Summary Field Report:
Saving Philippine Reefs

Coral Reef Monitoring Surveys for Conservation in Panglao, Dauis, and Baclayon Bohol, Philippines

March 26-April 3, 2007

A joint project of the:
Coastal Conservation and Education Foundation, Inc.
and the
Fisheries Improved for Sustainable Harvest Project

With participation and support of the Expedition Volunteers

Coastal Conservation and Education Foundation, Inc.

THE DAVID AND LUCILE PACKARD FOUNDATION

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FISH PHILIPPINES The Fisheries Improved for Sustainable Harvest Project

SUMMARY FIELD REPORT
"Saving Philippine Reefs"

Coral Reef Monitoring Surveys for Conservation In Bohol, Philippines (March 26-April 3, 2007)

A joint project of the:
Coastal Conservation and Education Foundation, Inc.
(formerly Sulu Fund for Marine Conservation, Inc.)

and the

Fisheries Improved for Sustainable Harvest Project
Of the Bureau of Fisheries and Aquatic Resources
Supported by the United States Agency for International Development

Principal investigators and researchers:
Alan T. White, Ph.D.
The Nature Conservancy
Hawaii, U.S.A.

Anna Meneses
Sheryll Tesch
Coastal Conservation and Education Foundation, Inc., Cebu, Philippines

Aileen Maypa, M.Sc.
University of Hawaii, Manoa U.S.A.

Brian Stockwell
Silliman University, Dumaguete City, Negros Oriental, Philippines

Evangeline E. White
Community Conservation Network, Hawaii, U.S.A.

Roxie Diaz
Ethan Y. Lucas
Coastal Conservation and Education Foundation, Inc., Cebu, Philippines

Rafael Martinez
Fisheries Improved for Sustainable Harvest Project, Cebu, Philippines

Summary Field Report: “Saving Philippine Reefs”
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Produced by the Coastal Conservation and Education Foundation, Inc. and Fisheries Improved for Sustainable Harvest Project

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Coastal Conservation and Education Foundation, Inc. (CCE Foundation) is a nonprofit organization concerned with coral reef conservation through marine protected areas.

The Fisheries Improved for Sustainable Harvest Project (CRMP) operates in selected areas in the Philippines to assist local and national government to develop coastal resource management plans and to facilitate their implementation.

Cover photo by Ian White.

All communications to:

The Coastal Conservation and Education Foundation, Inc.
3rd Floor, PDI Condominium, Archbishop Reyes Avenue, Banilad,
Cebu City, Philippines

or the

Fisheries Improved for Sustainable Harvest Project
5th Floor, CIFC Tower, North Reclamation, Cebu City, Philippines

Phones: 6332-233-6909 or 6332-232-1821
Fax: 6332-233-6891
Email: ccef@mozcom.com; alan_white@tnc.org
Website: www.coast.ph

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LIST IS ACRONYMS AND ABBREVIATIONS

BEMO	-	Bohol Environment Management Office
BFAR	-	Bureau of Fisheries and Aquatic Resources
BIDEF	-	Bohol Integrated Development Foundation
BIUPOP	-	Balicasag Island United People's Organization for Progress
BMT Project	-	Biodiversity Conservation and Management of the Bohol Marine Triangle Project
CCEF	-	Coastal Conservation and Education Foundation, Inc.
DA	-	Department of Agriculture
DENR	-	Department of Environment and Natural Resources
FARMC	-	Fisheries and Aquatic Resource Management Council
FPE	-	Foundation for the Philippine Environment
MCDP	-	Marine Conservation and Development Project
MPA	-	marine protected area
SU	-	Silliman University
BIFA	-	Bil-isan Fishermen Association
BIDR	-	Balicasag Island Dive Resorts
BMT	-	Bohol Marine Triangle
CESO	-	Canadian Executive Service Organization
CRM	-	coastal resource management
DOT	-	Department of Tourism
DPFA	-	Doljo-Panglao Fishermen's Association
ELAC	-	Environmental Legal Assistance Center
FISH Project	-	Fisheries Improved for Sustainable harvest Project
PACAP	-	Philippine Australian Community Assistance Program
PADAYON	-	Panglao, Dauis and Baclayon Project (formerly BMT Project)
SISO	-	San Isidro Fisherfolk Organization
SPR	-	Saving Philippine Reefs
SUML	-	Silliman University Marine Laboratory
WWF	-	World Wide Fund for Nature

ABSTRACT

This project collected data on the condition of coral reefs in the municipalities of Dauis, Baclayon, and Panglao in Bohol. Surveys were assisted by 12 active international volunteers, CCE Foundation staff, and local area collaborators and partners. Objectives achieved during the expedition were: 1) to determine reef quality indicator values for seven study sites through broad area surveys using scuba and snorkel; 2) measure living and dead reef substrate cover, fish species richness and abundance; 3) monitor the aesthetic appearance of the sites in comparison to years past while noting human uses and impacts; 4) evaluate the management status of marine protected areas; and 5) recommend improved management actions.

Most study sites showed a stable or decreasing living hard coral cover in the shallow areas. However, there is an increasing trend in live coral cover in the deeper areas (7-8 meters). The average increase in live coral cover since 2003 is 9.5 percent from an average LHC cover of 38.9% in 2003 to 42.6% in 2007. The decrease in living coral on the shallow reefs may be due to poor enforcement of regulations in several of the marine protected areas. According to community interviews there is a need for more MPA information dissemination and education through and with the local community, as well as a need to educate tourists who utilize many of the shallow reefs during their recreation activities.

Fish density and species richness are generally low and decreasing at all sites surveyed except in the few sanctuaries that are effectively managed, which are San Isidro-Dau, Balicasag, and Tawala Marine Sanctuaries. Only San Isidro-Dau Marine Sanctuary showed an increasing trend in fish species richness. Pamilacan Marine Sanctuary has experienced a general decrease in fish species and abundance with a stable condition in live hard coral in the shallow and deep reefs. An upcoming area surveyed was Tawala Marine Sanctuary where there is continuing and strong law enforcement and management. It showed an increasing trend in fish abundance and biomass.

Observations and interviews with stakeholders indicate that most of the sanctuaries have decreased management efforts thus decreasing the quality of protection over their MPAs. This is due to a lack of training and funding available for trainings for the local communities. There is also an ongoing need for awareness-building and community education about the purpose and benefits of MPAs. Several communities, especially in Pamilacan Island, complained of increased presence of commercial fishers in their area who fish close to the island and their sanctuary. Due to lack of logistical assistance and equipment the community is unable to prevent them from poaching in their sanctuary.

Despite these findings, there is still an enthusiastic interest to protect coral reefs through the use of marine sanctuaries, all of which have been declared by municipal ordinance. Recommendations on how to improve MPA management in the sites surveyed include: increased efforts to educate the local community and tourists, collecting user-fees so that financial benefits are available, and most critically, continuing the management efforts through law enforcement and increased participation in sanctuary maintenance.

ACKNOWLEDGEMENTS

This Saving Philippine Reefs Expedition and its outcome are credited to the 10 volunteers (see Appendix 2) from the United States, United Kingdom and Australia who dedicated their time and funding to the research work. Equally important are the Coastal Conservation and Education Foundation staff, partners and volunteers (see Appendix 2) that prepared for the trip, worked long hours and have all done their part in the overall successful completion of the Expedition. They include: Anna Meneses, Co-principal investigator, Sheryll Tesch, Data and research coordinator; Ethan Lucas, Divemaster; Brian Stockwell, Fish visual census specialist; Roxie Diaz, Assistant Divemaster; Rafael Martinez, GIS specialist; and Vangie White, Overall project coordinator for the trip. Others include Paula Lozada, Agnes Sabonsolin, Iolanthe Sara, Venerando Carbon, Pablita Toyong, Dean Apistar, and Marilyn and Danny Alilay for their assistance and support in the preparations for the expedition.

The Fisheries Improved for Sustainable Harvest (FISH) Project supported by the United States Agency for International Development operates in selected areas in the Philippines has provided support to the project through the participation of Rafael Martinez and his contribution of data, maps and analysis.

Bohol Beach club, in Panglao, Bohol and its resort manager, Fe Ginete, and the Bohol Beach club are thanked for being committed to the needs of the expedition team and providing excellent service, accommodations, food and diving services and assistance with traditional Filipino hospitality.

Padayon Project (formerly the Bohol Marine Triangle Project) provided assistance in the collection of the community perception data. Special thanks to Meann Tercero and Resti Tejido for presenting their project to the Expedition members during the trip.

The final production of this report has been efficiently accomplished by Sheryll Tesch, Aileen Maypa, and Anna Meneses of the CCE Foundation. Finally, any unpopular opinions or remaining errors are assumed by the authors.

Alan T. White
Principal Investigator

SAVING PHILIPPINE REEFS PROJECT
A Coral Reef Monitoring Expedition to Panglao, Dauis and Baclayon, Bohol, Philippines March 26-April 3, 2007

INTRODUCTION

The ***Saving Philippine Reefs (SPR) Project*** was initiated in the early 1980's by Alan White and his colleagues. SPR is a research project intended to improve the quality and quantity of information available on coral reefs for use in improving management and creation of appropriate policies for conservation and sustainable use of resources. SPR expanded through collaboration with the Earthwatch Institute and other local organizations and institutions, as well as through the support of regular volunteers and donors from Australia, United Kingdom and United States of America.

Through SPR's annual monitoring activities, over 50 marine protected areas (MPAs) and important coral dive-sites located in six provinces in Luzon and Visayas now have baseline data and/or time-series data. These datasets are now being used by the 16 municipal governments, which are monitored by SPR, as basis for their coastal resource management planning and conservation policy improvement.

Management History of Bohol Marine Triangle, Philippines

One of SPR's sites is Bohol, which is slowly gaining acknowledgement as an important marine heritage site, harboring rare species of sea turtles, devil manta rays, sting rays, seahorses, giant clams, and a wide variety of mollusks (BMT 2001, Christie, *et al.,* 2002). The area is frequented by important pelagic fish and whale sharks. The surrounding deep sea is the migratory route for whales and dolphins. Needless to say, the area is a marine paradise, ranking among the top 10 dive sites in the country with beautiful fine-sand beaches and remarkable coral reefs. This area is also a traditional fishing ground for locals and fishers from neighboring provinces. The *Badjaos*, an indigenous group originating from Mindanao also fish in the area.

In 1978, Balicasag Island (Panglao, Bohol) was surveyed and recommended for national marine park status, but was never declared as one. In 1985, baseline reef assessments were conducted in Balicasag and Pamilacan Islands (Baclayon, Bohol) by researchers from Silliman University through its Marine Conservation Development Program (MCDP). A year later, marine sanctuaries were established in Balicasag and Pamilacan Islands through community participation and support from the local government (MCDP, 1986).

The SPR Project, through the support of Earthwatch Institute and in collaboration with the Silliman University conducted a reef monitoring expedition in 1999 in the same area covering several new sites. Important recommendations that were given after this expedition included: (1) increased effort to support and unify sanctuary management committees; (2) increased information, education and communication activities in the affected communities in MPA management and benefits; (3) the need for all sanctuaries to be equally enforced to form a more effective network of marine sanctuaries to improve enforcement and decrease fishing activities; and (4) the need for sanctuary management groups to address tourism impacts in their areas.

In 2001, the Foundation for the Philippine Environment initiated the implementation of the Bohol Marine Triangle Conservation Project. The BMT Project's aim is to facilitate the implementation of improved coastal resource management (CRM) in the municipalities of Panglao, Dauis and Baclayon. The planning and implementation process adopted a highly participatory process involving coastal stakeholders from the onset to ensure long-term sustainability of CRM interventions. One of the targets was to establish 12 effective marine sanctuaries and to improve the management of existing marine sanctuaries in the three municipal areas.

SPR conducted a follow-up survey in 2003 supported by Earthwatch Institute and in collaboration with the Bohol Marine Triangle Conservation Project. Now, several more marine sanctuaries have been established, and the area is commonly referred to as the Bohol Marine Triangle (BMT) area. The overall physical condition of the coral reefs appears stable and somewhat improved in most sites. In contrast, fish abundance has gone down and there were indicators of increasing fishing intensity in the vicinity of the marine sanctuaries. At the same time, tourism and shoreline development increased. It was recommended that management be continued and strengthened through integrated and balanced approaches that involve all stakeholders (White, *et al*., 2003).

The BMT Project is now on its phase-out stage. As a strategy, PADAYON, an agency supported by Panglao, Dauis and Baclayon, was created to assume marine conservation management responsibilities. In 2007, the SPR Project went back to survey the marine sanctuaries in BMT. Eight of the 12 marine sanctuaries in the BMT area were surveyed. All data has been compiled and findings are summarized in this report and are being disseminated to all interested parties in the Philippines and elsewhere.

This Expedition – 2007

This SPR Expedition 2007 conducted in Bohol involved a team of 12 volunteers and eight staff. The team surveyed seven marine sanctuaries within the Bohol Marine Triangle area from March 26 to April 3, 2007. Locations of all study sites are shown in Figure 1 and on separate maps (Figures 2 to 7). The expedition itinerary is shown in Appendix 1. The research expedition went smoothly and was a delight to participate in, both as a volunteer and as a staff member. The commendable and enthusiastic volunteers and staff formed a very solid team and accomplished almost all the objectives (Appendix 2). Seven volunteers had participated in previous SPR Expeditions. The new volunteers learned quickly and collected accurate data. The team was hard working and knew how to have fun under the sun!

The team resided at the Bohol Beach Club (BBC) Resort in Bolod, Panglao Island. Bohol Beach Club provided excellent service and made an exceptional effort to give the expedition team an enjoyable and worry-free experience.

Data Collected and Methods

The Volunteers

Twelve volunteers participated in the "Saving Philippine Reefs Coral Reef Monitoring Expedition" in the municipalities of Panglao, Dauis and Baclayon in Bohol from March 26 to April 3, 2007. They made financial contributions which covered their local travel, accommodations, subsistence, and diving costs. The volunteers came from different backgrounds including

biologists, entrepreneurs, business and education consultants, and managers. They are all experienced scuba divers and a majority of them have participated in previous SPR surveys.

