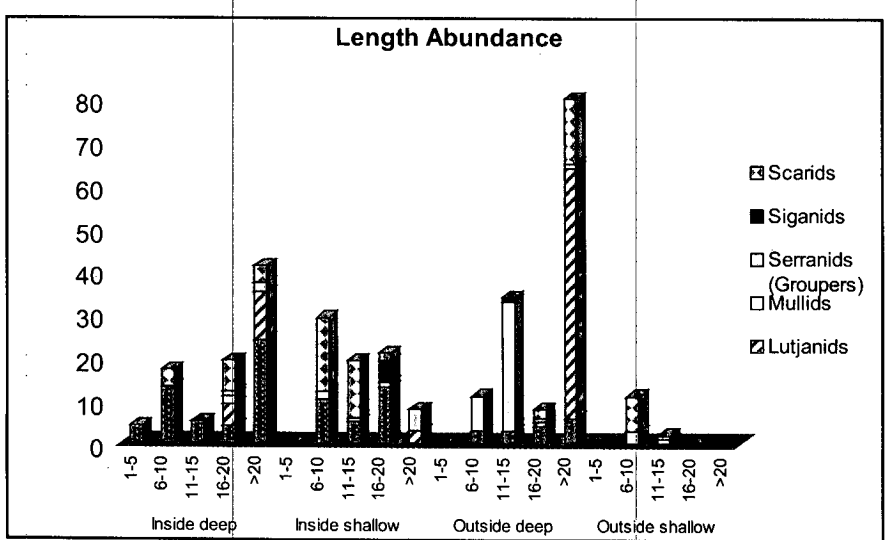


Figure 4. Fish abundance by length categories inside and outside the Tubod MPA.

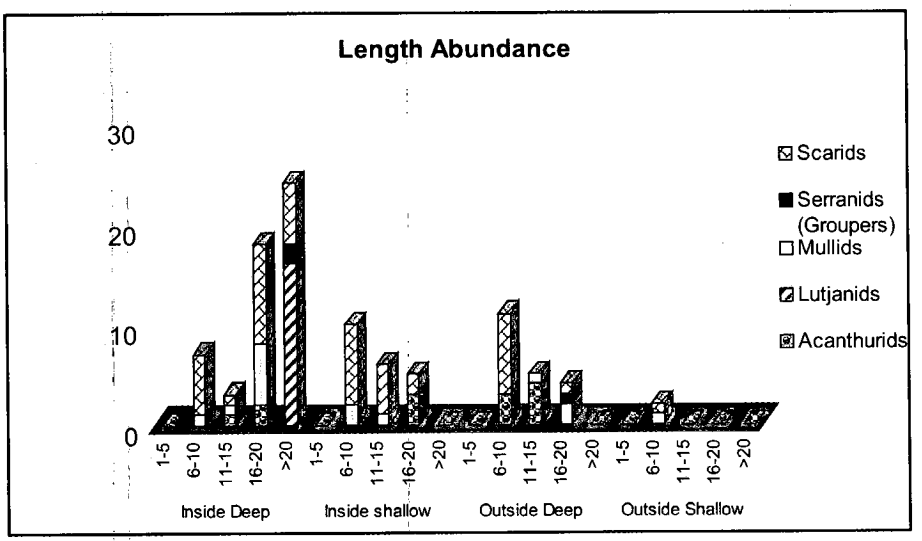


Figure 5. Fish abundance by length categories inside and outside the Nonoc MPA.

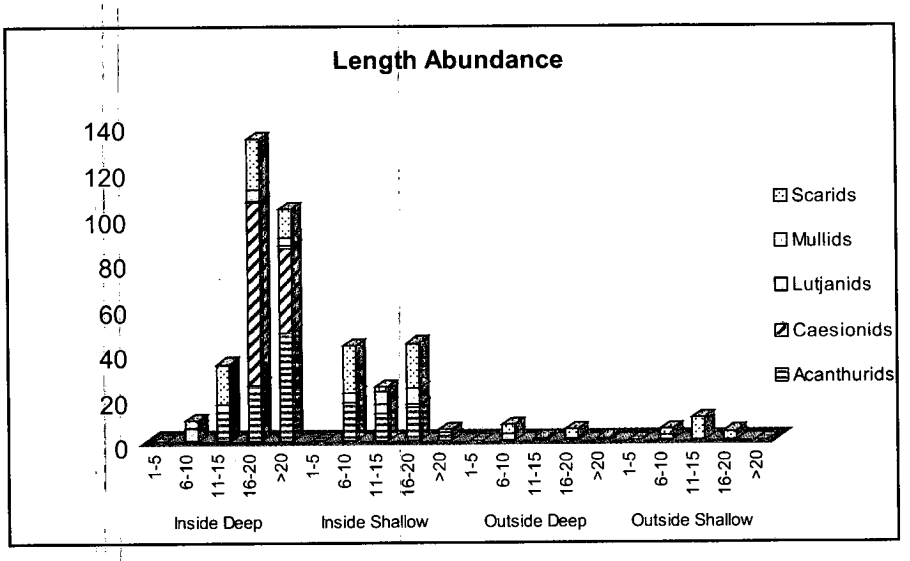


Figure 6. Fish abundance by length categories inside and outside the Tulapos MPA.

BASELINE INFORMATION ON FISH CATCH AND CATCH-PER-UNIT EFFORT (CPUE) FOR HOOK-AND-LINE IN THREE MARINE PROTECTED AREAS OF SIQUIJOR ISLAND, PHILIPPINES

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ABSTRACT

Based on interviews with fishers and actual identification and weighing of captured fishes, the researcher found out that fish catch and catch-per-unit effort (CPUE) using hook-and-line in three marine protected areas around Siquijor Island are relatively low. The estimated mean CPUE for Nonoc in Larena is 0.47 kg./man-hr.; 0.27 kg./man-hr. for Tubod in San Juan; and 0.28 kg./man-hr. for Tulapos in Enrique Villanueva. These findings may be attributed to ineffective or lack of spillover of adult fish biomass from the reserve area to the fished area. The three areas may also be over-fished resulting in very low fish biomass and diversity; only 22 species of fish belonging to 15 families were recorded.

INTRODUCTION

In recent years, the volume and diversity of fish catch from marine ecosystems throughout the world have remarkably declined. Coastal fisheries, particularly, have collapsed; marine biodiversity has been reduced, if not lost, and the trophic structure of marine ecosystems has been altered. Some experts have attributed these problems to the rapid growth in human population (FAO 1995) that resulted in an increase in the number of mouths to feed and fisheries overexploitation. In their efforts to survive, after all, fisherfolk would catch even the smallest fish by using fine-meshed gill nets.

In order to help manage and sustain marine fisheries around Siquijor Island, three marine reserves or marine protected areas (MPAs) were established by the Central Visayas Regional Program (CVRP) in 1986. MPA is an area protected from all forms of fishing and extractive activities by people (Maypa et al. 2002). Here, fishes and other marine organisms are allowed to grow and reproduce without being disturbed. Indeed, evidence is accumulating that higher biodiversity and abundance and larger sizes of fish and other organisms are direct effects of protection (Alcala and Russ, 1990; Russ and Alcala 1996a, 1996b, 1998).

Marine reserves were established in Nonoc in Larena, Tulapos in Enrique Villanueva, and Tubod in San Juan, all on the island of Siquijor. The MPA in Tubod was managed by the local government unit and the DA-BFAR from 1986 to 1998, after which

people's organizations took over. However, protective measures were strictly enforced only in May 2004 (personal communication). The MPA in Tulapos was launched on December 1, 1993, by the DENR and the People's Organization. The latter protects and manages it up to the present. On the other hand, the MPA in Nonoc was established in 1996 through the initiative of the CVRP and managed by the Fisherfolk Association of Barangay Nonoc. Later, the MPA was turned over to the local government of Larena but became inactive due to lack of funds and conflict among the stakeholders. In 2003, the MPA was re-established with technical assistance from the Siquijor Coastal Resource Enhancement Program (SCORE). Currently, the MPA is managed by the Marine Management Committee (MMC) of Larena, Siquijor.

A marine reserve can restore lost marine biodiversity and altered tropic structure of marine ecosystems if managed properly. It is also expected to sustain fisheries outside the area by exporting adults and propagules, referred to as spillover and recruitment effects, respectively (Russ, 2002). In addition, marine reserves can enhance tourism in the area (Roberts and Hawkins 2000).

However, since the establishment of the marine reserves 10 to 20 years ago, there have been no studies done to determine the abundance and diversity of fish catch and other organisms in the three areas. Hence, the present study aims to establish baseline information on the three marine protected areas. This information will be useful for future monitoring and evaluation of the effectiveness and impact of marine protected areas on the marine fisheries of Siquijor Island.

MATERIALS AND METHODS

This report is based on interviews of fisherfolk in the localities where the three marine protected areas are located, namely Nonoc in Larena; Tulapos in Enrique Villanueva; and Tubod in San Juan, all on Siquijor Island. The island is located 90 11' N latitude and 123035' E longitude with a total land area of about 31,812 has. (NAMRIA 1999, as cited by Bendijo et al. 2004). Majority of the island's inhabitants depend on fishing as their primary source of income and animal protein.

The fisherfolk were interviewed by the seashore on two occasions: (1) during the lean season for fishing, coinciding with the southwest monsoon in October and November, 2005 and (2) during the peak season in April and May, 2006. Any of four types of fishing gear was used by the fisherfolk, such as hook-and-line, spear gun, fish trap or fish pot and gill net. Among the questions asked during the interview were: (1) name of fisherfolk, (2) size and number of hooks used, (3) total weight of fish catch, (4) number of hours spent at sea, (5) number of helpers (if any), and (6) buying price of fish per kilo by fish vendors.

The fish catch was also actually inspected, identified (using the local, English or scientific name) and the number of fish per species was counted. A taxonomic identification of the fish was made using several references but mostly from Fish Base. The values of CPUE (catch-per-unit effort) were then computed by dividing the total weight of fish catch by the number of fisherfolk and number of hours spent at sea per fishing trip or day.

RESULTS

Fish Catch and Catch Per Unit Effort (CPUE)

The comparison of fish catch and catch-per-unit effort (CPUE) for hook-and-line was based only on data collected during the lean season in October and November, 2005. During the peak months in April and May, none of the fisherfolk in Tubod and Tulapos used hook-and- line; instead, they used spear and gill nets in Tubod, and fish pots and gill nets in Tulapos.

Table 1 shows that 21 fisherfolk in Nonoc used hook-and-line, 12 in Tubod, and 9 in Tulapos. The total fish catch amounted to 63.85 kg. in Nonoc; 20 kg. in Tubod; and 13.5 kg. in Tulapos. Total fish catch ranged from 0.1 kg. to 27 kg. in Nonoc, 0.25 kg. to 3.5 kg. in Tubod and 0.75 kg. to 2.5 kg. in Tulapos. Correspondingly, total CPUE was highest in Nonoc, with 9.838 kg./man-hr., followed by Tubod, with 3.287 kg./man-hr. and Tulapos, having the lowest, at 2.521 kg./man-hr.