Study Site

Data Collection

Bohol Marine Triangle

Panglao Municipality

1. Balicasag Marine Sanctuary
2. Bolod Marine Sanctuary
3. Tawala Marine Sanctuary
4. Doljo Marine Sanctuary
5. Bil-isan Marine Sanctuary

Dauis Municipality

1. Dau-San Isidro Marine Sanctuary

Baclayon Municipality

1. Pamilacan Marine Sanctuary

Substrate Cover. Systematic snorkeling surveys were carried out in the shallow reef flat at 2–3 meters depth, covering a distance of 0.5–1 kilometer parallel to the reef crest. The distance covered for sampling is limited by the reef extent and may be less than 0.5 km in some sites. The substrate was evaluated within an estimated area of $1m^2$ quadrat at every 50-meter stop (station). The following data was recorded:

1. Percent cover of living coral (hard and soft)
2. Percent cover of non-living substrate (e.g. rock, rubble, sand, dead coral)
3. Percent cover of living substrate (e.g. seagrass, algae, sponges)
4. Numbers of indicator species (e.g. giant clams, lobsters, Triton shells, Crown-of-thorns starfish, and other invertebrates)
5. Presence of large marine life (e.g. sharks, manta rays, Humphead wrasses, sea turtles, whales, dolphins, and others)
6. Causes of reef damage

Distances between stations were estimated through kick cycles, wherein volunteers calibrated their kicks along a transect tape prior to surveys. Each volunteer attempted to make at least five or more stations on one snorkel survey, limited by the extent of the reef.

Scuba surveys were carried out in the deep area (6–10m depth) parallel to the reef crest using a systematic point-intercept method. Transects were laid on sections of a reef flat, reef crest or slope. Substrate was evaluated at 25cm intervals along a 50m transect. Data gathered during scuba surveys were the same type as those collected during snorkel surveys. Distance between transects were 5 – 10m, however, were closer in some areas where the reef extent was narrow.

Fish Estimates. Fish abundance and diversity were estimated using a 50 x 10m transect using an underwater visual census (UVC: n = 3 – 6) technique done by three specialists. Substrate transects were utilized during UVC. The abundance of target species, indicator species, indicator species and numerically dominant and visually obvious were all counted. Biomass of target species was computed by converting estimated fish lengths to biomass using species-specific length to weight relationships from Fishbase (2004)

Data Analysis

Coral and Fish Abundance. The classification for live hard corals (LHC) followed that of Gomez et al. 1994. Comparisons between years for both LHC percent cover and fish densities used one-way Analysis of Variance (1-ANOVA) or t-test whenever appropriate. Data not meeting the assumptions of variance equality and normality (when necessary) were log/square root transformed. Levene's Test was used to check for variance homogeneity.

Fish Biomass. Fish biomass was computed using the formula: $W = a \cdot L^b$ (Fishbase 2004), where: W = weight of fish and a and b are species-specific constants. Biomass of target fish (commercially important food fish) species were computed on the species level and summed up per family: Epinephilinae (Serranidae), Lethrinidae, Lutjanidae, Acanthuridae, Caesionidae, Carangidae, Haemulidae, Nemipteridae, Mullidae, Scaridae, and Siganidae.

Daily Log of Human Activities. Each day, observations on human use of the site being surveyed were recorded. These observations included fishing, boats, dropping of anchors, divers, shoreline development and any other activities with potential impacts.

Perception Survey and Management Rating. Key informants from each of the sites were identified and interviewed for their observations and experience on MPA implementation. The survey result was coupled with information gathered from informal conversations with key informants and personal observations.

For each site surveyed, about four to six samples were taken. *Barangay* officials, people's organization members and officers, residents, dive resort operators, or fishers were targeted for the interview. Questions asked pertained to the general perception of the area throughout the years in terms of human activities and natural impacts, marine protected area management, fishing practices, and laws pertaining to the dive sites or protected areas. The following table shows the number of respondents interviewed per study site:

Study Site	Number of Respondents
Balicasag Island Marine Sanctuary	4
Bolod Marine Sanctuary	5
Tawala Marine Sanctuary	2
Doljo Marine Sanctuary	4
Bil-isan Marine Sanctuary	6
San Isidro-Dau Marine Sanctuary	3
Pamilacan Marine Sanctuary	6

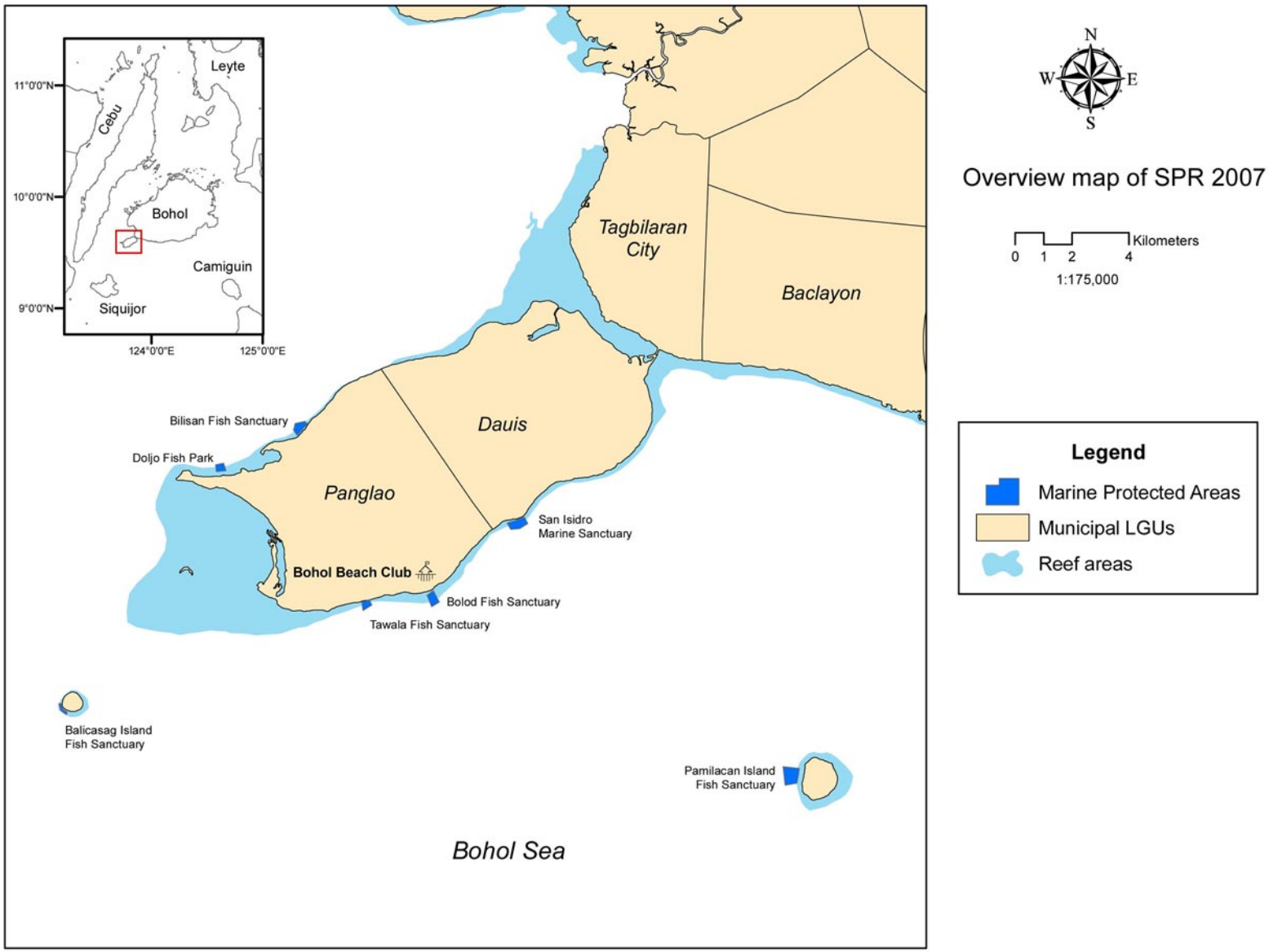

Figure 1. Saving Philippine Reefs Expedition (2007) survey sites , Bohol, central Philippines.

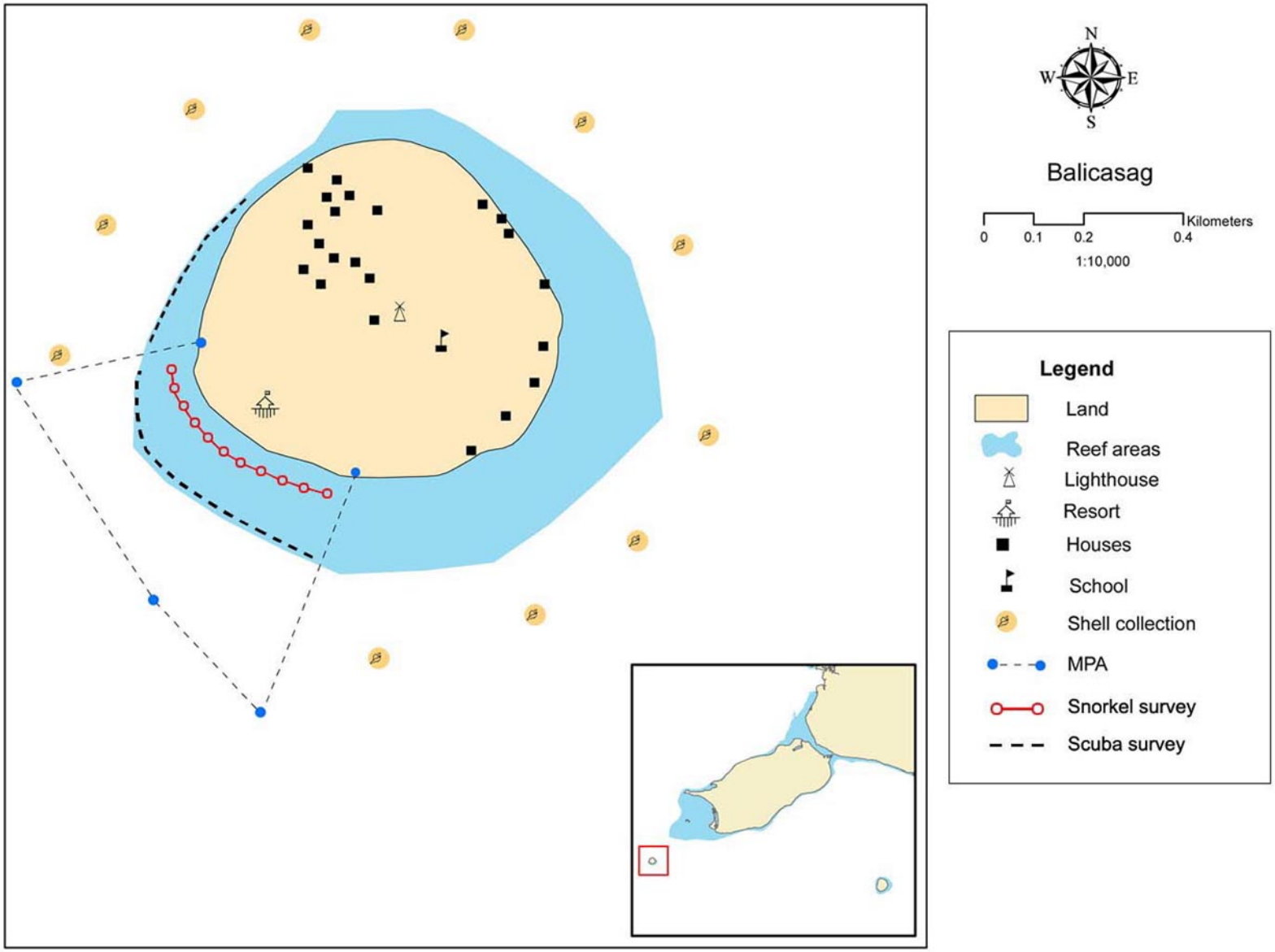

Figure 2. Survey locations in Balicasag Island, Panglao, Bohol.

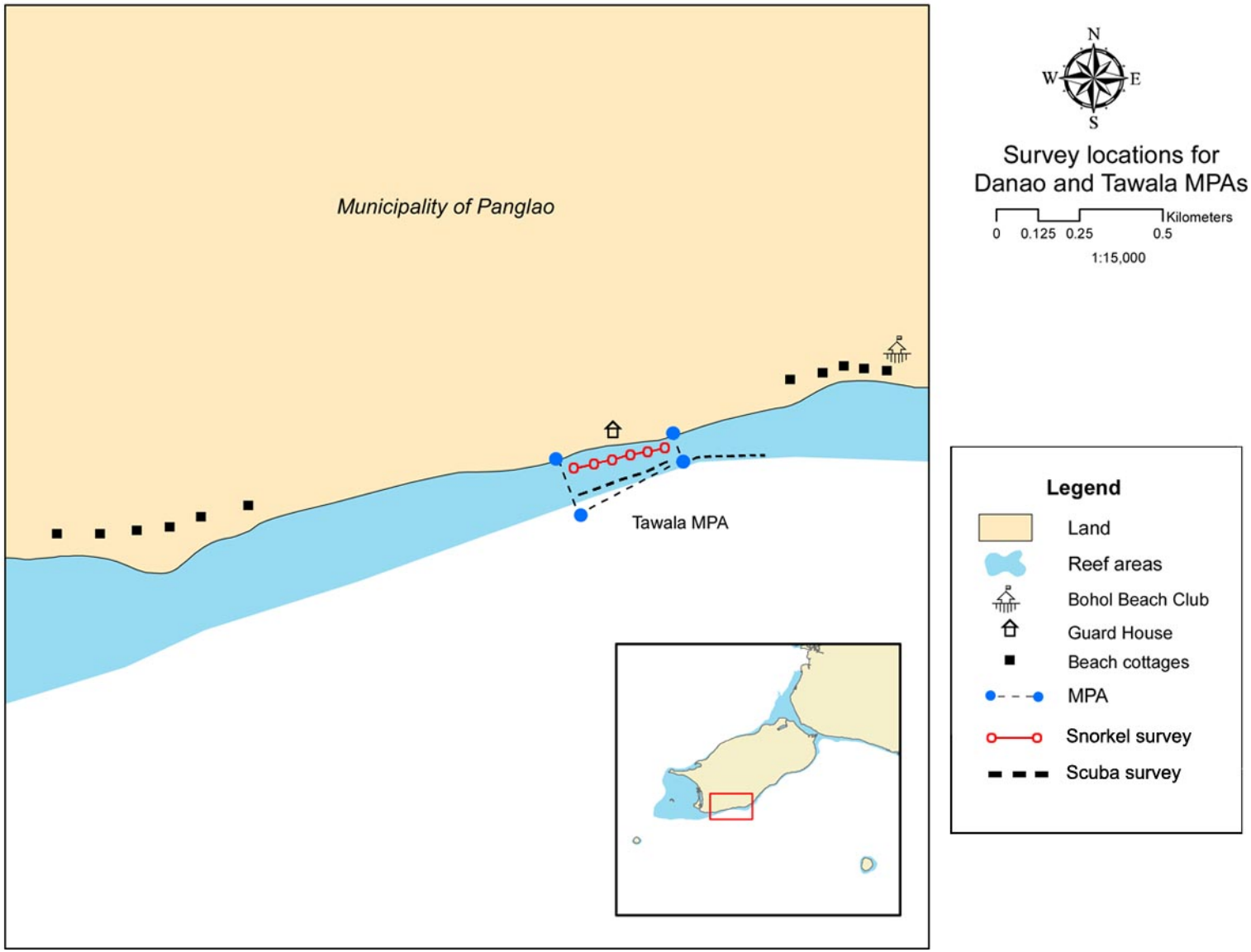

Figure 3. Survey site at Tawala Marine Sanctuary, Panglao, Bohol.

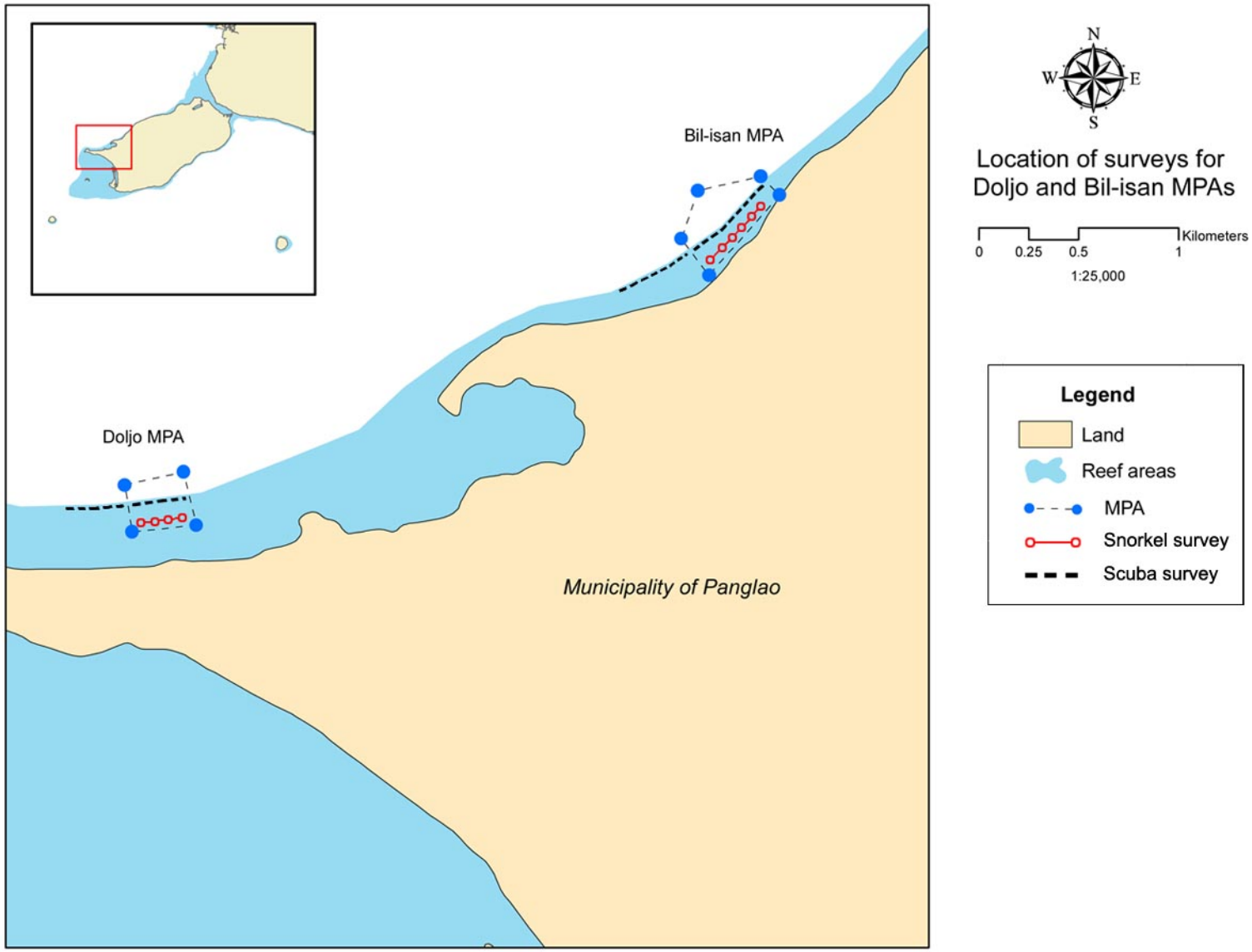

Figure 4. Location of survey sites at Doljo Marine Sanctuary and Bil-isan Marine Sanctuary, Panglao, Bohol.

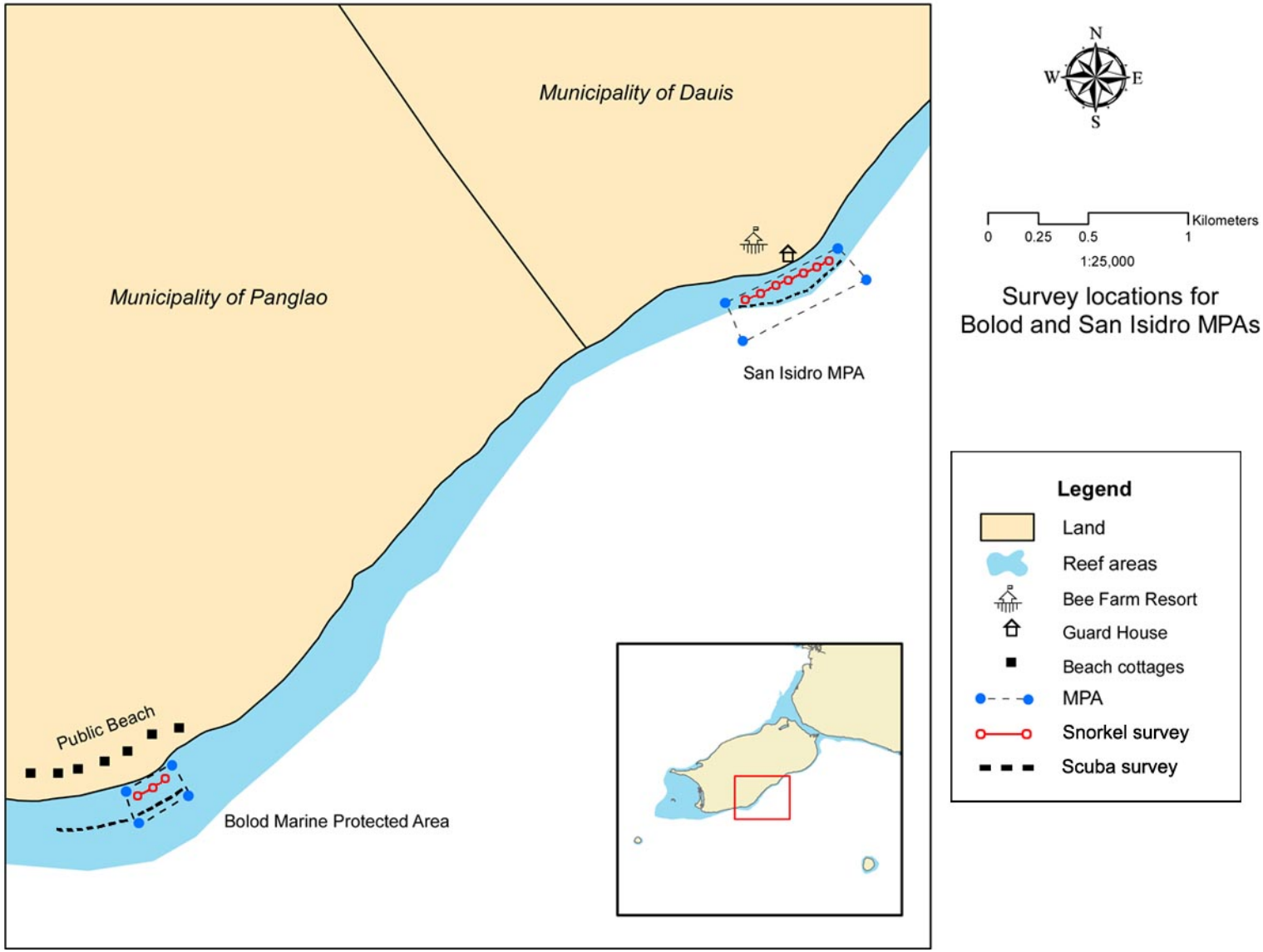

Figure 5. Location of survey sites in Bolod Marine Sanctuary, Panglao, and San Isidro-Dau Marine Sanctuary, Dauis, Bohol.

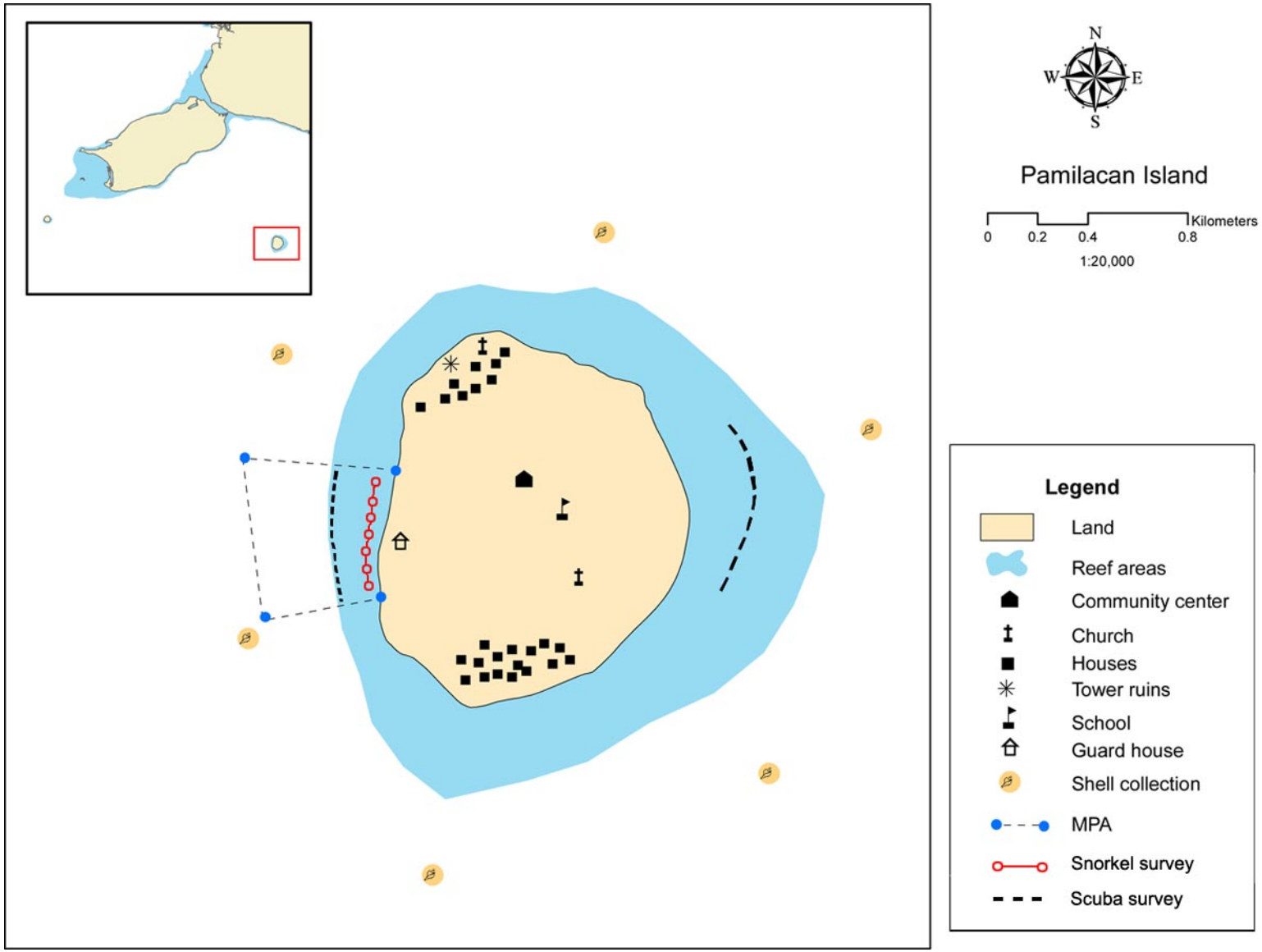

Figure 6. Location of survey sites in Pamilacan Island, Baclayon, Bohol.

OVERVIEWS AND RESULTS OF SITES SURVEYED

PANGLAO

In 2005, a municipal marine protected area ordinance was passed re-stating the six existing MPAs and declaring two additional MPAs. The *core zones* are no take-no human activity areas. Only research activities with approval are allowed. The *buffer zones* are regulated areas. Only fishers from the *barangay* where the MPA is located are allowed to fish using only hook-and-line and spears. Guided tours and diving/snorkeling with permission and appropriate fees are also allowed (Table 31).