Table 2 presents the computed mean fish catch which was highest for Nonoc, 3.04 ± 1.24 and lowest for Tulapos, 1.5 ± 0.22. The estimated mean CPUE was also highest for Nonoc, 0.47 ± 0.08 kg./man-

hr. but those of Tubod and Tulapos were almost the same, 0.27 ± 0.08 and 0.28 ±0.06, respectively. However, using T-test for equality of variances, Table 3 reveals that the t-value obtained for Nonoc and Tulapos (0.28), was insignificant which meant that the amounts of fish catch in Nonoc did not vary much from those in Tulapos. Similarly, the difference in fish catch between Nonoc and Tubod and between Tulapos and Tubod was not significant. In terms of CPUE, the T-tests further proved that hook-and-line fishing did not vary significantly with location (Table 4).

Catch Composition and Fish Abundance

The fish caught by hook-and-line in the take zones of the three marine protected areas of Siquijor Island included only some 22 species of fish belonging to 15 families (Table 5). Of the 15, two are basically non-reef families of fish (i.e., Carangidae and Scombridae). Most of the families are represented by only one species, except Carangidae with 4 species and Labridae, Pomacentridae, Scombridae, and Siganidae, with 2 species each. Although there are no measurements made on the fish samples, many of them are small in size or were juveniles.

Table 6 shows that the overall total of fish samples caught by hook-and-line from the three marine protected areas in October and November, 2005 was 424. Out of the total number, 184, or roughly 43%, are Carangids, 46 or about 11% are Lethrinids while Nemipterids and Scombrids are composed of 39 (9%) individuals each. Fish are caught in Nonoc (240), Tubod (127), and Tulapos (57). However, the most diverse fish catch was from Tubod, represented by 12 families; those in Nonoc included only 6 families, and in Tulapos only 4 families.

DISCUSSION

Throughout Siquijor Island, fisherfolk are usually limited in their activities by strong winds and waves caused by the southwest monsoon from May to September or October. Hence, these months are considered lean months for fishing which often yield remarkably low fish catch. Low fish catch results in low estimates of catch-per-unit effort (CPUE). In general, low CPUE indicates low abundance as well as low fish biomass.

Based on estimated mean CPUE for hook-and-line, the value obtained in Nonoc where there is an existing marine protected area is only 0.47 kg./man-hr.; in Tubod, 0.27 kg./man-hr.; and in Tulapos, 0.28 kg./man-hr. These values are comparatively much lower than those obtained from other islands with existing marine reserves like Apo Island, Sumilon Island, and Mantigue Island. The mean CPUE for hook-and-line in six different sites at Apo Island ranges from 0.41 kg./man-hr. to 2.67 kg./man-hr. (SUAKCREM unpublished data). On the other hand, the annual mean CPUE for hook-and-line in Mantigue Island of southern Philippines is 1.61 kg./man-hr. (Maypa et al 2002).

The main objective of establishing marine protected areas or marine reserves is to increase fish yields and conserve marine diversity. All forms of fishing and extractive activities are prohibited in the reserve area to allow fish and other marine organisms to grow and reproduce without being disturbed. As the density of fish increases over time, they tend to move out of the reserve area to the adjacent non-reserve area where fishing is allowed (Alcala and Russ 1990). The no-take marine reserve is thus expected to export adults (spillovers) and propagules (eggs and larval recruits) to sustain fisheries and marine productivity outside the MPA.

The low fish catch and low CPUE estimates obtained in the three marine reserves of Siquijor Island might indicate that there is little or no spillover or export of fish from the reserve area going outside (Alcala et al. 2002). This might also suggest that the three areas are not well-protected and not well-managed. In fact, some fisherfolk have been actually observed catching fish using fine-mesh gillnet (± 5 cm.) and multiple hook-and- line in Tubod, and setting their fish pots near or within the boundaries of the Tulapos reserve area.

The key to an effective and successful marine protected area would be proper management and adequate protection as those on Apo Island and Sumilon Island. On Apo Island, the marine reserve has been maintained and protected since 1982. As a partial result of protection, total reef/reef-associated yields ranged from 16.69 to 31.8 t/km2/yr (Maypa et al. 2002). Likewise, at Sumilon Island, fish yield partly resulting from the spillover of fish from the reserve

area going outside to the fished area, ranged from 14 to 36.9 t/km2/yr (Alcala and Russ 1990).

The three marine areas covered in this study are probably over-fished; the fish diversity and productivity have been affected by intense fishing activity in the past. This claim may well be supported by the data on fish catch which is composed of only 22 species of fish belonging to 15 families based on limited sampling. At Apo and Sumilon Islands, about 125 edible species of fish have been reported over the past 20 years (Alcala and Russ 2002).

CONCLUSION AND RECOMMENDATIONS

Fishing is known to be the most direct human activity that changes fish diversity and productivity. It does not only reduce fish populations but also changes the species composition. Fish sanctuaries, aside from increasing fish yields, have also been shown to be very effective in terms of conserving the diversity of the area. Therefore, based on the results of this preliminary study, it is recommended that the three marine protected areas at Siquijor Island be maintained and be given permanent, long-term protection in order to increase diversity and yields from spillover as well as recruitment into the fisheries stocks.

Acknowledgment

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List of Tables

Table 1. Total fish catch and CPUE for hook-and-line in Nonoc, Tubod and Tulapos, Siquijor Island during the lean months of October and November, 2005

Location	Sample No.	Total Catch (kg)	Catch Per Unit Effort (CPUE) kg/man-hr
Nonoc	1	2	0.5
	2	2	0.5
	3	1	0.25
	4	1	0.33
	5	0.75	0.37
	6	3	1.2
	7	1	0.33
	8	0.25	0.12
	9	4	1.33
	10	0.25	0.25
	11	3.5	0.7
	12	6	1.2
	13	1	0.5
	14	3	0.23
	15	27	0.56
	16	1	0.18
	17	1.5	0.23
	18	3	0.23
	19	1	0.5
	20	1.5	0.3
	21	0.1	0.028
	TOTAL	**63.85**	**9.838**

Location	Sample No.	Total Catch (kg)	Catch Per Unit Effort (CPUE) kg/man-hr
Tubod	1	1.5	0.176
	2	2	0.44
	3	0.5	0.11
	4	1.5	0.214
	5	1	0.166
	6	1	0.14
	7	1	0.118
	8	0.75	0.094
	9	2	0.22
	10	3.5	0.437
	11	5	1.11
	12	0.25	0.062
	TOTAL	**20**	**3.287**
Tulapos	1	2	0.5
	2	1	0.14
	3	0.75	0.062
	4	1	0.083
	5	2.5	0.5
	6	2	0.4
	7	2	0.4
	8	1.5	0.3
	9	0.75	0.136
	TOTAL	**13.5**	**2.521**

Table 2. Summary of data from Nonoc, Tulapos, and Tubod on hook-and-line fishing during the months of October and November, 2005

Location	N	Mean Catch (kg)	Standard error	Mean CPUE (kg/man-hr)	Standard Error
1. Nonoc	21	3.04	1.24	0.47	0.08
2. Tulapos	9	1.5	0.22	0.28	0.06
3.Tubod	12	1.67	0.39	0.27	0.08
Grand Mean		2.07		0.34	

Table 3. T-tests on hook-and-line fish catch during the lean months of October and November, 2005 in Nonoc, Tubod and Tulapos, Siquijor Island

Fishing Locations	t-value*	d.f.	p-value	Remarks
Nonoc vs. Tulapos	0.28	28	0.429	not significant
Nonoc vs. Tubod	0.819	31	0.419	not significant
Tulapos vs. Tubod	-0.339	19	0.739	not significant

*test for equality of variances was conducted to determine the appropriate t-value.

Table 4. T-tests on CPUE for hook-and-line fishing in Nonoc, Tubod and Tulapos on Siquijor Island during the lean months of October and November, 2005.

Fishing Location	t-value*	d.f.	p-value	Remarks
Nonoc vs. Tulapos	1.476	28	0.151	not significant
Nonoc vs. Tubod	1.589	31	0.122	not significant
Tulapos vs. Tubod	0.056	19	0.956	not significant

*test for equality of variances was conducted to determine the appropriate t-value.

Table 5. Species and Families of fish caught using hook-and-line in three marine reserves of Siquijor Island in October and November 2005

Family	Species
1. Acanthuridae	*Naso* sp.
2. Balistidae	*Balistapus undulatus*
3. Belonidae	*Tylosaurus crocodilus*
4. Carangidae	*Alepes kalla*
	Carangoides sp.
	Citula sp.
	Selar crumenopthalmus
5. Labridae	*Oxycheilinus bimaculatus*
	Halichoeres sp.
6. Lethrinidae	*Lethrinus* sp.
7. Mullidae	*Parupeneus* sp.
8. Nemipteridae	*Scolopsis* sp.
9. Pomacentridae	*Amphiprion* sp.
	Pomacentrus sp.
10. Scaridae	*Scarus ghobban*
11. Scrombidae	*Auxis* sp.
	Rastralliger sp.
12. Serranidae	*Epinephelus merra*
13. Siganidae	*Siganus canaliculatus*
	Siganus guttatus
14. Sphyraenidae	*Sphyraena* sp.
15. Synodontidae	*Synodus* sp.

INTRODUCTION

People have co-existed with coral reef ecosystems for thousands of years. These ecosystems are not only important to the cultures of coastal communities, but are also valuable to their economy for they have been a vital source of food and employment (Burke et al 2002). Despite their values and significance, however, coral reef ecosystems face threats mainly from human activities. And the most prevalent threat to coral reef ecosystems is overexploitation.

Studies conducted by Russ and Alcala (1989) emphasized that fishes are an important resource on coral reefs. Despite their importance, a number of destructive fishing methods have been used that resulted in the destruction of fish habitats and depletion of fisheries resources. According to Russ (1991), coral reef fishes, as often suggested, may be more vulnerable to overexploitation. Such problem of dwindling fisheries and coral reef resources must be addressed for the benefit of coastal populations.

Effective management is the key to maintaining coastal resources. The establishment of marine reserves, protected areas or sanctuaries has become the most common option to effectively address the problem of overexploitation and to ensure sustainable supply of fish stocks and preservation of coral reef resources in coastal areas. Marine Protected Areas (MPAs) have increased in number throughout the region, but vary in levels of management and protection. Periodic monitoring and evaluation of MPAs are therefore crucial to the sustainability and management of coastal resources.

The present survey was conducted to document and evaluate the density of target and useful indicators of reef fishes, as well as assess the habitat (coral reefs) within and outside the boundaries of two MPAs in Southern Leyte, Philippines. These are Biasong MPA in Libagon and Tomas Oppus MPA in San Antonio. The data gathered from this study will form part of the baseline information for the two MPAs. The data will also be part of the monitoring program for establishing baseline information on MPAs in the Visayas. The survey is a cooperative effort of various higher education institutions in the Visayas and is funded by the Commission on Higher Education (CHED) Zonal Research Center (ZRC) - Grants in Aid (GIA). The data will be complemented by the information on the catch- per- unit effort (CPUE).

Site Description

The study was conducted at two selected marine protected areas (MPAs) in Southern Leyte: Biasong MPA in Libagon and Tomas Oppus MPA in San Antonio, both in Southern Leyte (Figure 1). The Biasong MPA was established in 1990 while the Tomas Oppus MPA was established in the mid-1990s. The selection of MPA sites was based on the recommendations of the HEI members of the CHED-ZRC. Legal ordinances as well as level of management, establishment and community participation were also used as additional criteria in the selection of the MPAs. Table 1 presents the site description for each MPA.

METHODS AND MATERIALS

Status of Coral Reefs: Line Intercept Transect (LIT)

The Line Intercept Transect (LIT) method as prescribed by English et al (1994) was used in determining the coral condition and species biodiversity. A 20-m. transect was laid at random, covering two coral communities, separated by depth gradients (3 m. and 10 m.). Three transects per depth gradient per MPA site (both inside and outside) were laid for a total of 24 transects. Benthic lifeforms (e.g., corals and invertebrates) intercepted by the transects were recorded and identified in situ whenever possible. From the LIT, percent coral cover as well as a coral species checklist was generated. Large invertebrates like sea cucumbers and giant clams were also assessed. The numbers or counts of various life forms found in the transects were recorded.

Reef Fish Assemblages and Standing Stock: Fish Visual Census (FVC)

The underwater fish visual census method (English et al 1994) was used to assess the coral reef fishes in the reserve and non-reserve (control) areas. The coral LIT was conducted after the Fish Visual Census procedure to minimize disturbance on the organisms. A 50-m. transect line parallel to

the shore was laid at 10 m. (deep) and 5 m. (shallow) depth zones. Three replicates were made, with a total transect belt of 750 sq. m. per depth zone. Target species (those favored by fisherfolk for food), chaetodontids (butterflyfishes) and visually obvious fish species encountered along the 50-m. transect line and within 2.5 m. on either side of the transect line, as well as 5 m. above, were identified. Abundance of fishes was estimated cumulatively and recorded according to their size. Identification of fish species was confirmed using several field guides (Randal et al.1990, Meyers 1991, Debelius 1993, Kuiter et al. 1994, Lieske and Myers 1994, and Allen and Steene 1994). Biomass of target species was computed using published length-weight constants from FishBase (2004).

RESULTS

Corals and coral reef

A total of 153 species of scleractinian and non-scleractinian corals belonging to 15 families and 54 genera in Biasong MPA and reef area were identified, while 172 species (also including scleractinian and non-scleractinian corals) belonging to 55 genera and 16 families were identified in Tomas Oppus MPA (Table 2).

The dominant types of coral growth-form found in the MPA sites were the massive, branching, and encrusting. Common species of massive corals were observed (e.g., Porites and Lobophyllia). Branching species of Acropora, Pocillopora, and Seriatopora as well as encrusting and foliose types of Montipora were also observed.

Low percentage live cover (less than 25% coral cover) of hard coral and soft coral was observed for both depth gradients (10 m. and 5 m.) inside Biasong MPA (Figure 2). Outside the Biasong MPA, the percentage cover was relatively higher at 14.67% in the deep area and 28% in the shallow areas. In Biasong MPA and Tomas Oppus MPA, both depth gradients inside the reserve had "fair to good" coral cover at 43.33% (10 m.) and 30% (5 m.). The coral cover outside Tomas Oppus MPA was lower at 19.5% in the deep area, and 10.33% in the shallow area.

The substrate category is composed of sand, rock and coral rubble. In all of the MPA sites surveyed, the substrate is mostly sand, loose coral rubble, and rock (greater than 50% of the areas/transects surveyed for both inside and outside of the MPA sites). Coral rubble inhibits coral growth and colonization due to its instability. Dead coral cover fall within the range of 0-10% in all areas surveyed.

Macro-invertebrates

There were 14 species of macro-invertebrates found during the survey of the Biasong MPA and the Tomas Oppus MPA. Although there were indicator species of invertebrates such as giant clams and sea urchins, these were not numerous. In the Tomas Oppus MPA, 19 species of macro-invertebrates were found and identified. Based on these counts, the most common macro-invertebrates found in the sites are sea urchins, shells and starfishes.

Fish

Biasong Marine Protected Area
Composition and diversity of reef fishes

A significant difference in terms of fish species diversity was observed between inside and outside the marine reserve. The reserve had a total of 60 species in 14 families, while 27 species in 10 families were observed outside the MPA. The fish community inside the reserve consisted mainly of pomacentrids (damselfishes), serranids (fairy basslets), nemipterids (coral breams), and chaetodontids (butterflyfishes). This was followed by acanthurids, labrids, lutjanids, and scarids. Haemulids and siganids were the least represented groups. In comparison, the adjacent reef outside was dominated by pomacentrids and labrids, mainly Thalassoma lunare and Cirrhilabrus spp. Acanthurids and haemulids were not found outside the reserve (Figure 3).

A distinct difference was observed in the composition of chaetodontids inside the reserve (5 species) and those outside (2 species). Of the 6 species, only Chaetodon barronessa is common to both.

Abundance of fish species

The fish density inside the marine reserve was higher, with 1,445 individuals per 1,500 sq. m., compared to that of the adjacent reef outside, with 1,307 individuals per 1,500 sq. m. Inside the reserve, pomacentrids (damselfishes) and serranids (fairy basslets) had the highest count, with 459 and 675 individuals per 1,500 sq. m., respectively (Table 3).

There are more fish in the deeper portion of the reserve than in the shallows. The majority of the fish in the deeper portions are acanthurids (surgeonfishes) and lutjanids (snappers), and these ranged in size from 16 to 20 cm. A significant fish size difference was observed in the deeper portion between outside and inside of the MPA. The outside portion had fishes of smaller sizes (5 to 10 cm.). Another observation made was that acanthurids were not found in both deep and shallow transects of the reef outside the reserve (no-tale zone).

Biomass of Target Species

In the Biasong MPA, there was a significant difference in the observed biomass of target species between the inside and outside areas of the no-take reserve, as well as between the deep and shallow areas. The deep portion of the reserve had a target fish biomass of 18.89 kg./1000m2 (converted from the original data of kg./750m2), while the shallow portion had only 3.38 kg./1000m2. The biomass of target fishes outside the reserve was very low, 0.42 kg./1000m2 in the deep portion and 0.049 kg./1000m2 in the shallow portion (Figure 4).

Tomas Oppus Marine Protected Area

Composition and diversity of reef fishes

Fifty-three (53) species in 15 families were observed inside the marine reserve, while 46 species in 12 families were observed outside. Pomacentrids (damselfishes), serranids (fairy basslets), and caesionids (fusiliers) dominated the fish community of the marine reserve. Haemulids (sweetlips) were only observed inside the reserve, and serranids and mullids (goatfishes) were the least represented groups. The fish species in the adjacent reef outside the reserve are predominantly pomacentrids and labrids (wrasses). Scarids (parrotfishes) are more dominant in the deep than in the shallow zones inside and outside the reserve. About eight species of chaetodontids (butterflyfishes) were found inside the reserve, while only five species were found outside.

Abundance of fish species

Table 3 provides a summary of the total fish abundance in the shallow and deep zones, inside and outside the marine reserves. Results show a significant difference in fish abundance inside and outside of the MPA, with about twice the fish count inside the no-take reserve (2,240 individuals) compared to that outside (1,121 individuals). Alcala (1988) reported that the Sumilon reserve, which was actively protected for 10 years, contained significantly larger number of individuals in practically all categories of fish compared to the Apo reserve, which had limited protection from 1982 to 1985, and the Balicasag site (now a reserve), which had no protection during the period. Russ (1991) who did a similar study on the effects and yields of coral reef fisheries also reported that the site which had been protected had the highest overall abundance of fishes, including significantly higher density and biomass of large piscivores (serranids, lutjanids, and lethrinids) and a significantly higher biomass of serranids.

The same pattern was observed for chaetodontids, 46 individuals inside the MPA, with Chaetodon barronessa having the highest counts of 31 individuals while there were 22 individuals outside the reserve, with Chaetodon octofasciatus having the highest count (7 individuals).

The length distribution and abundance of some target species inside and outside the marine reserve are presented in Figure 5. A greater proportion of the particular target species, notably the caesionids, is within the size range of 11 to 15 cm. in both deep zones, that is, inside and outside the no-take marine reserve. It is important to note though that the marine reserve has generally bigger (more than 20 cm.) fish sizes (not presented in this graph) like serranids (groupers) and haemulids (sweetlips).

Biomass of target species

The deep portion of the Tomas Oppus MPA registered the highest target fish biomass among all the stations surveyed with 25.779 kg./1000m2. The shallow portion of the reserve had much less target fish biomass, 7.652 kg./1000m2 (Figure 4). Outside, the target fish biomass was observed to be 8.760 kg./1000m2 in the deep portion and 0.585 kg./1000m2 in the shallow portion. These observations are consistent with the results from many other MPAs which typically have higher fish biomass in the deeper portions compared to that in the shallow portions, as well as higher biomass inside compared to that outside the no-take reserve.

DISCUSSION

The target fish biomass at Tomas Oppus no-take zone may be compared with earlier estimates in 2001 and 2002. The mean for these two surveys is about 20 k.g/1000m2 (10kg in year 2002 and 30kg in 2001 based on unpublished data at SUAKCREM). The present estimate is 25.8 kg./1000m2 which is higher than the estimates three to four years earlier. This indicates some degree of protection and management of the MPA. In light of this efficient marine resource protection management, the local government of San Antonio, particularly its mayor and the officials of Barangay Tomas Oppus, deserves to be given due credit.

The current fish biomass at Tomas Oppus may also be compared with the biomass of target fish in other MPA sites in the Bohol Sea, particularly the Dauin Poblacion MPA in Negros Oriental, which has also been a protected area for the same length of time as the Tomas Oppus. Target fish biomass in Dauin Poblacion MPA is about 80 kg./1000m2 (SUAKCREM unpublished data), or almost four times larger. The fish density at Tomas Oppus (2,240 individuals/1500m2) is also lower compared to that of Dauin Poblacion MPA (3,732 individuals/1500m2). This finding could be attributed to still unknown differences in environmental quality which should be studied in the future.

The target fish biomass at Biasong ranges from 3.38 to 18.89 kg./1000m2 and is lower than that of Tomas Oppus. The Biasong MPA is protected more recently than the Tomas Oppus MPA; it is therefore expected to show lower fish biomass. Levels of management in the Biasong and Tomas Oppus MPAs should also be documented as part of the continued information and data gathering efforts.

CONCLUSION AND RECOMMENDATION

The target fish biomass and fish density at the two MPA sites in Southern Leyte show evidence of protection and management, but they are lower compared to their counterparts with the same number of years of protection and management (e.g., Dauin Poblacion MPA). The three MPAs being compared are located in the Bohol Sea. It is not yet known what factors account for the differences. But one thing is certain: for the Southern Leyte MPAs to improve the status of their biodiversity, concerned authorities should continue protecting and managing their MPAs (such as, but not limited to, continuing data gathering, establishing long-term monitoring and evaluating strategies, as well as prioritizing community involvement and commitment).

Acknowledgment

The authors wish to acknowledge the financial support of the Commission on Higher Education through the Silliman-CHED ZRC and the logistical and technical support of Mr. Olegario Adesna, Aquaculture Technician of Southern Leyte State University-Bontoc Campus. Acknowledgment is also due to Dr. Angel C. Alcala for editing the earlier and final versions of the manuscript. They were very helpful in facilitating the conduct of the survey as well as instrumental for the success of the study.