Panglao MPAs are assisted by the Bohol Marine Triangle – Panglao, Dauis, Baclayon (BMT-PADAYON) group for financial and technical assistance; Bohol Environment Management Office (BEMO) for technical assistance; Silliman University Marine Laboratory (SUML) for research and monitoring; Coastal Conservation and Education Foundation (CCE Foundation) for technical assistance and development of education and awareness materials.

BALICASAG ISLAND MARINE SANCTUARY, Panglao

Site Description and Management. Balicasag Island Marine Sanctuary is a 5.4-hectare MPA containing a shallow crest at about 3 to 4 meters with a wall and dramatic overhanging features covered by dense hard corals.

Balicasag Island Marine Sanctuary was established in 1986 through the assistance of Silliman University. This was prompted by the reef survey in 1985, which showed high marine biodiversity with signs of stress from destructive fishing and unregulated tourism. A follow-up survey in 1999 showed that this coral reef area remained healthy and stable in spite of the coral bleaching event in 1998 and continuing pressures of fishing and diving in the area. It was observed at the time that sanctuary management effort had weakened (White, et al, 1999 and the Balicasag Island United People's Organization for Progress (BIUPOP) was inactive. This observation on sanctuary management showed that there was not much improvement in management by 2004. However, the sanctuary's fish density and target fish diversity was highest in this area compared to the rest of the sanctuaries surveyed in 2003. Reef damage observed was mostly associated with increasing tourism activity in the area (White, *et al*., 2003).

Management Perceptions. In the 2007 survey, results of the perception survey show that the level of awareness on the sanctuary is very high and there is strong community support. BIUPOP gets additional assistance from the Balicasag Island Dive Resort (BIDR) for logistical needs and participation in dive-monitoring activities, and World Wide Fund for Nature (WWF) for MPA materials and maintenance.

Balicasag Marine Sanctuary management rating is at level 2 meaning that it is has attained an "established phase" in implementation. After 21 years since the sanctuary's declaration, it appears that BIUPOP lost its commitment and motivation to manage the sanctuary and there are underlying issues that are causing the slow progress in management.

The existing municipal ordinances on fishery management, marine protected areas, and tourism management for this site, although adequate and practical, are not fully enforced by the local government. The problem lies in the absence of an implementation framework and lack of support for field operations.

Trends in Coral Abundance and Reef Fish. Live hard coral cover in the Balicasag MPA shifted from poor (in 1984 at 21%) to fair (in 1992 to 2007 reflecting 30.5% to 47.9% live hard coral cover) on the reef crest and reef slope (at 7 to 8 m depth). This increasing coral trend in the MPA and adjacent fishing ground is shown with a steep decline in rock and block substrate (Figures 7 and 8). This suggests that colonization by corals on rock and block substrate may have occurred and probably that the anchor buoy system around the island has prevented anchor damage on this portion of the reef. On the reef flat (at 3 to 4m depth), live hard coral cover has not changed much since 1999 and remains stable at about 20%.

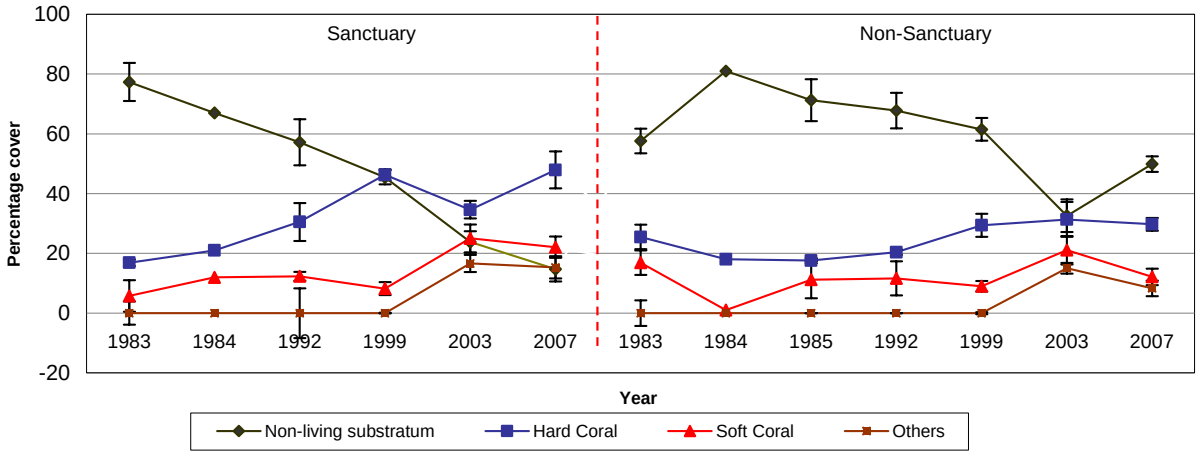

Figure 7. Changes in substrate (% mean ±SE) in Balicasag Marine Sanctuary from 1984 to 2007 (7-8m depth).

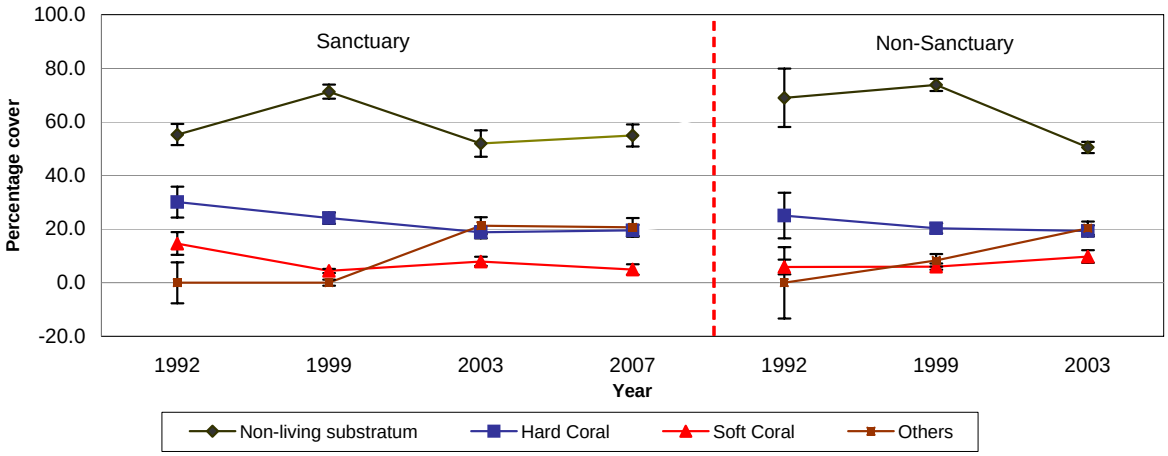

Figure 8. Changes in substrate (% mean ±SE) in Balicasag Marine Sanctuary from 1999 to 2007 (3-4m depth).

The fish surveys over time show that the Balicasag MPA, consistently harbors schools of fusiliers (*Pterocaesio spp., Caesio spp*.) whose densities have been maintained over 20 years. No significant difference in densities were found between years ($p = 0.055$, $F = 3.73$, $df = 14$; CCE Foundation's existing data only allowed for a statistical analysis from 1999 to 2007). It should be noted, however, that the p-value is of marginal insignificance and an increasing pattern results when a regression line is fitted from 1999 to 2007 (Figure 9a). Further, the snappers (*Lutjanus* spp.) and Labrids also show an increasing trend.

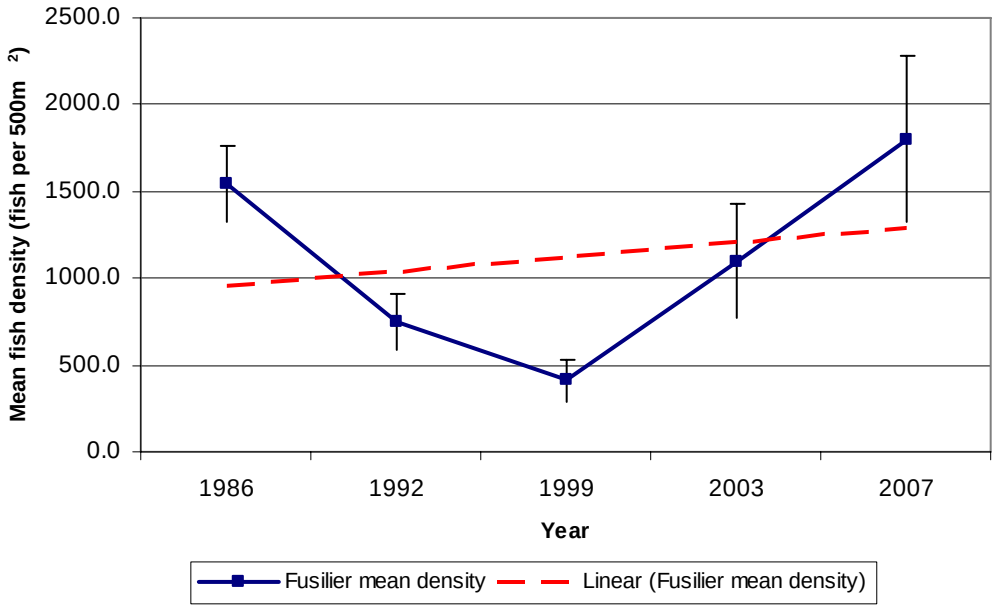

Figure 9a. Mean (±SE) density (individuals/500m^2) of Fusiliers (Caesionids) from 1986 to 2007 in Balicasag Marine Sanctuary.

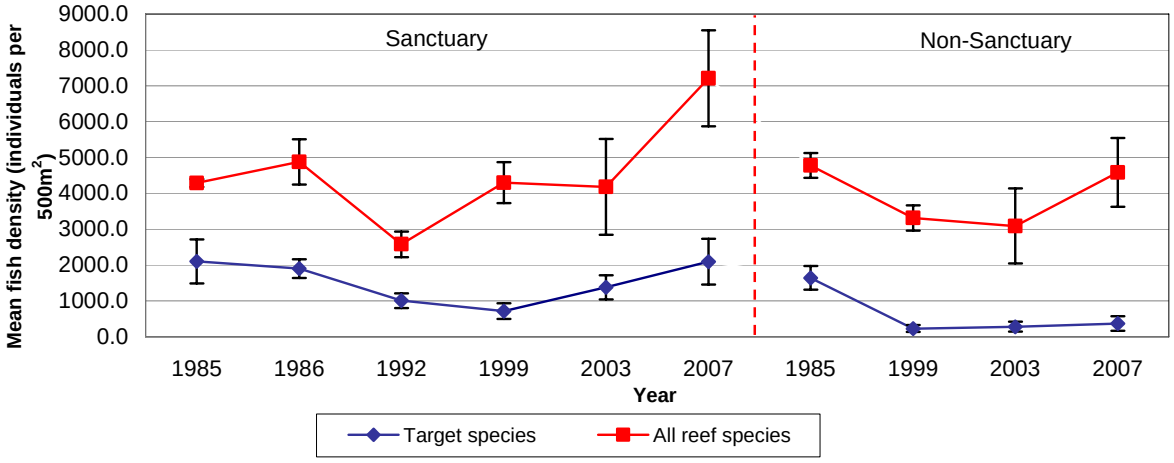

Figure 9b. Mean (±SE) density (individuals/500m^2) at Balicasag Marine Sanctuary, Panglao from 1986 to 2007.

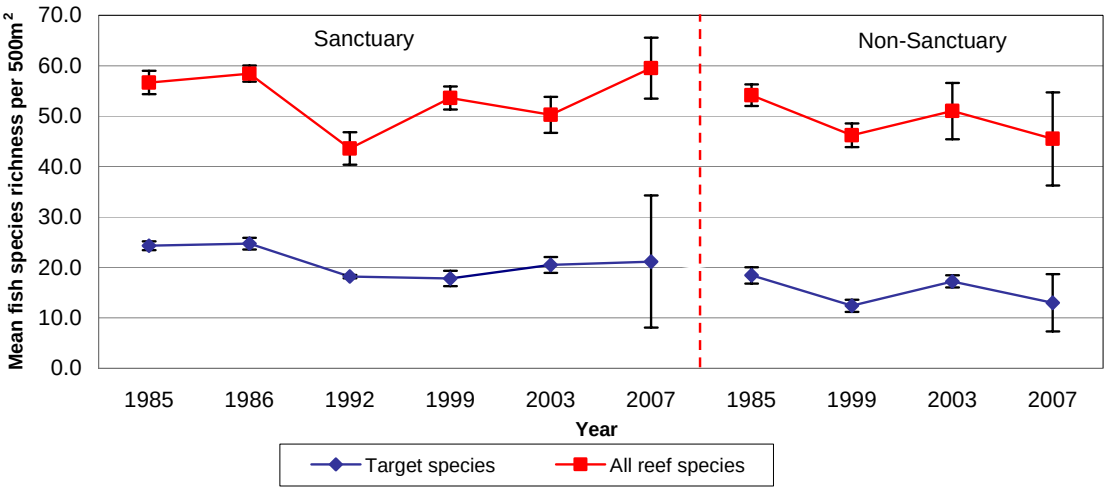

Figure 10. Mean (±SE) number of species/500m^2 at Balicasag Marine Sanctuary, Panglao from 1992 to 2007.

Overall fish abundances for all reef and target species also appeared to increase. It is worth noting that target fish density inside the MPA in the year 2007 appeared higher compared to previous years, and similar to 1986. The density of jacks (77.5 fish/500m^2, Table 4) was especially high in 2003. Jacks are highly mobile and this sudden increase in density may just be due to a school recorded on one transect. However, jacks have always been noted in Balicasag MPA on the deeper part of the reef slope (60-70 ft) over the years since the mid-1990s (A. Maypa, personal observation). Target fish biomass, in contrast, appeared to decrease steeply inside the MPA from 97 kg/500m^2 in 2003 to 34.2 kg/500m^2 in 2007 (Figure 11). This may be explained by increasing fish mortality in adjacent fishing grounds as noted below or more likely some poaching is occurring, i.e., fishing illegally inside the MPA. This may occur along what was previously the "off-shore boundary" that has been moved closer to the reef and fishers are thus actually fishing inside the MPA near or on the reef slope.