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List of Tables and Figures

Table 1. MPA site description and information for the two MPA sites
Source: Actual Survey/Interview.

MPA Site	Area (ha)	General MPA Description/Information	Legal Basis
Biasong MPA, Libagon	2	MPA area is relatively small with patchy condition of coral growth. Substrate is mostly sand and new coral recruits were observed. Water visibility (at time of survey) was good/ clear. Management of MPA: A proposal to increase the area of the MPA has been planned.	Established in 1990. Municipal Ordinance not indicated.
Tomas Oppus MPA, San Antonio	not indicated	Corals are growing on large dead coral colonies. Coral rubbles (CR) were also noted. Dead corals were observed (probably due to *Acanthaster* - Crown of Thorns Starfish predation). Indicator invertebrate species were observed – *Tridacna*.	MPA date of establishment and legal basis not indicated but probably in mid-1990s.

Table 2. Summary of coral species, genera and families identified in the study sites (includes Non-Scleractinian Corals).

MPA Sites	Number of Corals Identified		
	Families	Genera	Species
Biasong MPA	**15**	**54**	**153**
Tomas Oppus MPA	**16**	**55**	**172**

Table 3. Summary on fish abundance and diversity inside and outside the marine reserves surveyed.

Areas	MPA Zones					
	Inside			Outside		
	Deep [10m]	Shallow [5m]	Total Combined Transects [1500m²]	Deep [10m]	Shallow [5m]	Total Combined Transects [1500m²]
BIASONG MPA						
Total No. of Individuals	789	656	1445	567	740	1307
Total No. of Species	45	33	78	24	18	42
Total No. of Families	13	11	24	10	6	16
TOMAS OPPUS MPA						
Total No. of Individuals	1374	866	2240	747	375	1122
Total No. of Species	46	31	77	40	19	59
Total No. of Families	15	12	27	12	6	18

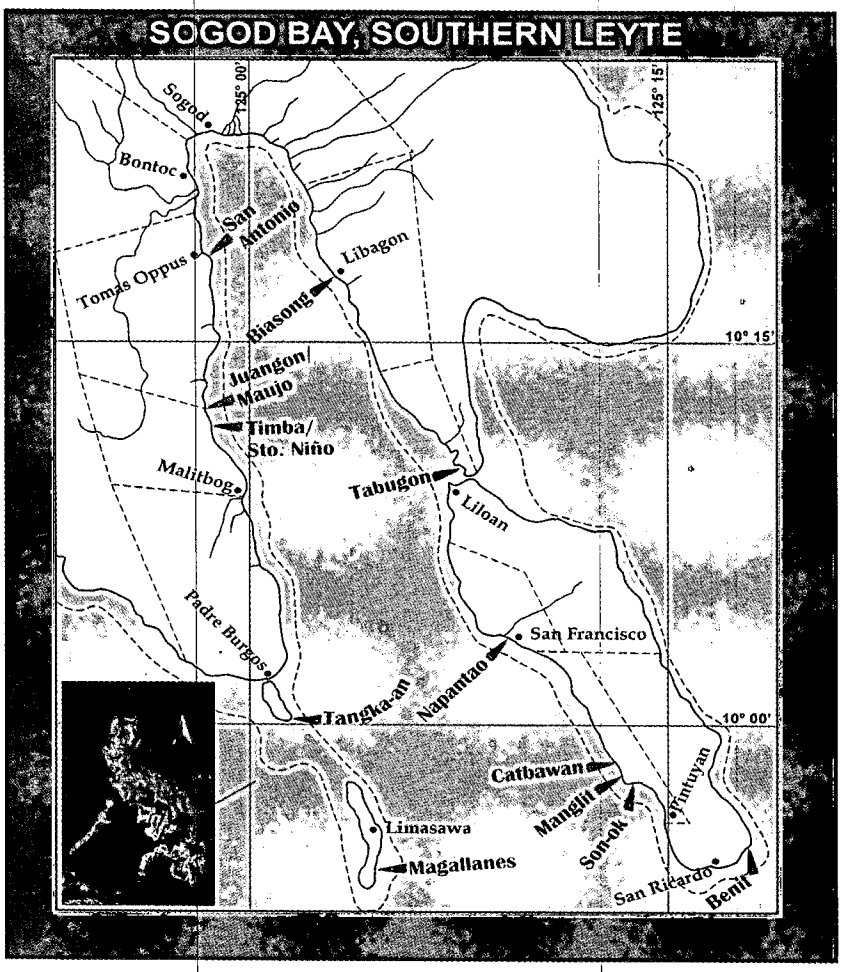

Figure 1. Map indicating the locations of the surveyed sites in Southern Leyte.

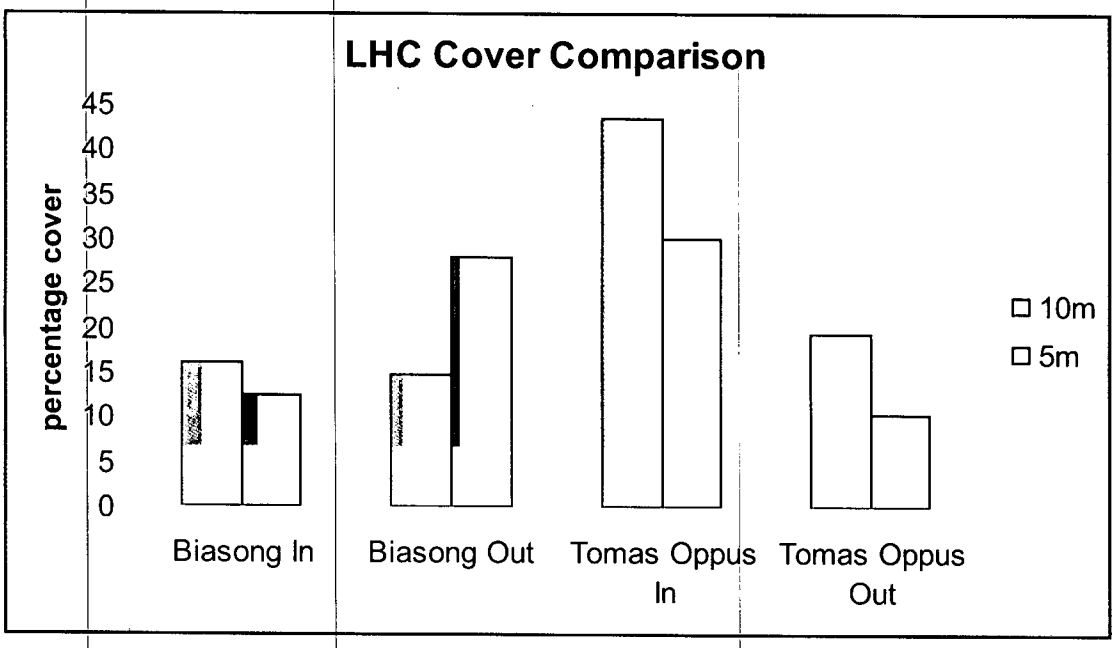

Figure 2. Live hard coral cover comparison across all sites surveyed.

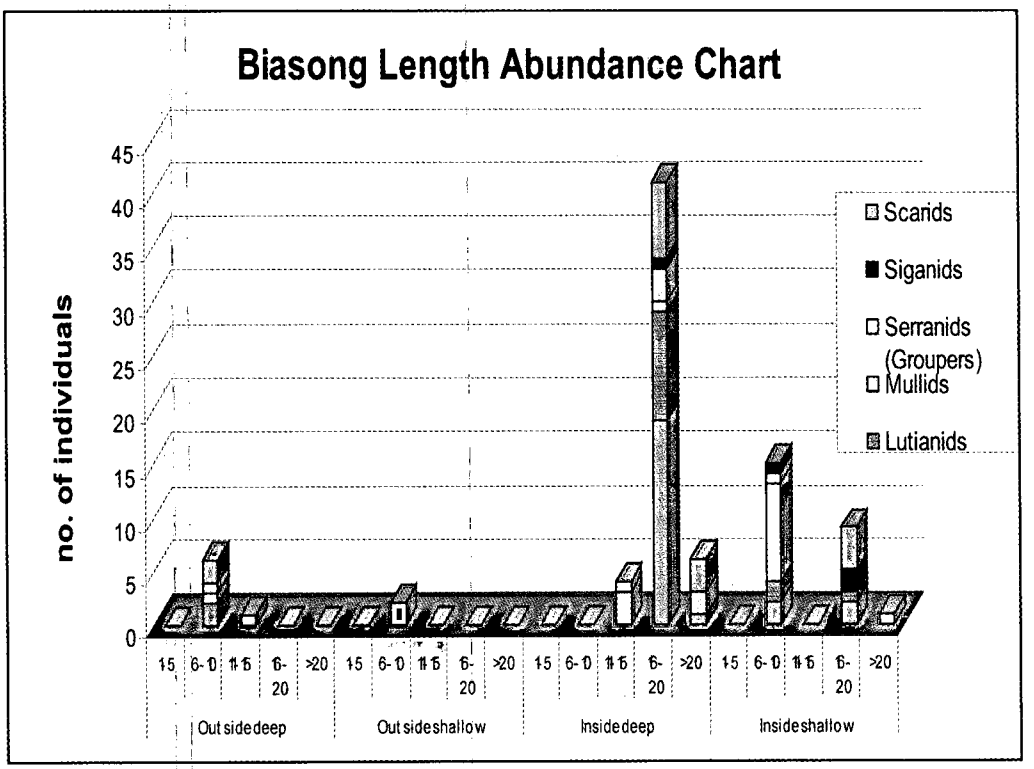

Figure 3. Length abundance chart showing relative numbers of target fishes according to families observed in Biasong MPA.

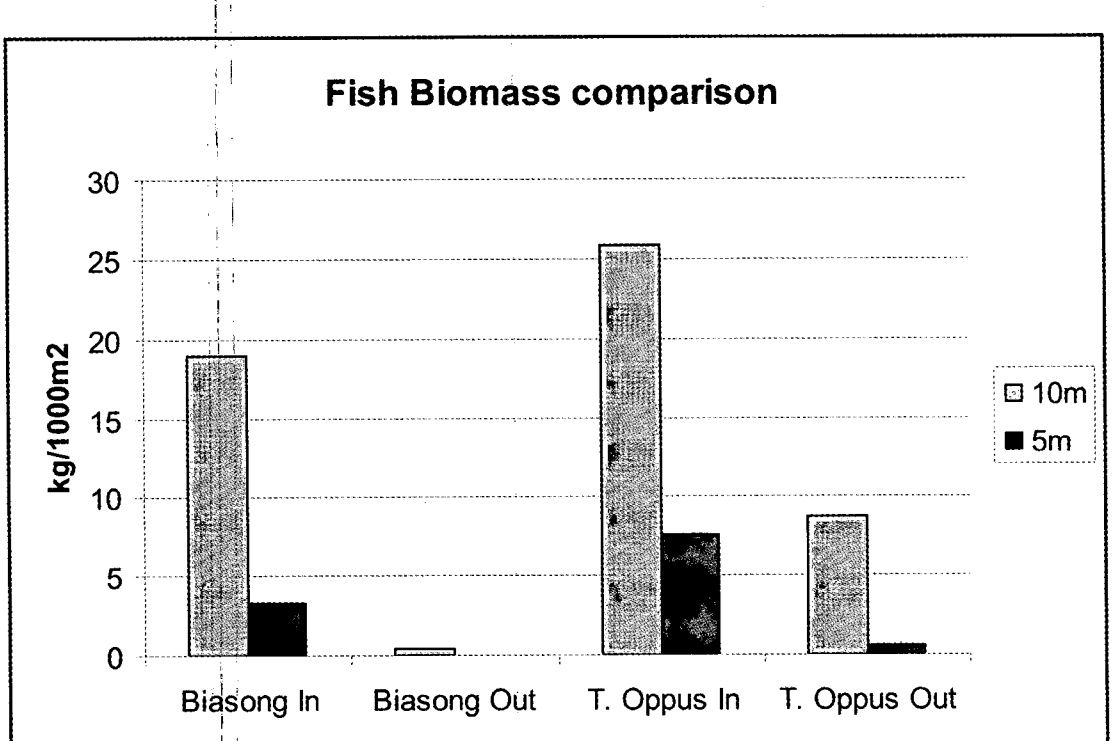

Figure 4. Comparison of target fish biomass observed across all stations surveyed.

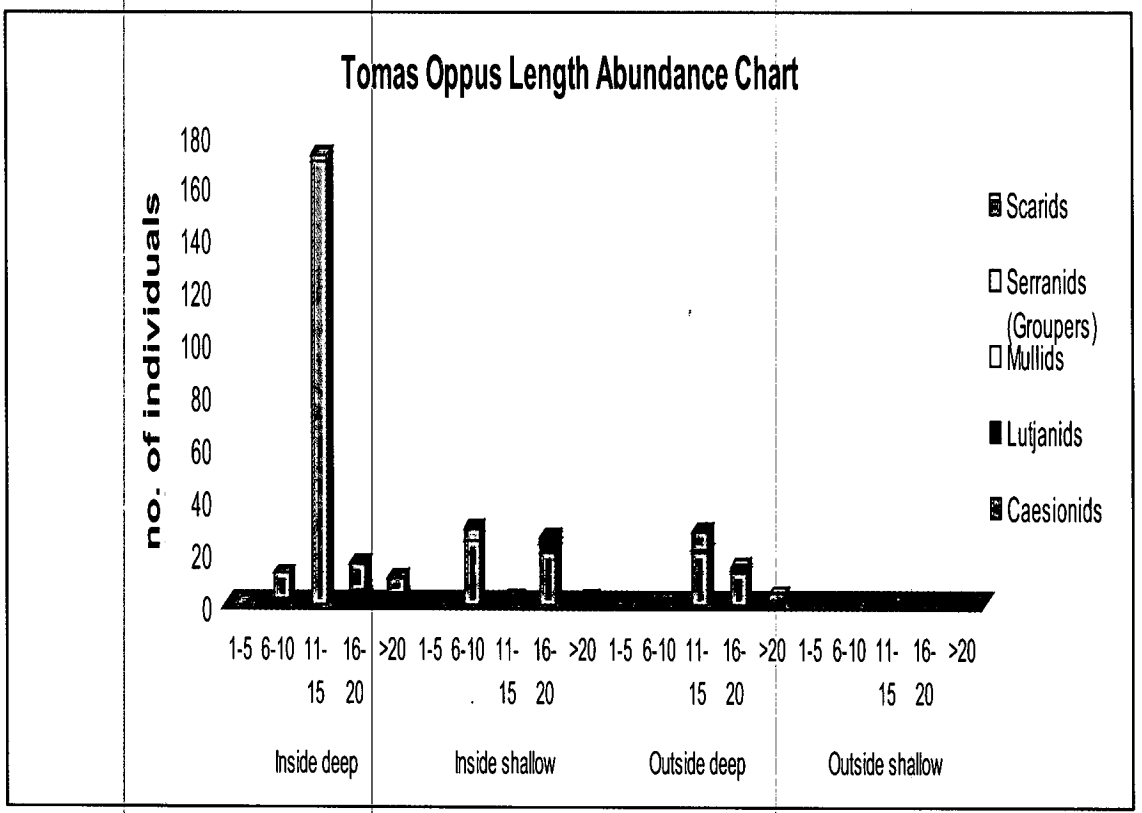

Figure 5. Length abundance chart showing relative numbers of target fishes according to families observed in Tomas Oppus MPA.

MANGROVE INVENTORY AND ASSESSMENT IN COGTONG BAY, BOHOL, PHILIPPINES

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ABSTRACT

We assessed the mangrove areas in Cogtong Bay, the composition of both flora and fauna, using the quadrat method along transect lines, to compare diversity and abundance of plants and their associated macro-fauna in natural stands, reforested, and wilderness areas. Possible mangrove threats and disturbances were also observed in these areas. We found that there were 35 mangrove and mangrove-associated species in the bay, of which 27 were found in natural areas, 14 in the wilderness and only 10 in the reforested areas. Eight species were encountered outside the sampling plots. We also found 17 species of marine invertebrates in reforested areas but much lesser numbers were found in wilderness and natural stands. We concluded that species richness in both natural and wilderness areas were less diverse while that of the reforested areas were much less diverse.

INTRODUCTION

Mangroves are among the most productive and biologically diverse ecosystems in the world comprising the coastal zone (Hogart, 1999). Their productivity and diversity are of considerable economic and ecological importance. The trees themselves are exploited for the production of food, medicines, tannin, fuelwood, and construction materials (Melana et al, 2000; Primavera et al., 2004).

In order to continue sustainable Coastal Resource Management (CRM) efforts, an evaluation of Marine Protected Areas (MPAs) and, to a broader extent the CRM, is needed. One principal challenge to Integrated Coastal Management (ICM) evaluation is the difficulty of demonstrating the quantitative linkages among human, natural, and institutional settings. In evaluating outcomes of ICM projects, the ideal situation is to compare quantitative performance indicators before and during the project. Examples of such indicators are species population characteristics (Maliao et al., 2004), biodiversity assessments, income generation, equity of benefit distribution, and other community livelihood parameters. Unfortunately, many ICM projects lack baseline quantitative information such as focal species abundance, habitat quality, or local livelihood. Lack of data is common to projects with limited resources, particularly in developing countries.

One of the goals of CRM is the establishment of MPAs. It is a good entry point for coastal resources management. Achieving improved CRM through setting up of MPAs always requires substantial involvement of communities with the strong support from the local, and sometimes national, government. Thus, MPA planning and implementation normally proceed along the path of a community-based coastal resource or fishery management process. Being part of a community-based CRM initiative, MPAs often take a central role and become the main project itself.

Cogtong Bay is located in the southeastern part

of the province of Bohol in the Central Visayas, Philippines (Figure 1). The municipal waters of Cogtong Bay are shared by the town of Mabini to the north, and Candijay to the south. The Bay has 2,000 hectares of mangrove forest, of which 1,300 hectares are still intact and the rest have been converted to fishpond. The 2,000 hectares have been classified as timberlands by the Department of Environment and Natural Resources (DENR). About 700 hectares have been released for fishpond development. The remaining 1,300 hectares remain intact but need a management program to sustain them. The coastal resources were abundant until the 1960s but started to decline thereafter, due to the growing number of fishers and others dependent on mangrove resources. They constitute about 15% of the workforce in these two towns. Another reason is the clear cutting of mangroves for fishpond development which started in 1979.

Mangrove management in the project site began in 1985 when the DENR, through the Bureau of Forest Development (BFD), implemented the program in Baranggay Cogtong in Candijay. The rest of the mangrove areas remained under an open access, "free-for-all" arrangement of resource use.

The Rain-fed Resources Development Project (RRDP) wanted to shift the communities' traditional role from mere resource users to resource managers. To achieve this, the RRDP program addressed the resource use issue of property rights over the coastal resources. Through the Integrated Social Forestry (ISF) program of DENR, the project reforested 110 hectares, and delineated 108 hectares for enhancement areas and 25 hectares for Assisted Natural Regeneration. The Parcellary survey of Certificates of Stewardship Contract awarded to mangrove planters during the RRDP intervention in the area covered 349 hectares.

Increasing awareness of the importance of mangroves resulted in mangrove restoration and reforestation (Kaly and Jones, 1998; Primavera et al., 2004). However, there are no studies showing the differences in diversity, density, and volume of tree stands among natural mangrove forests, reforested areas, and mangrove wilderness in these areas. Neither are there reports on invertebrates. The wilderness areas are the mangrove islets that were covered by Presidential Proclamation Nos. 2151 and 2152. Information about the difference in community structure and secondary productivity between the reforested mangrove stands from the natural stands and wilderness areas is still absent.

Although Cogtong Bay has a long history of coastal resource management, reports about Cogtong Bay are anecdotal and various projects are not evaluated as to their impacts. The bay now has an extensive reforested mangrove area, a vast natural stand and four wilderness islets included under Presidential Proclamation No. 2151. Furthermore, studies regarding the effect of habitat alteration on the faunal community have not been attempted. There is therefore a need to study the changes on the fauna, flora, and physical environment of the newly-rehabilitated mangrove ecosystem and compare these with the nearby similar and undisturbed mangrove ecosystems. Hence this study was conducted.

Objectives

The general objective of this study is to conduct an inventory and assess the natural mangrove stands, the reforested, and the wilderness areas of Cogtong Bay. Specifically, the research has the following objectives:

1. to determine the species diversity and abundance of mangroves in three different classified areas;
2. to determine the species diversity and abundance of invertebrates and fishes in these areas; and
3. to determine the current disturbance and environ-mental threats to these areas.

METHODOLOGY

This study used the quadrat sampling method of inventory and assessment along transect lines following the methods used by English et al (1994).

Reconnaissance Survey

This was done in the first two consecutive days of the inventory in order to know the number of baselines and sampling plots to be established in the study area based on its current landscape. The number of baselines depended upon the present mangrove forest classification (wilderness, reforestated area, natural stand).

Pilot Study and Quadrat Sampling

Baselines were established parallel to the shoreline. The length of the baseline depended on the size of the mangrove forest surveyed. Transect lines perpendicular to the baseline were laid out after having finished the baseline establishment. The length of the transect line starting from the baseline was 100 m. up to the seaward side of the vegetation. Quadrats (sample plots) were set up alternately on the transect lines with an interval of 5 m. each. The size of the quadrat (sample plots) was 20 m. x 20 m. At least 20 sample plots were laid out in each stand type.

The invertebrate survey was done through transect method. For every 100-m. transect, five (5) 1 m. x 1 m. quadrats were laid left to right alternately along the transect lines. For every transect, 5 quadrats were sampled. The macrofauna found within were then identified and recorded.

Actual Field Inventory and Assessment

Four (4) teams were formed with each team having 3 members. Materials and instruments used were magnetic compasses, fiberglass chain tapes, tree calipers, nylon rope number 10, meter sticks, plastic bags (for sample tree species, invertebrates, and fishes), and range poles. Record sheets were produced for both mangroves and invertebrates and fishes prior to the inventory.