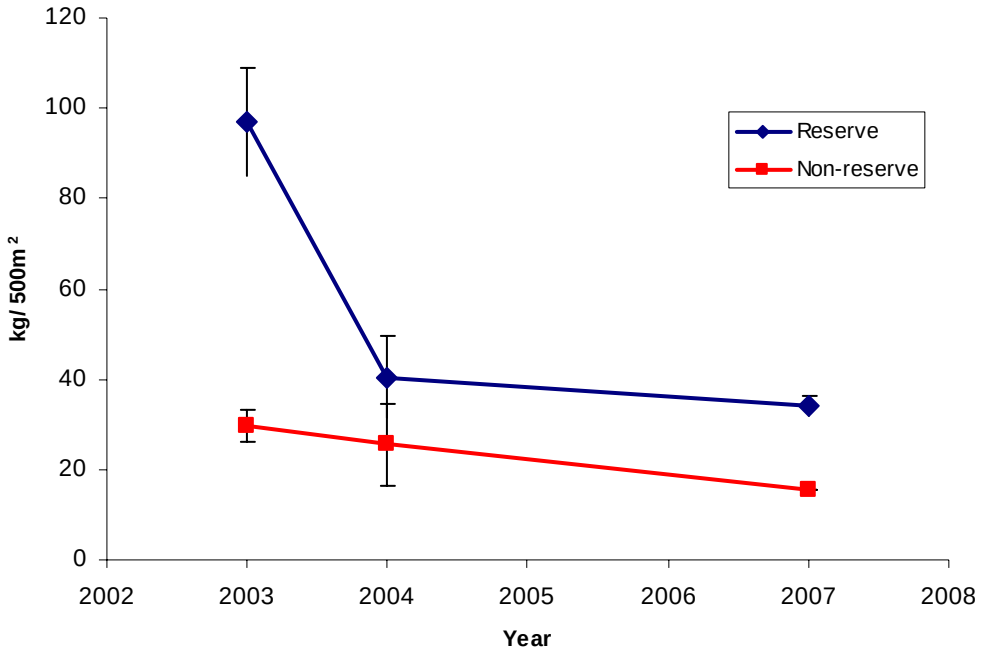

Figure 11. Mean Target Fish Biomass (kg/500m^2) in Balicasag Marine Sanctuary from 2002 to 2007.

It is hypothesized that Balicasag MPA is effectively exporting adult fish biomass into adjacent fishing grounds (*spillover*) due to the absence of target fish abundance gradients from the MPA across boundaries, to fishing grounds (see Abesamis 2006). Similar fish densities were also seen inside the MPA and surrounding fished areas in 1999 (Walmsley and White, 2003). The current data on fish target abundance, however, contrasts with the aforementioned observations. Mean total target fish density in the MPA is 2,092 fish/500m^2 and this value is significantly higher than 370.8 fish/500m^2 in the adjacent fishing ($p = 0.018$, t-value = -3.24, df = 6). This suggests that that catch rates and/or fishing effort in adjacent fishing grounds may have increased in the years 2005 to 2007, between the surveys made by Abesamis et al. (2006) and this SPR expedition. It appears that a high level of fishing mortality caused the significant decreases observed in the fish stocks in fishing ground adjacent to the MPA. This indicates that the catch levels in the area may be unsustainable and need urgent management. Fish catch monitoring studies may be done by other institutions that can verify these observations which are unavailable at present.

BOLOD MARINE SANCTUARY, Panglao

Site Description and Management. Bolod Marine Sanctuary was established in 1998 along with Tawala, Doljo, Bil-isan and other new MPAs in Panglao. Bolod Marine Sanctuary is a 3.9-hectare MPA enclosing patches of seagrass beds and corals in shallow water. The reef crest is about 8 to 10 meters consisting of large branching corals and massive coral patches. Bolod Marine Sanctuary reef has sloping-to wall-like topography. This area is popular for divers and beach picnickers and is located in front of a public beach and a number of resorts frequented by up to 500 tourists every weekend during summers. The Bolod MPA management issues identified during the 2003 survey were weak law enforcement, continuing fishing violations, and increasing tourism pressure (White, *et al*., 2003).

Management Perceptions. In this 2007 survey, the results of the perception survey show that the level of awareness on the Bolod Marine Sanctuary is very high and community support is positive. Bolod MPA is managed by the Bolod *Barangay* Government. Bolod gets additional assistance from MAPOBO (a local people's organization) for on-site support, the Bohol Integrated Development Foundation (BIDEF) for training, and dive-shop operators for logistical support and participation in dive-monitoring activities.

The management rating of Bolod Marine Sanctuary has improved since the last survey in 2003. It has attained one level higher on the MPA Rating System, reaching an "established phase" in implementation or level 2. The identified top management problems and issues are weak support from the Panglao Municipal Government, sporadic fishing inside the sanctuary (particularly by *Badjaos*), and the need for collaborative efforts of stakeholders to strengthen enforcement of MPA guidelines and policies.

Trends in Coral Abundance and Reef Fish. The percent cover of live hard coral in Bolod MPA in 2007 is 11.4% in the shallow (3-4m depth) and 22.4% in the deeper 7-8m areas (Figures 12 and 13). In the non-sanctuary area, live hard coral cover is also poor in the shallow area but slightly higher in the deep at 33.3%. It appears that the MPA live hard coral cover has increased since the sanctuary's establishment in 1998 but only the data from the 1999 to 2007 surveys were available for statistical testing: 1999 > 2003 = 2007 (1-ANOVA: p = 0.005, F = 7.08, df = 22; Tukey's Test).

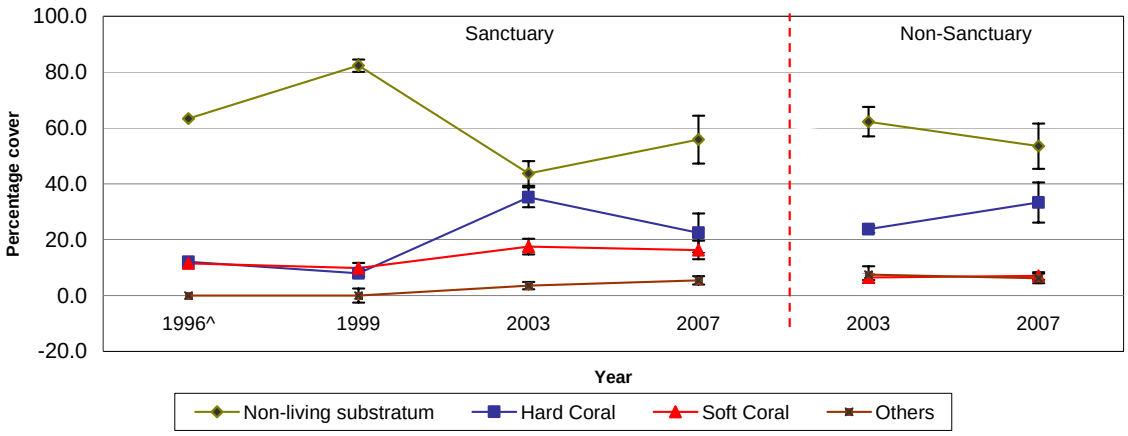

Figure 12. Changes in substrate (% mean ±SE) in Bolod Marine Sanctuary from 1996 to 2007 (7-8m depth).

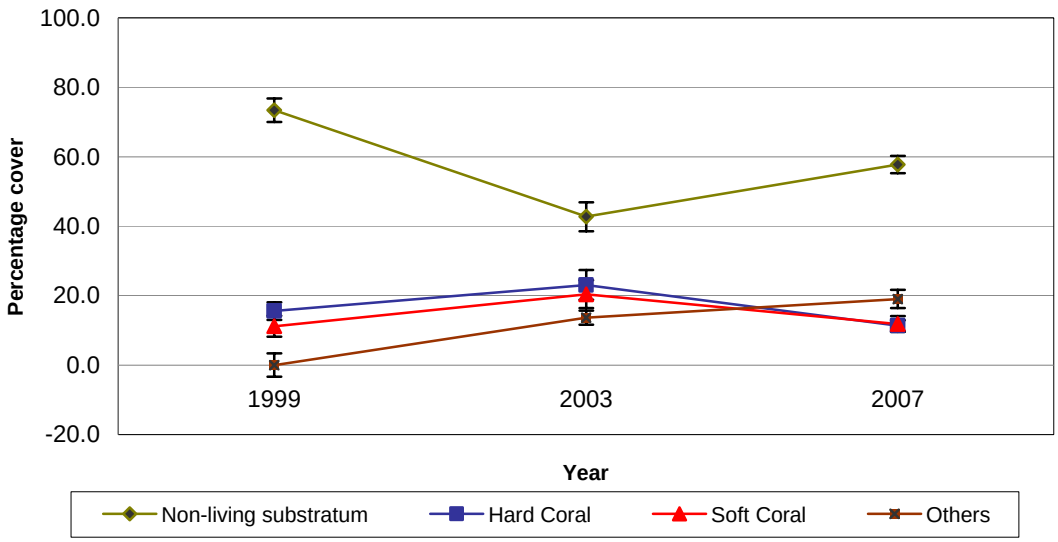

Figure 13. Changes in substrate (% mean ±SE) in Bolod Marine Sanctuary from 1996 to 2007 (3-4m depth).

Mean target fish abundance in Bolod MPA is among the lowest in this 2007 SPR survey (41.3 fish/500m$^{2)}$, and it is much lower than in the non-sanctuary (89.3 fish/500m^2; Figures 14 and 15, Tables 8 and 9). Pomacentrids and Anthids numerically dominate this area with occasional schools of Caesionids. In the non-sanctuary area, schools of Scarids and Kyphosids were recorded which were not observed inside the sanctuary area.

It appears that the fish stock inside the sanctuary has not improved after nine years since establishment. The density of target fish remains the same and it is not statistically significant between years (1-ANOVA: p = 0.87, F = 3.25, df = 111: only 1999-2007 was compared). The low fish density reflects poor enforcement of the MPA as well as the boundary of the sanctuary only encloses the shore side excluding the reef drop where the main concentration of fish is found and available for fishing (personal communication, BG and MAPODO members).

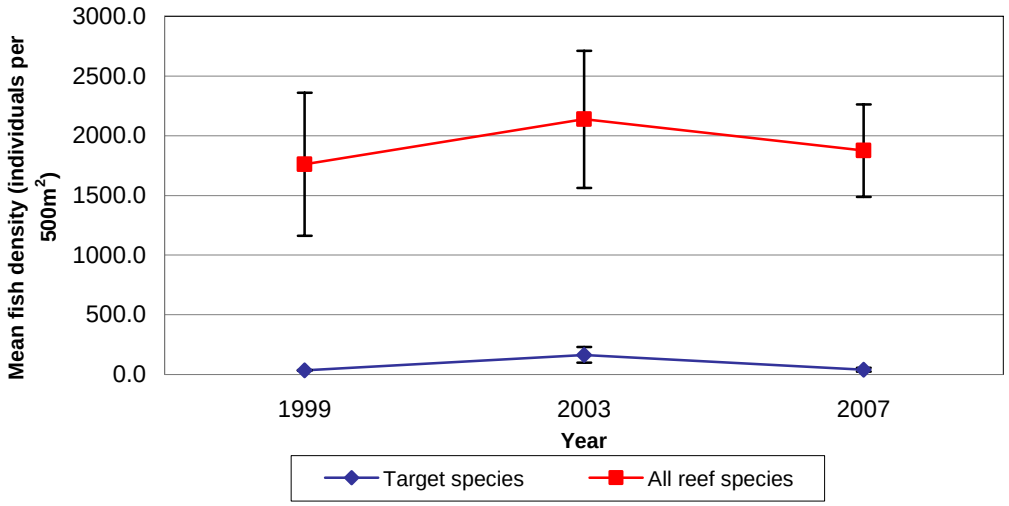

Figure 14. Mean (±SE) density (individuals/500m^2) at Bolod Marine Sanctuary, Panglao from 1999 to 2007.

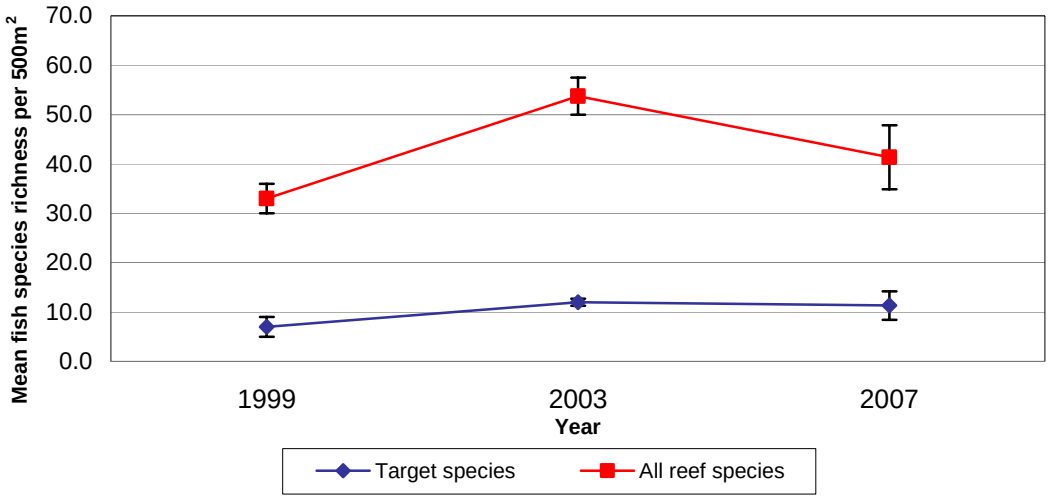

Figure 15. Mean (±SE) number of species/500m^2 at Bolod Marine Sanctuary, Panglao from 1999 to 2007.

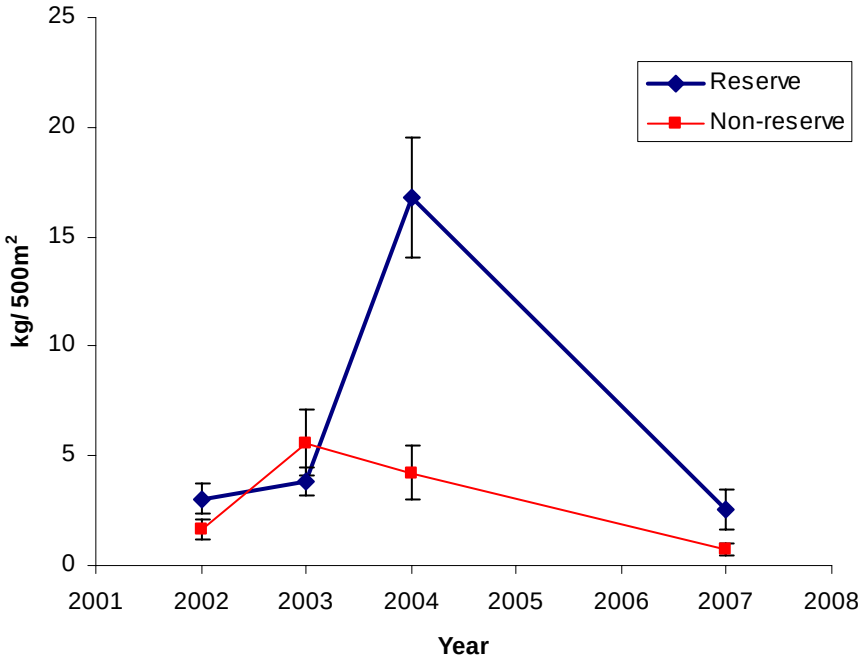

Figure 16. Mean Target Fish Biomass (kg/500m^2) in Bolod Marine Sanctuary from 2002 to 2007.

TAWALA MARINE SANCTUARY, Panglao

Site Description and Management. Tawala Marine Sanctuary was established in 1998 along with a new group of MPAs in Panglao. Tawala Marine Sanctuary is a 5.4-hectare MPA enclosing areas with seagrasses and algae and dense branching coral growth in shallow water. The reef crest begins at 5 to 7 meters with amazing old-growth hard corals. The Tawala

sanctuary reef extends down to wall-like features with some overhanging areas creating a dramatic reef.

Tawala Marine Sanctuary is located between Bolod and Danao beach resorts, with over 20 dive shops combined. It is managed by the Tawala Barangay Government. When surveyed in 2003, top management problems and issues identified were the need for additional information campaigns, the need for local capacity development, and the need to strengthen law enforcement (White, *et al*., 2003).

Management Perceptions. In this 2007 survey, results of the perception survey showed that the level of awareness on Tawala Marine Sanctuary is very high and there is strong community support. Tawala gets additional assistance from the Farmer's Association (a local people's organization) for local support, the Canadian Executive Service Organization (CESO) and WWF for MPA materials and maintenance.

The management rating of Tawala Marine Sanctuary has improved since the last survey and has achieved an "enforced phase" in implementation or level 3. Tawala sanctuary is well-guarded and enforcement support structures are maintained. A small monthly honorarium is provided for two guards on rotation duty to watch the sanctuary. Tawala Marine Sanctuary is one of the better enforced sanctuaries in Panglao. Management priorities include improved collaboration with the dive sector, complete elimination of fishing violations inside the sanctuary by *Badjaos* and others, and acquiring their own law enforcement equipment.

Trends in Coral Abundance and Reef Fish. The live hard coral cover in Tawala is good at 60.5% (7-8m depth) inside the MPA, but poor in the shallow with 11.3% (3-4m). This is because the shallow is dominated by coral rubble (16.3%) and dead coral with algae (13.3%). Branching corals make up most of the cover recorded (35.5%). In the adjacent fishing ground, live hard coral cover is slightly higher in the deep (71.3%) but also poor in the shallow (11.3%).

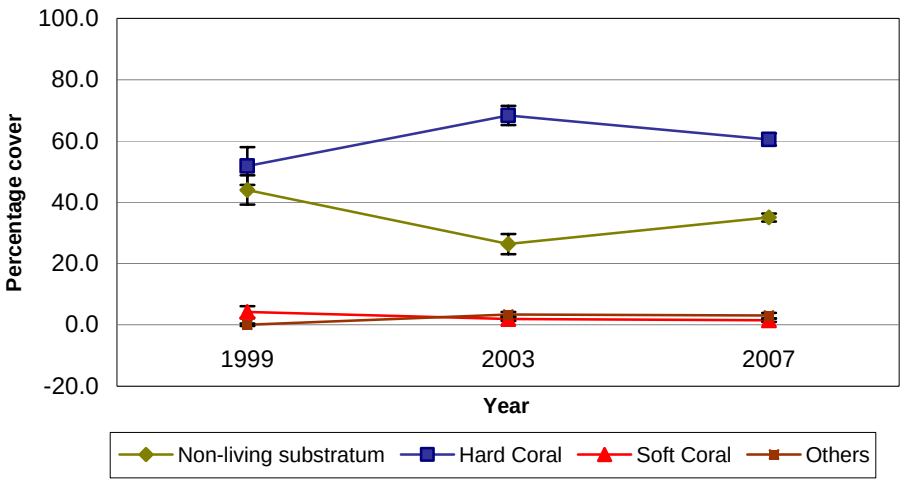

Figure 17. Changes in substrate (% mean ±SE) in Tawala Marine Sanctuary from 1999 to 2007 (7-8m depth).

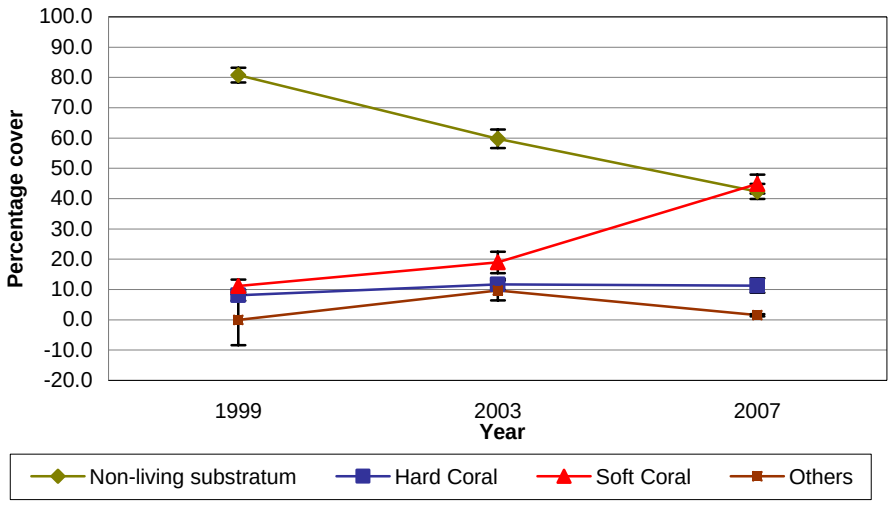

Figure 18. Changes in substrate (% mean ±SE) in Tawala Sanctuary from 1999 to 2007 (3-4m depth).

Fish biomass is highest in Tawala sanctuary with a total mean biomass of 60.07kg/500m^2 and target fish biomass of 43.83 kg/500m^2 (Figure 21). In contrast, fish abundance and species richness in Tawala is not as high as Balicasag MPA (Figure. 19 and 20, Table. 12 and 13). Jacks and rudderfishes make up most of the biomass while damsels and fairy basslets numerically dominate. The high target fish biomass in the area may reflect largely how the tight enforcement has benefited the area. However, these biomass values should be treated with caution since the computation was only based on two replicate transects.

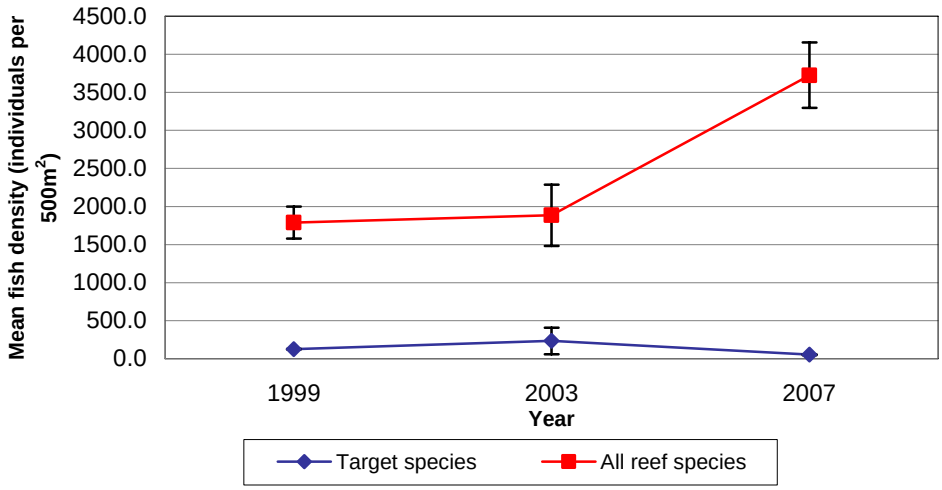

Figure 19. Mean (±SE) density (individuals/500m^2) at Tawala Marine Sanctuary, Panglao from 1999 to 2007.

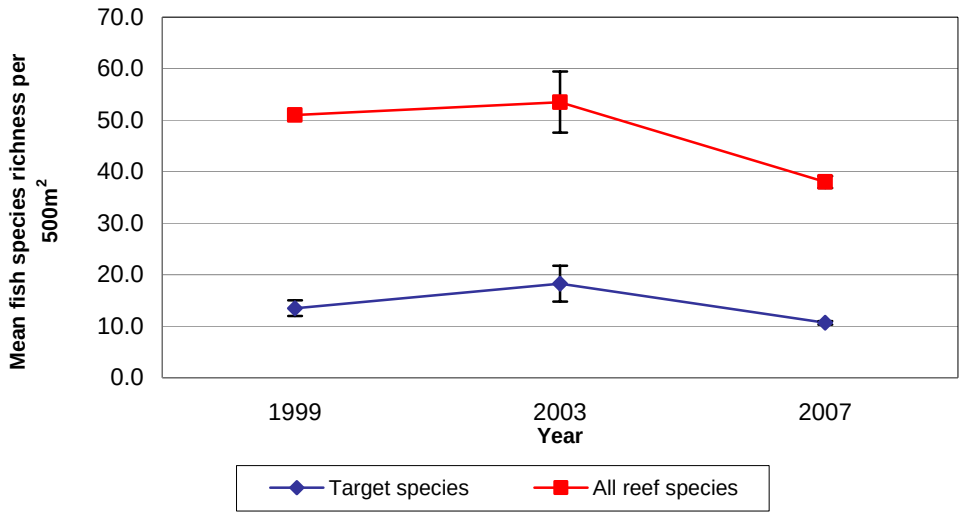

Figure 20. Mean (±SE) number of species/500m^2 at Tawala Marine Sanctuary, Panglao from 1999 to 2007.

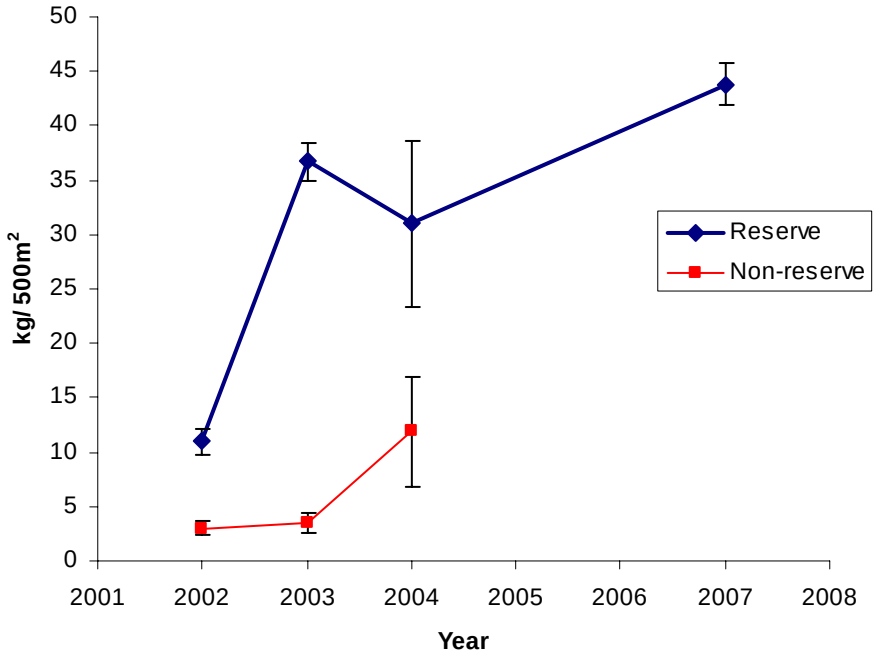

Figure 21. Mean Target Fish Biomass (kg/500m^2) in Tawala Marine Sanctuary from 2002 to 2007.

DOLJO MARINE SANCTUARY, Panglao

Site Description and Management. Doljo Marine Sanctuary is a 7.3-hectare MPA covering patches of corals interspersed with seagrasses in the shallow area. The reef crest is at about 7 to 9 meters deep with areas covered with delicate branching corals and large patches of *Padina* algae. The Doljo Marine Sanctuary reef extends down to wall-like features with a mix of branching and massive corals.

The surrounding waters of Doljo were first declared as a marine park with a 20-hectare sanctuary in 1986. This was amended in 1998 retaining only 7.7-hectare of sanctuary under protection. Doljo sanctuary has remained a part of Panglao's MPA network as stipulated in the 2005 Panglao MPA Ordinance. Doljo is a traditional fishing area with emerging tourism activities. When surveyed in 2003, Doljo sanctuary was managed by the Doljo Barangay Government and major management problems and issues identified were the sustainability of MPA protection activities and the maintenance of MPA enforcement structures (White, *et al*., 2003).

Management Perception. In this 2007 survey, the result of the perception survey shows that the level of awareness on Doljo Marine Sanctuary is very high and community support is relatively strong. However, the management rating of Doljo MPA did not improve since the last survey in 2003. It has maintained a level 2 rating which is the "established phase" in implementation. Doljo MPA is managed by Doljo-Panglao Fishermen's Association (DPFA - a local people's organization). DPFA gets additional support from the Doljo *Barangay* Government for management planning and field operations,a local youth group for guarding duties, and Feed the Children Foundation for training activities.