Data Analysis

Plant species and macro-invertebrates diversity and abundance were computed using the formula of Shannon-Weiner and Simpson's indices.

To analyze the data, the Shannon-Weiner diversity index was employed using the following equation:

SWI = pi*Ln pi

where: SWI – Shannon-Weiner Index of diversity

pi – is the total count of all species

Ln – natural logarithm

Mangrove species were identified using field guides by Primavera et al (2004) and by Melana and Gonzales (2000).

Macro-invertebrate species were identified using Simon and Schuster's Guide to Shells (1980) and White (2001).

RESULTS AND DISCUSSION

Twenty seven species of mangroves are found in the three sampled areas (Table 1) The natural areas yielded the highest number of identified species, with twenty seven (27) composed of 3 unidentified species; the wilderness areas, 14; and the reforested areas, 10. There are also eight species identified outside the quadrats (Table 2), for a total identified species of 35 (Melana et al., 2000; Primavera et al., 2004). *Rhizophora mucronata* is the most abundant in Cogtong Bay, with a relative abundance of 46.23%; followed by *R. apiculata*, with 15.36%; followed by Avicennia marina with 10.82 percent. In all areas, mangrove cutting was observed.

When the data were subjected to the Shannon-Weiner Diversity index analysis, it was found that species richness and diversity of both mangroves and marine macrofauna at the three study sites range from less diverse to much less diverse (Table 4).

Sixteen invertebrate species were recorded in the reforested site, 11 in the wilderness area, and 11 in the natural stands (Table 3). These, however, do not represent all the invertebrate species found in the three sites. During the survey, it was very difficult to see the fishes in the mangroves, considering the disturbance caused by the survey team while laying the transects and quadrats, aside from the water turbidity in all the surveyed areas. Furthermore, these areas do not contain much water. The animal species listed in Table 3 are some of the most visible ones.

Both natural and wilderness areas have firm mud to sandy-muddy substrates, while the reforested areas situated near the river mouths have very deep, soft sediment bottoms. Except for Nypa fruticans and Ceriops tagal, other species do not show a zonation pattern. However, in the wilderness areas, the Avicenniaceae and Euphorbiaceae dominate in landward, sandy areas.

CONCLUSION

Based on the findings of this study, it can be

concluded that the area studied is a disturbed mangrove forest community and that protection is needed to allow it to approximate its former pristine condition.

Acknowledgment

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Table 1. Mangrove species found in Cogtong Bay, Candijay, Bohol.

Species name	Common name	NAT	WIL	REF	OUT
Family RHIZOPHORACEAE					
Rhizophora apiculata Blume.	Bakhaw-lalake	+	+	+	
Rhizophora mucronata Lamk.	Bakhaw-babae	+	+	+	
Rhizophora stylosa Griff.	Bakhaw-bato/bankau	+		+	
Rhizophora x lamacrkii Montr.	Bakhaw				+
Bruguiera cylindrica (L.) Blume	Pototan/Pototan-lalaki	+	+		
Bruguiera gymnorrhiza (L.) Lamk.	Busain, Pototan				+
Bruguiera parviflora Wight and Arn. Ex Griff.	Hangalai/langarai				+
Ceriops decandra Giff. Ding Hou	Lapis-lapis	+	+		
Ceriops tagal (Perr.) C.B. Rob.	Tungog/Tangal				+
Family AVICENNIACEAE					
Avicennia alba Blume	Bungalon/Api-api	+			
Avicennia marina (Forsk.) Vierh.	Bungalon	+	+	+	
Avicennia officinalis L.	Api-api	+	+	+	
Avicennia lanata	Api-api	+	+	+	
Family SONNERATIACEAE					
Sonneratia alba J. Smith	Pagatpat	+	+	+	
Sonneratia caseolaris	Pedada	+	+	+	
Sonneratia ovata Backer	Pedada	+			
Family COMBRETACEAE					
Lumnitzera racemosa Willd.	Tabao/Kulasi	+	+	+	
Lumnitzera littorea (Jack) Voigt	Tabao	+	+		
Terminalia catappa L.	Talisay				
Family MELIACEAE					
Xylocarpus granatum (Koen.)	Tabigi	+	+	+	
Xylocarpus moluccensis (Lam.) M. Roem	Piagao/Lagutlot	+			
Family MYRSINACEAE					
Aegiceras corniculatum (L.) Blanco	Saging-saging	+	+		
Aegiceras floridum	Tinduk-tindukan	+			
Family RUBIACEAE					
Scyphiphora hydrophyllacea Gaertn.f.	Sagasa/Nilad	+			
Family EUPHORBIACEAE					
Excoecaria agallocha L.	Alipata/buta-buta	+	+		
Family PALMAE					
Nypa fruticans (Van.) Wurmb.	Nipa	+			
Family MYRTACEAE					
Osbornia octodonta F. Muell.	Tawalis	+			
Family ACANTHACEAE					
Acanthus ilicifolius L.	Lagiwliw/ragoyroy				
Acanthus volubilis Wall.	Lagiwliw/ragoyroy	+			
Acanthus ebracteatus Vahl.	Lagiwliw/ragoyroy	+			
Family LYTHRACEAE					
Pemphis acidula Forster	Bantigi/Nilad				+
Family FABACEAE					
Derris sp.*		+			
Family STERCULIACEAE					
Heritiera littoralis Dryand. ex W. Ait.	Dungon				+
Family MALVACEAE					
Hibiscus tiliaceus L.*	Malubago	+			
Family PTERIDACEAE					
Acrostichum aureum L.*	Lagolo	+			
BOMBACACEAE					
Camptostemon philippinense (Vidal) Becc.	Gapas-gapas				+
Family BIGNONIACEAE					
Dolichandrone spathacea (L.F.) K. Schum.*	Tui				+
Wild sunflower (unidentified species)					
TOTAL		27	14	10	8

Legend: + = present; NA=Natural; WIL=Wilderness, REF=Reforestation, OUT=additional species found outside the sampling plots. * = Mangrove-associated species (after Tomlinson 1986)

Table 2. Mangrove species, total number of individuals in the three areas and relative abundance (RA).

	Mangrove Sp.	Natural	Reforested	Wilderness	Total No. of ind.	RA (%)
1	*A. ebracteatus*	3			3	0.018479
2	*A. ilicifolius*	6			6	0.036959
3	Anso 2x (unidentified)	69			69	0.425033
4	*A. officinalis*	176	16	129	321	1.977331
5	*R. stylosa*		441		441	2.716521
6	*R. mucronata*	329	6,905	271	7505	46.230134
7	*R. apiculata*	40	63	2,392	2495	15.368978
8	*A. marina*	1,375	114	268	1757	10.822964
9	*E. agallocha*	2		4	6	0.036959
10	*Derris* sp.	53			53	0.326475
11	*L. littorrea*	326	13	53	392	2.414685
12	*Acrostichum* sp.	254			254	1.552297
13	*L. racemosa*	29			29	0.178637
14	*A. volubilis*	16			16	0.098558
15	*C. decandra*	66		37	103	0.634471
16	*S. hydrophyllacea*	6			6	0.036959
17	*N. fruticans*	491	97		588	3.622027
18	*S. alba*	364	52	186	602	3.708266
19	*S. caseolaris*	174	76	263	513	3.160034
20	*X. moluccensis*			2	2	0.012319
21	*A. lanata*	96	2	2	100	0.615991
22	*B. cylindrical*	13		3	16	0.098558
23	*S. ovata*	9			9	0.055439
24	*A. corniculatum*	4		6	10	0.061599
25	*L. racemosa*	3	18	13	34	0.209436
26	*X. granatum*	187	25	105	317	1.952691
27	*O. octodonta*			99	99	0.609831
28	Tigbau (unidentified)	470			470	2.895158
29	*A. floridum*	1			1	0.006159
30	Wild Sunflower *(undintified*	15			15	0.092398
	Total	**4579**	**7822**	**3833**	**16234**	

Table 3. Species of mangrove invertebrates --- English common names and local names.

No.	Reforestation	Natural	Wilderness
1	Oyster – sisi, tagimtim	Virgin nerite - sihe	Virgin nerite – sihe
2	Flag pen shell - lapad	Ramose murex – lubot-anay	Ramose murex – lubot-anay
3	Virgin nerite - sihe	Venus comb murex - paitan	Venus comb murex – paitan
4	Ramose murex – lubot-anay	Horn shell - bagongon	Horn shell – bagongon
5	Venus comb murex - paitan	Variable risso - suso	Variable risso – suso
6	Screw turret - tororot	Fiddler crab - agokoy	Fiddler crab – agokoy
7	Horn shell - bagongon	Violet ulnegar crab - asan	Violet ulnegar crab – asan
8	Variable risso - suso	Hermit crab - umang	Hermit crab – umang
9	Incomparable scallop-tagnipis	Goby – bugo	Mantis shrimp – takla
10	Fiddler crab - agokoy	Mantis shrimp - takla	Soft shell clam – tuway
11	Violet ulnegar crab-karaskaras	Soft shell clam - tuway	Oyster – sisi, tagimtim
12	Hermit crab - umang		
13	Unequal arc - bakan		
14	Goby – bugo		
15	Siverside – guno		
16	Mangrove crab - asan		
Total	**16**	**11**	**11**

Table 4. Species counts and diversity of mangroves and invertebrates at the sampling sites.

Areas	Mangrove species count	pi*Lnpi	Invertebrate species count	pi*Lnpi
Natural	4352	2.43-less diverse	1220	1.67-less diverse
Wilderness	3316	1.41-less diverse	1496	2.18-less diverse
Reforested	9343	0.56-very less diverse	8067	1.37-less diverse