Members of the management body are not properly trained in MPA implementation. The DPFA expressed their need for further training in sanctuary management and enforcement. They feel they are not fully prepared for the implementation tasks required of them. In this case, assistance from the local government and/or external assistance providers could have been beneficial, but unfortunately is lacking. Among Doljo MPA's major problems are the lack of information dissemination campaigns, and unresolved conflicts between stakeholders due to absence of coordination.

Since, Doljo MPA is located directly in front of Ananyana Resort, an exclusive dive resort, and is also next to a public beach which receives about 300 tourists every weekend during summers,, the DPFA struggles in performing basic enforcement functions, like controlling the tourists and their activities in the area. During this SPR survey, the team observed approximately over 100 people swimming inside the sanctuary. Public beach goers chose to swim inside the MPA because the water fronting the public beach is densely covered with hard corals, while inside the sanctuary is a wide reef flat mostly of sand and rubble. Moreover, fishing violations still occur inside the sanctuary and there were deep-water fish traps seen during the dives which were tied to coral boulders inside the sanctuary.

Furthermore, according to the perception survey, DPFA and Ananyana Resort are in conflict. Although DPFA claimed that they are in good terms with Ananyana, Ananyana said otherwise. Ananyana complained of the lack of communication and coordination by DPFA and the local government with them. Ananyana cited that they were not informed when the marker buoys were installed in front of their resort. Ananyana also objects to inconsistencies in enforcement of the "no human activity policy" by DPFA. Ananyana divers are disallowed inside the sanctuary, but hundreds of swimmers are commonly seen inside. There is an urgent need for the municipal government and BMT-PADAYON to intervene and help DPFA address these existing problems.

Moreover, Ananyana recommends that the location of the sanctuary be reviewed because the habitat enclosed is mostly sandy flat with only a few patches of corals. The actual coordinates of the MPA boundaries show that the complete reef flat, crest and wall are within the protected area. However, the physical delineations indicated by marker buoys fall short of the richest part of the reef that really needs protection, which is over 7 meters in depth. Because of this, fishing and destructive tourist activities occur in the unbounded reef area. The management body

needs to reconsider the techniques they use to indicate boundaries to better enforce their sanctuary regulations.

Trends in Coral Abundance and Reef Fish. Live hard coral percent cover in Doljo is fair at 31.3 – 38.4% in all stations (3-4m depth) inside the MPA for 2007. In the deeper portion, there has been a steep decrease in live hard coral cover after the MPA's establishment from 51% in 1996 to 38.6% in 1999, but no raw data is available for statistical testing. This decline may have been partly due to the severe bleaching episode caused by El Nino in 1998. Further, no significant differences were found between 1999 to 2007 (1-ANOVA, p = 0.123, F = 2.29, df = 260).

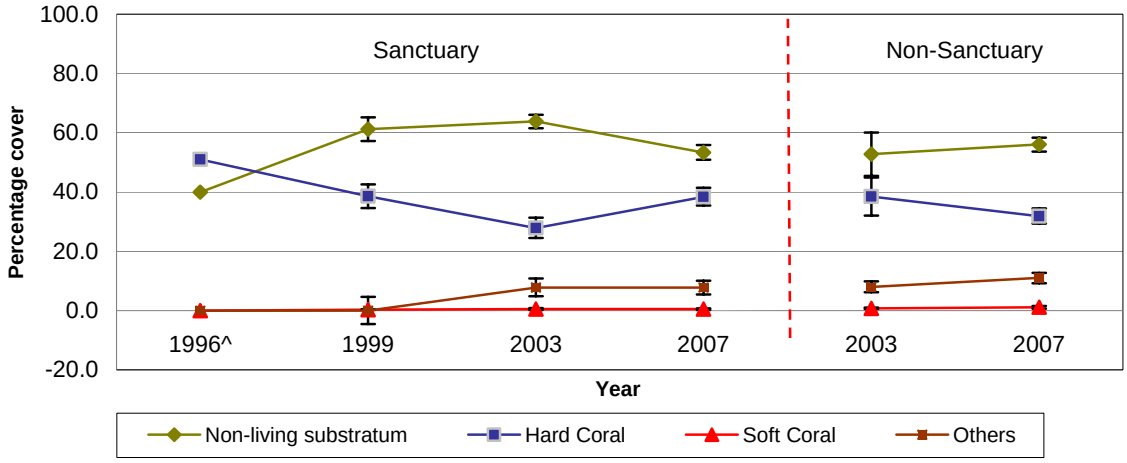

Figure 22. Changes in substrate (% mean ±SE) in Doljo Marine Sanctuary from 1996 to 2007 (7-8m depth).

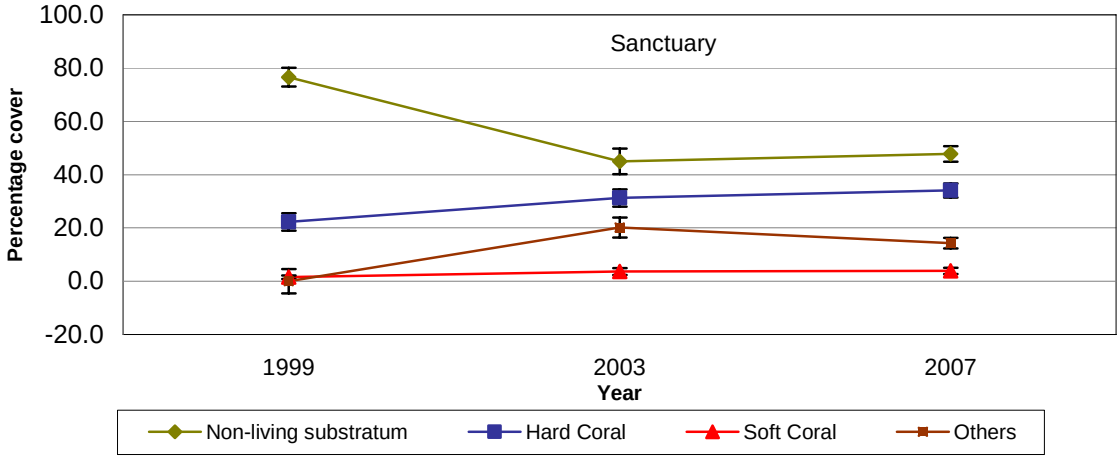

Figure 23. Changes in substrate (% mean ±SE) in Doljo Marine Sanctuary from 1999 to 2007 (3-4m depth).

Fish abundance inside the MPA is low but is still slightly higher than Bolod Marine Sanctuary. Target species density did not change from 1999 to 2007, yet decreased significantly in the non-sanctuary area from 2003 (276.3 fish/500m^2) to 2007 (247.3 fish/500m^2) by 10 percent (p = 0.048, t-value = 3.25, df = 3). Numerically, the fish make up most of the target fishes (Figure. 22

and 23). The low fish abundance and biomass (target fish mean biomass was recorded at 0.99 kg/500m^2) in this MPA may be a reflection of poor MPA management. (Figure. 24)

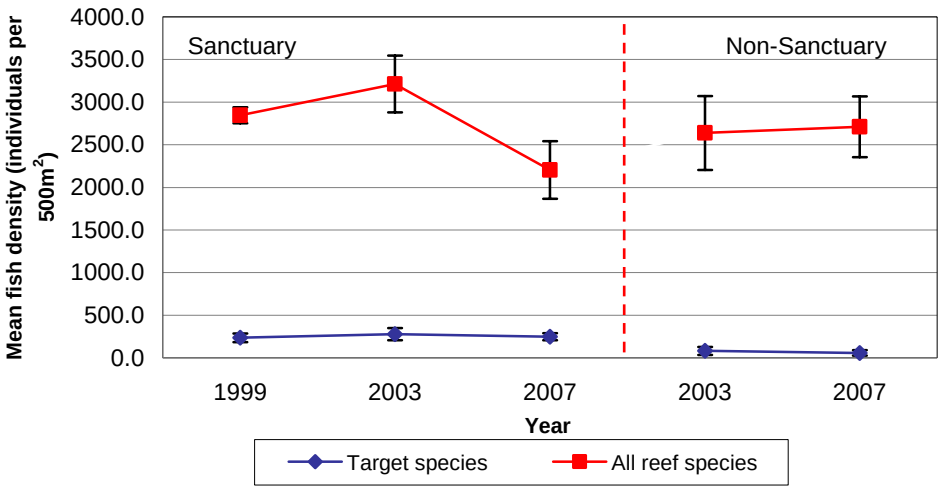

Figure 24. Mean (±SE) density (individuals/500m^2) at Doljo Marine Sanctuary, Panglao from 1999 to 2007.

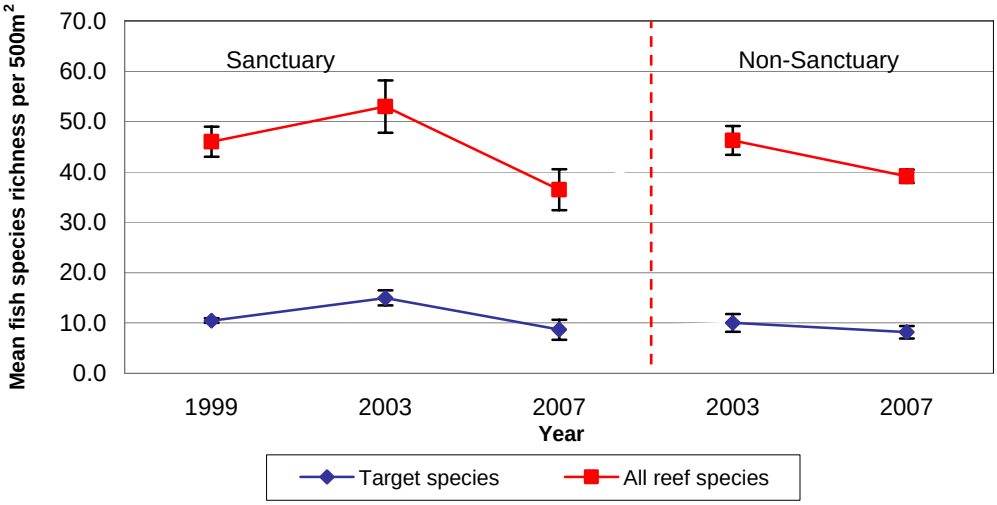

Figure 25. Mean (±SE) number of species/500m^2 at Doljo Marine Sanctuary, Panglao from 1999 to 2007.

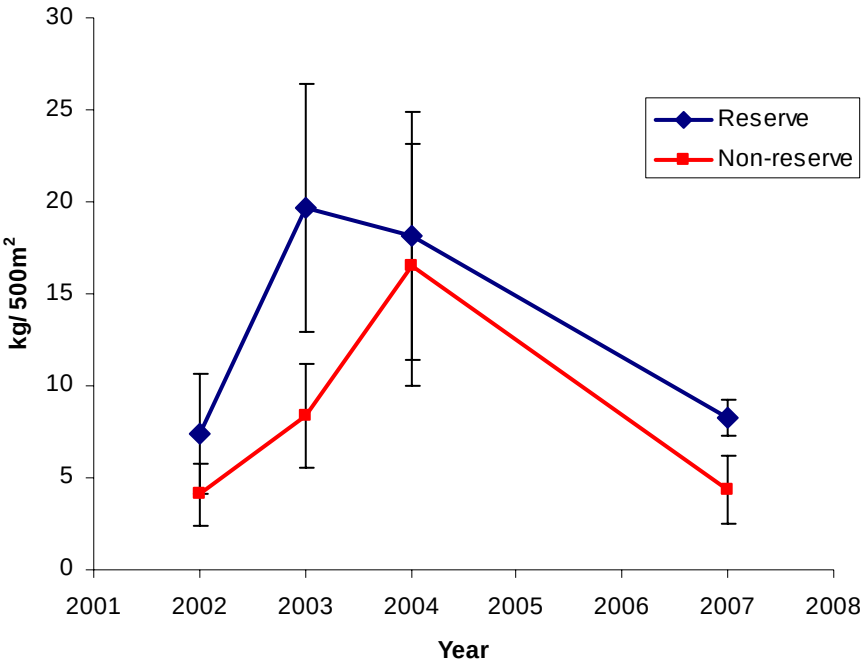

Figure 26. Mean Target Fish Biomass (kg/500m^2) in Doljo Marine Sanctuary from 2002 to 2007.

BIL-ISAN MARINE SANCTUARY, Panglao

Site Description and Management. Bil-isan Marine Sanctuary was established in 1998 in Panglao. Bil-isan MPA is an 8.2-hectare MPA containing patches of corals interspersed with seagrasses in shallow water. The reef crest begins at 7 to 9 meters with large patches of *Padina* algae and delicate branching corals. The Bil-isan reef extends down to wall-like features with branching and massive corals.

Previously in 2003, Bil-isan MPA was managed by the Bil-isan *Barangay* Government but was not properly enforced. There were no indications that a sanctuary existed there because there were no boundary markers or signage to indicate to the public that the area was protected. Fish counts, at the time, showed a decreasing trend. The management problems/issues identified were the need for assistance to revive management, the need to create a management plan, and the need to conduct an education program to obtain interest and support (White, *et al*., 2003).

Management Perception. In this 2007 survey, results of the perception survey show that the level of awareness about Bil-isan Marine Sanctuary is very high and community support is positive and active. Bil-isan MPA is currently managed by the Bil-isan Fishermen Association (BIFA). BIFA gets additional assistance from WWF for sanctuary materials and maintenance.

The management rating of Bil-isan MPA has shown a remarkable improvement since the last survey by an increase in two levels, achieving an “enforced phase” in implementation or level 3. Officers and members of Bil-isan MPA are motivated and active and the enforcement system is now operational and in effect. Fishing violations have been minimized. Currently, the Bil-isan MPA is among the better-managed sanctuaries in Panglao.