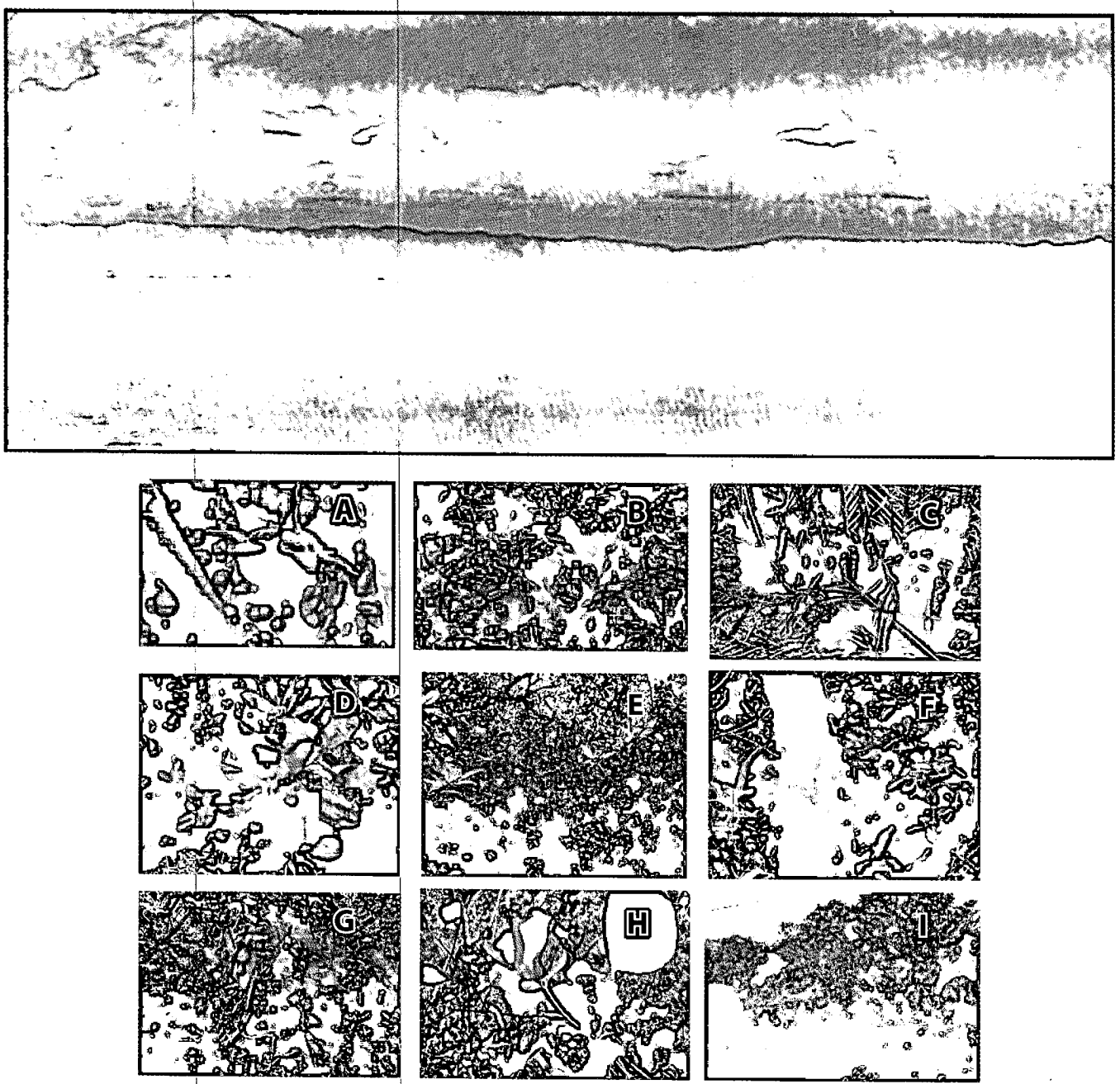

Figure 1. Cogtong Bay (top photo) and a few of the many mangrove species in the bay:

A- *Sonneratia alba*; B- *Lumnitzera littorea*; C- *Nypa fruticans*; D- *Avicennia officinalis*; E- *Rhyzophora mucronata*; F- *Rhyzophora apiculata;* G- *Xylocarpus granatum*; H- *Sonneratia caseolaris*; I- *Avicennia alba.*

STATUS OF CORAL AND REEF FISH RESOURCES OF PASIL REEF MARINE SANCTUARY, COGTONG BAY, BOHOL, PHILIPPINES

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ABSTRACT

The status of coral and reef fish resources inside the Pasil Reef Marine Sanctuary in Cogtong Bay, Bohol, Philippines was surveyed, using the Line Intercept Transect method to obtain percent coral cover. The coral reef fish populations in the sanctuary were assessed using Fish Visual Census along a 50-m. transect covering two coral communities separated by two depth gradients (2 m. and 10 m.). Benthic life forms intercepted by the transect were recorded and identified in situ. A similar census was also conducted outside the Marine Protected Area (MPA) to serve as controls. The results showed that live hard massive corals dominate in both areas. However, live hard and soft coral cover appears higher inside the sanctuary than outside. We compared the results of the present survey with that of a survey conducted two years before and found out that the percentage of live coral cover and fish populations inside and outside the sanctuary increased. Protection of the Pasil Reef Marine Sanctuary could have been the reason for the increases. However, the surveys were not conducted at exactly the same spots.

INTRODUCTION

Coral reefs in the world cover an estimated area of 600,000 sq. km. and are located in the region between 30 degrees north latitude and 30 degrees south latitude. They are a dominant feature of shallow waters throughout the tropics and an essential ecological and life support system necessary for human survival and sustainable development. The Philippines has an estimated total of 20,000 sq. km. of reef area, generating a considerable contribution to fisheries. A more productive reef yields a maximum of 36 tons of fish per sq. km. yearly, whereas a poor reef may give only one-tenth of this or less (Alcala and Russ 1990). In the Philippines, coral reef fisheries provide livelihoods for more than a million small-scale fishers who contribute almost US$1 billion annually to the country's economy (White et al 2000).

The world's coral reefs are subjected to several anthropogenic disturbances that eventually threaten the natural equilibrium of these resources. The anthropogenic causes of coral reef destruction include sedimentation from soil erosion, use of explosives, and cyanide to capture fishes, muro-ami, and kayakas fishing, pollution from industry and coral reef quarrying (McAllister 1988). Jameson et al (1995) estimate that 10% of the world's coral reefs are degraded beyond recovery and a further 30% are expected to become irreversibly degraded within the next 20 years. In the ASEAN region, up to 70% of the reefs have been considerably degraded by human activities (Gomez et al. 1994).

Serious economic losses have resulted from fish production lost due to deterioration of the marine environment. It is also a major contributor

to poverty in coastal communities (McAllister, 1998). Coastal management has been practiced in the Philippines over the last two decades to try to stem this increasing tide of habitat degradation and fisheries production decline (Courtney and White, 1998). Current approach towards the sustainable use and management of coastal resources is integrative, holistic, multi-disciplinary and system oriented. This approach is called Integrated Coastal Management (ICM). One of the activities in ICM is the establishment of marine protected areas (MPAs) (White et al, 2002)

MPAs have been widely recognized as means for both fisheries management and conservation of biodiversity (Hixon et al, 2001). The outcomes of MPA implementation have demonstrated successes at several locations (Roberts et al, 2001). They are widely advocated as a means for managing coastal resources and are being touted as the most efficient tool for the management of over-exploited coastal resources in tropical developing countries (Pollnac et al, 2001). Despite the long experience of the Philippines in ICM, only a meager 20% to 25% of the over 400 MPAs are considered as successful (Pollnac and Crawford, 2000). In Bohol, only 10% are considered as functional and effective among 50 implemented sanctuaries (Green et al., 2002).

In the municipality of Candijay, Bohol, the Pasil Reef Marine Sanctuary (now more popularly known as Kawasihan Reef Sanctuary) was established in 2001 through Municipal Ordinance No. 9 dated December 19, 2001. This came as the culmination of a decade of coastal resource management undertaken in Cogtong Bay. The primary objective of the implementation of this sanctuary was to rehabilitate the coral reef resources in the area. This study was conducted to assess and compare the present status of the sanctuary with that taken two years before.

Objectives of the study

The general objective of this study is to determine the present status of corals and coral reef fish populations of the Pasil Reef MPA. The following are the specific objectives:

1. To determine the status of the Pasil Reef Marine Sanctuary.
2. To compare the status of the coral reef and reef fishes inside the sanctuary with that outside the sanctuary.
3. To compare the status of the sanctuary with the baseline information from a previous similar study.

METHODS

Status of Coral Reefs

The Line Intercept Method (LIT) as prescribed by English et al (1994) was used in determining coral condition and life form inventory. A 20-m. transect was laid on the reef at two depth gradients (2 m. and 10 m.). Benthic life forms intercepted by the transect were recorded and identified in situ. From the LIT, the percent of coral cover was computed and compared to the previous baseline assessment. Control transects were also laid outside the MPA and were surveyed to serve as controls.

Reef Fish Assemblages

The coral reef fish population of targeted species was assessed using Fish Visual Census (FVC). Fish species and abundance were estimated. This method was conducted in conjunction with the LIT. A 50-m transect was laid following the depth contour similar to the LIT for corals, and FVC of fish populations was conducted within a 5-m. area along the transect. A similar census was also conducted outside the MPA to serve as controls.

RESULTS AND DISCUSSION

The type of reef around Pasil (Kawasihan) sanctuary is fringing (Figure 1). Rows of massive rocks surround the reef, which is locally known as pasil where the reef derived its name. A number of the giant clams, Tridacna squamosa and T. derasa in medium sizes were observed outside the transect during the survey.

Figure 2 shows the comparison of benthic forms and their percent composition inside the MPA between the 2003 and 2005 surveys. It shows that live hard corals inside the sanctuary dramatically increased in percent cover from18.0% in 2003 to 38.4% in this survey, or an increase of 113.3%; and

live soft coral increased from 1.3% in 2003 to 3.7% in this survey, or an increase of 184.6 percent. Macro-algae and dead standing corals also increased in percent cover by 30% and 116%, respectively.

Figure 3 shows the benthic forms and their percent composition outside the MPA during the 2003 and 2005 surveys. It shows that the percent cover of sand and silt (S/Si) was highest in 2003 with 28.5% cover but decreased to 18.38% in 2005. Live hard coral cover increased from 10.5% in 2003 to 19.6% in 2005. Live soft coral cover also increased from 2.25% in 2003 to 6.52% in 2005.

Figure 4 shows that the percent cover of live hard corals inside the sanctuary was higher than that outside, but live soft coral cover outside the sanctuary was higher than that from the inside of the MPA.

The Fish Visual Census inside and outside the MPA in November 2005 compared to the FVC conducted in November 2003 shows that in 2003, the total coded number of fishes inside and outside of the MPA were 24 and 12; respectively, while in the present census, the figures increased to 48 and 32, respectively, or an increase of 100% inside the sanctuary and 166.6% outside (Table 1).

CONCLUSIONS

The results clearly point out that the percent cover of both hard and soft corals increased both inside and outside the sanctuary within a period of two years, as did the results of fish visual census on fish assemblages. Percent cover of live hard corals inside the sanctuary increased from 18% in 2003 to 38.4% in 2005, while live soft coral cover increased from 1.3% in 2003 to 3.7% in 2005. We see this as a partial impact of protection brought about by the implementation of the MPA. On the other hand, the areas where the transects were laid out in the present survey were not the same sites surveyed in the 2003 assessment. However, despite this limitation, the researchers still believe that the increases could be due to the implementation of the sanctuary.

RECOMMENDATIONS

The researchers recommend that continuous scientific monitoring be done on the MPA to closely observe the growth of corals and other changes in benthic life forms over time. It is also recommended that seeding of animals with high commercial value such as giant clam, abalone and others be considered in the MPA to enhance its biodiversity. Finally, continuous education of the local stakeholders should be conducted to sustain the MPA.

Acknowledgment

The researchers are thankful to the Commission on Higher Education for providing funds for this study, the Local Government of Candijay, Bohol, and the different NGOs and POs involved in this assessment, without which this study might not have been possible. Dr. A.C. Alcala also edited an earlier draft of the manuscript.

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List of Figures and Tables

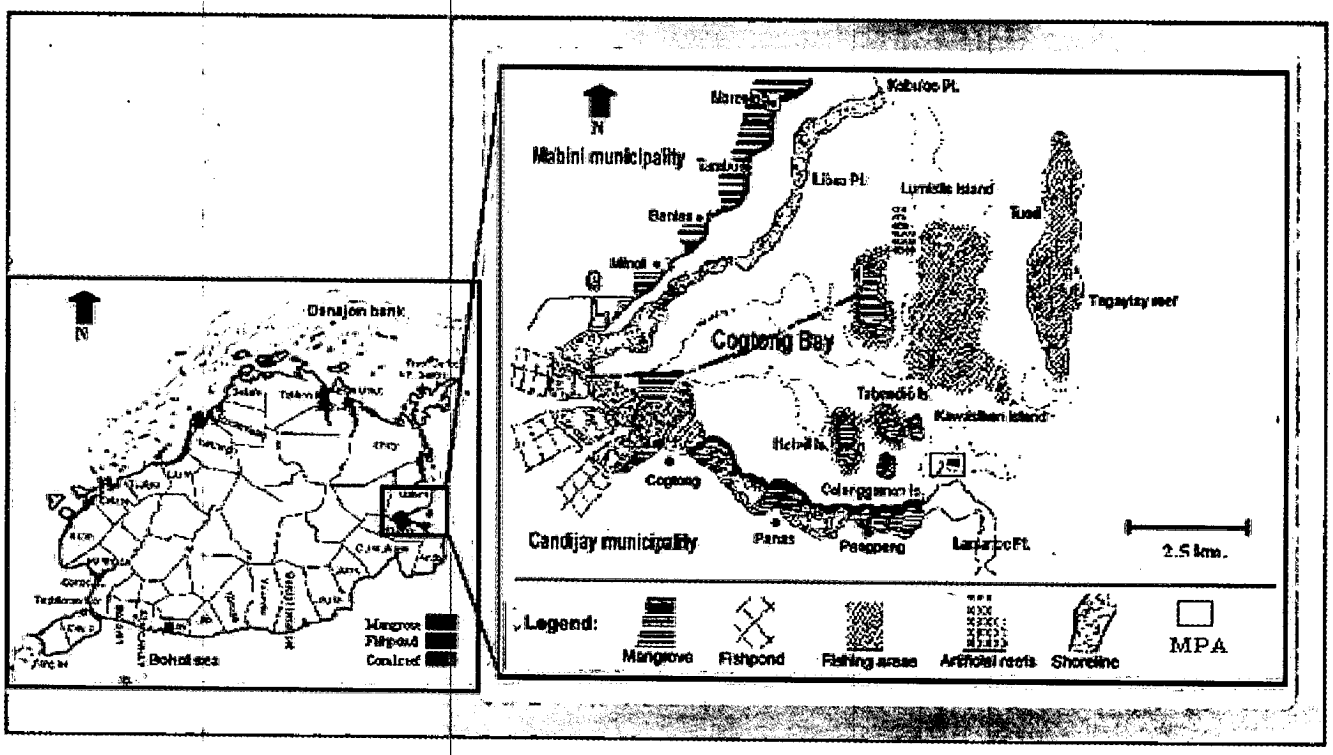

Figure 1. Bathymetric map of Cogtong Bay showing the location of the MPA.

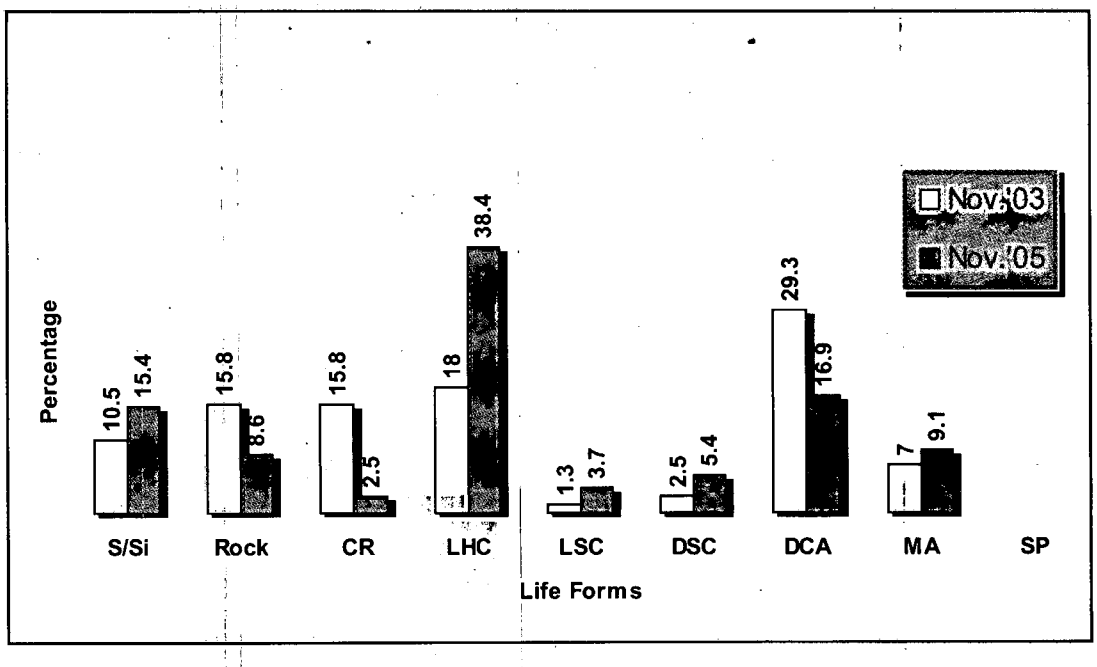

Figure 2. Comparison of benthic forms and percent composition inside sanctuary between the 2003 and 2005 surveys.

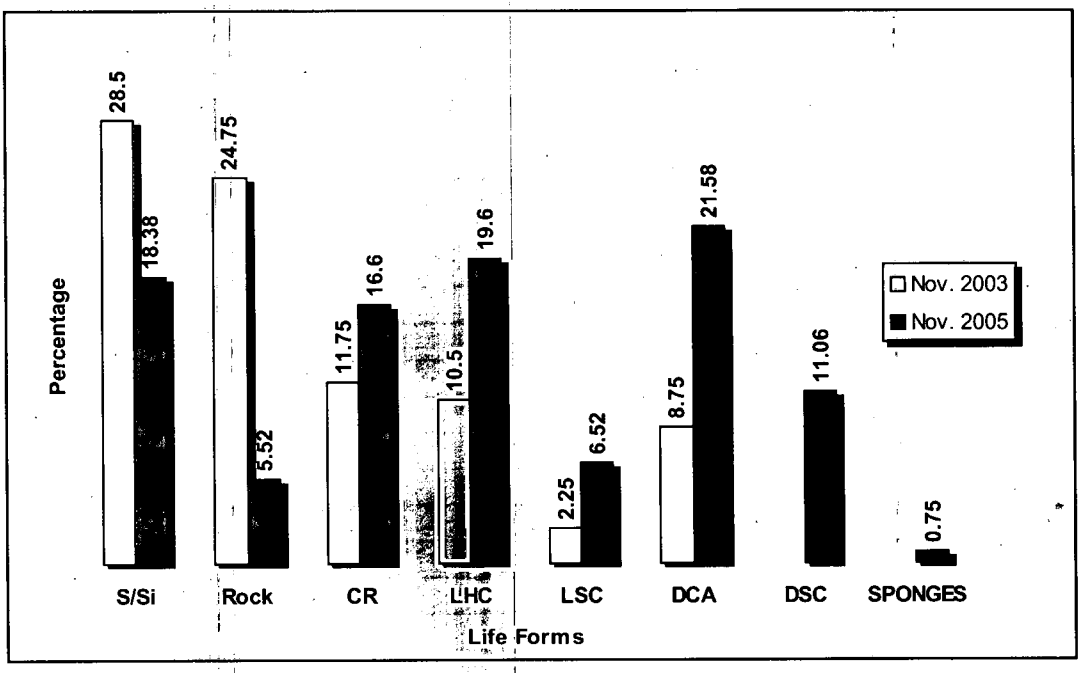

Figure 3. Comparison of benthic forms and percent composition outside the MPA between the 2003 and 2005 surveys.

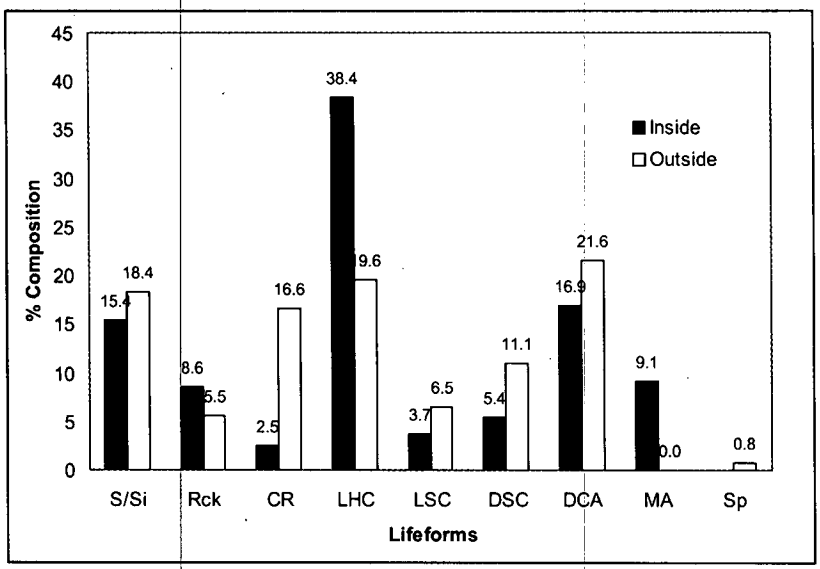

Figure 4. Comparison of benthic forms and % composition inside and outside of the MPA.

Table 1. Species composition and abundance of fish inside and outside the MPA, based on visual census of Pasil Reef Marine Sanctuary, Cogtong Bay, Bohol

Fish Type	November 2003		November 2005	
	Inside	Outside	Inside	Outside
1. Butterfly fish	2	2	3	2
2. Zanclus cornutus (baga)	0	2	3	3
3. Siganus cannaliculatus	2	0	4	0
4. Surgeon fish	0	1	0	2
5. Eel	3	0	4	4
6. Abudefduf bengalensis (kapaw)	1	0	2	2
7. Lethrinid (katambak)	2	2	0	2
8. Siganus guttatus	2	2	2	3
9. Green spotted wrasse (labayan)	3	0	4	3
10. Theraponid fish	2	0	3	2
11. Parrotfish	3	0	0	3
12 Damsel fish	4	2	2	0
13. Loligo sp.	0	1	2	0
14. Apogon notatus (moong)	0	0	2	2
15. Clown fish	0	0	1	0
16. Anchovy (libud)	0	0	4	0
17. Lizard fish (horiki)	0	0	1	0
18. Siganus lineatus (tagbago)	0	0	2	0
19. Grouper (pugapo)	0	0	1	2
20. Mullet (uhawon)	0	0	2	2
21. Siganus sp. (lap)	0	0	1	0
22. Unidentified Fish	0	0	3	0
Total	24	12	48	32
% increase between Nov. 2003 to Nov. 2005			100 %	166.6%

Legend:

Code		Number of fishes
1	=	1 – 5
2	=	6 – 25
3	=	26 – 125
4	=	126 – 625
5	=	more than 625

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