Interestingly, when Bil-isan sanctuary officers were asked what they needed to help them in management, they said they need kitchen materials for the guardhouse for use during daily duties and activities. They also expressed the need for enforcement support equipments such as flashlights, binoculars, megaphones, snorkels, etc. They also asked for a copy of underwater video footage and photos for the purpose of conducting information dissemination activities for their community. They're also hopeful in getting honorarium for their effort from the local government. They have requested for a typewriter so that the women and youth can learn to type as an additional skill. These requests and planned activities all indicate their initiative and dedication in implementing the Bil-isan Marine Sanctuary.

Trends in Coral Abundance and Reef Fish. Live hard coral cover in the deep area of Bil-isan sanctuary and the adjacent fishing ground is fair at 32.7% and 21.1% respectively. An increasing trend is shown from 1999 to 2007 with and accompanying decrease in the non-living substrate, especially sand and silt and coral rubble. These patterns suggest coral growth (Figures 27 and 28, Table 18). In the shallow, the substrate is dominantly sand and silt, rock and block, and fleshy macroalgae, thus, live hard coral cover is poor.

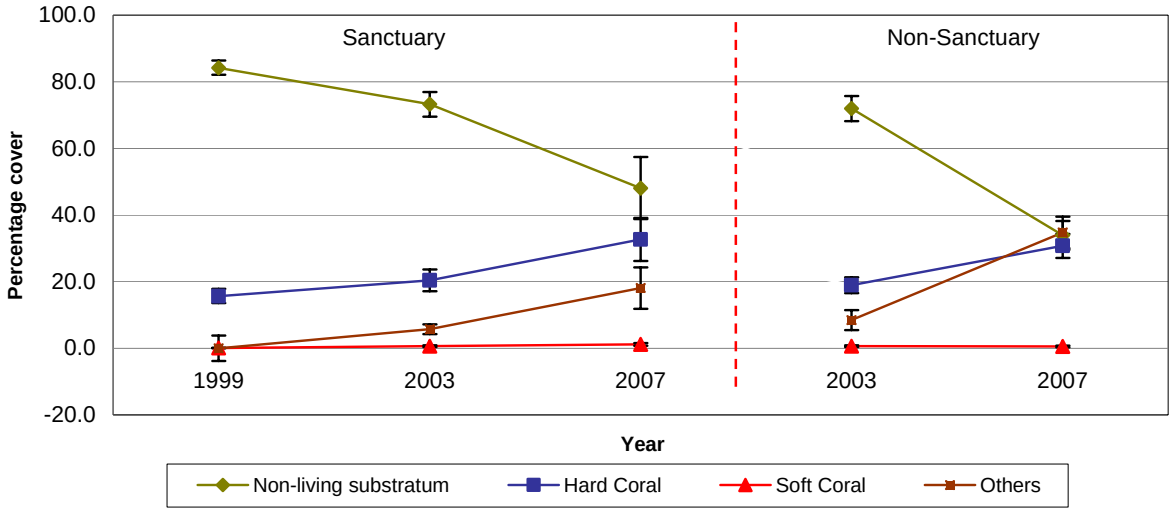

Figure 27. Changes in substrate (% mean ±SE) in Bilisan Marine Sanctuary from 1999 to 2007 (7-8m depth).

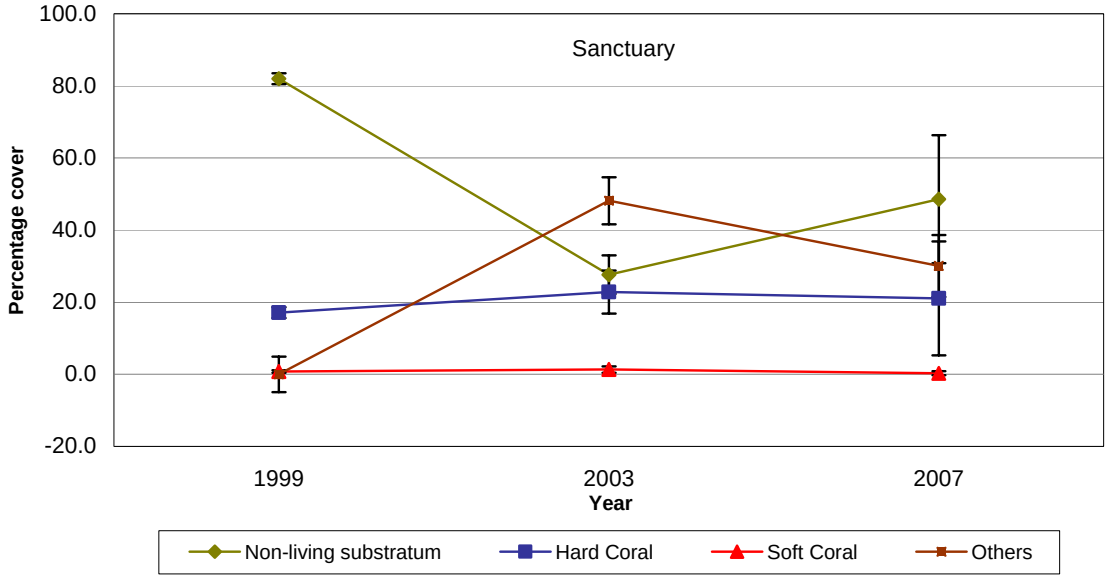

Figure 28. Changes in substrate (% mean ±SE) in Bilisan Marine Sanctuary from 1999 to 2007 (3-4m depth).

Fish densities in the sanctuary for all reef and target species have decreased. In 1999 fish mean total target biomass (93.5 fish/500m^2) was significantly higher (1-ANOVA: p = 0.031, F = 4.85, df = 2) than the succeeding years (Tukey's Test: 1999>2003=2007: Figure. 29, 30 and 31). A noteworthy decrease in the fish families of Acanthuridae, Siganidae, Mullidae and Scaridae was observed. A similar decreasing pattern is observed in the adjacent fishing ground. In contrast, the Caesionids appeared to increase over the years (Tables 20 and 21).

More importantly, even with the documented decrease in mean target fish densities, the mean target fish biomass inside the sanctuary increased overtime from 3 to 20kg/500m2. This indicates larger sizes of the present target fish populations compared to previous years and suggests protection. However, by 2007, a slight decrease in piscivores is observed which is reflected in the overall target biomass decrease (18 kg/500m^2) (Figure 31).

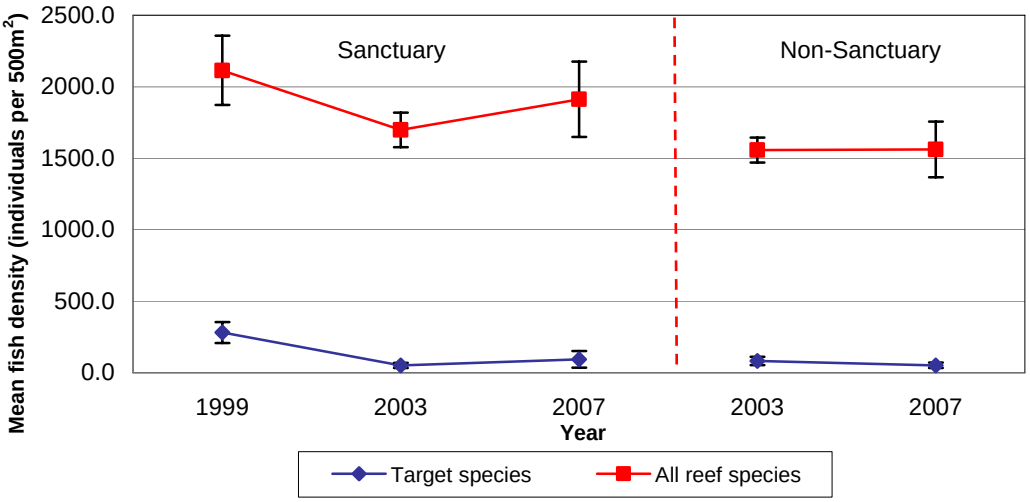

Figure 29. Mean (±SE) density (individuals/500m^2) at Bilisan Marine Sanctuary, Panglao from 1999 to 2007.

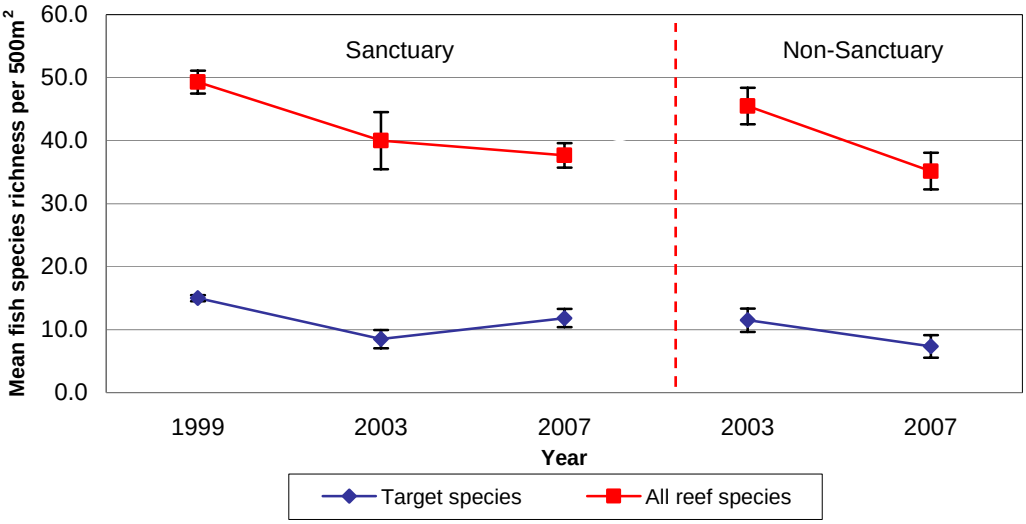

Figure 30. Mean (±SE) number of species/500m^2 at Bilisan Marine Sanctuary, Panglao from 1999 to 2007.

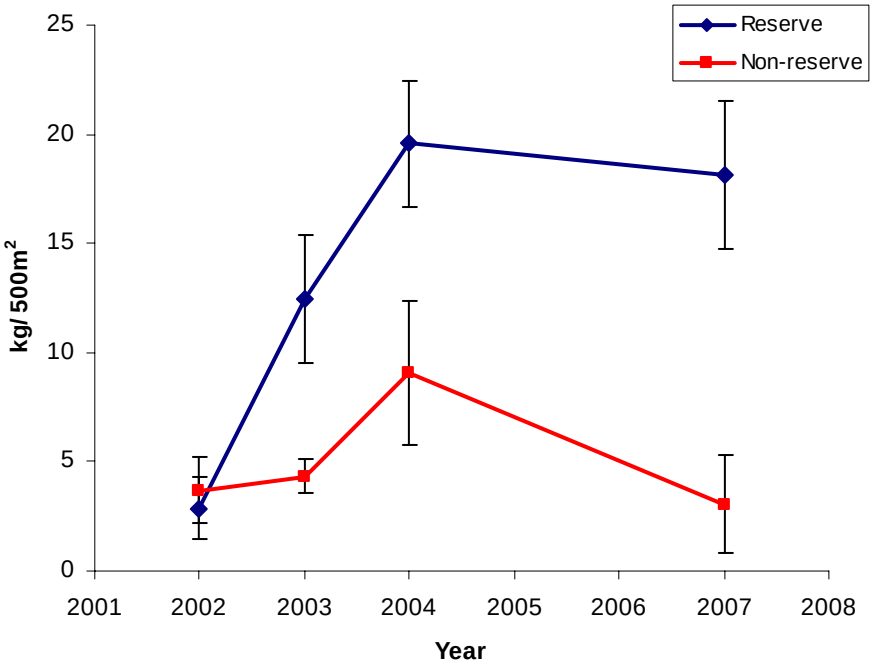

Figure 31. Mean Target Fish Biomass (kg/500m^2) in Bil-isan Marine Sanctuary from 2002 to 2007.

DAUIS

SAN ISIDRO-DAU MARINE SANCTUARY, Dauis

Site Description and Management. Dao-San Isidro Marine Sanctuary was established in 2002, the youngest among sites surveyed, and the largest in Dauis with a size of 11.1 hectares. The area encloses patches of corals and large areas of sand in shallow water. The reef crest

starts at about 5 meters depth with intact branching and massive coral formations. The San Isidro-Dau sanctuary reef extends down to mostly wall-like features with nice branching corals. This sanctuary is seated between the *barangays* of Dau and San Isidro and is under their joint jurisdiction.

The baseline assessment of San Isidro-Dau MPA was taken during the 2003 survey. This site showed the lowest fish density among all the sites surveyed. Management concerns at that time were the need for stricter enforcement, formation of a management group, and creation of a long-term management plan (White, *et al*., 2003).

Management Perceptions. In the 2007 survey, results of the perception survey show that the level of awareness of the San Isidro-Dau MPA is very high and community support is positive. The management of San Isidro-Dau Marine Sanctuary is headed by the *barangay* captains of Dau and San Isidro with members from San Isidro Fisherfolk Organization (SIFO) and the Dau Farmers and Fishermen's Association (DFFA).

The San Isidro-Dau MPA gets additional assistance from First Consolidated Bank, Inc. (FCB) for trainings, Life Foundation and Philippine Australian Community Assistance Program (PACAP) for sanctuary materials and equipment.

The management rating of San Isidro-Dau MPA has improved since the last survey by a level higher, attaining an "established phase" in implementation or level 2. The identified top management problems and issues are the need for a more open and better working arrangement between *barangays* Dau and San Isidro, the need to address the prevalent fishing inside the sanctuary (particularly by *Badjaos*), and continuing illegal foreshore development.

Trends in Coral Abundance and Reef Fish. Live hard coral cover in the San Isidro-Dau sanctuary deep areas increased significantly ($p = 0.022$, t-value = 2.77, df = 9) from 2003 (52.8%) to 2007 (64.5%), classified as good (Figures 33 and 34; Table. 22). In the shallow, live hard coral cover decreased by 52%, while rock and block cover increased by 260%. This pattern may indicate live hard coral death wherein approximately 50% of the branching and massive coral were impacted (Figures 32 and 33).

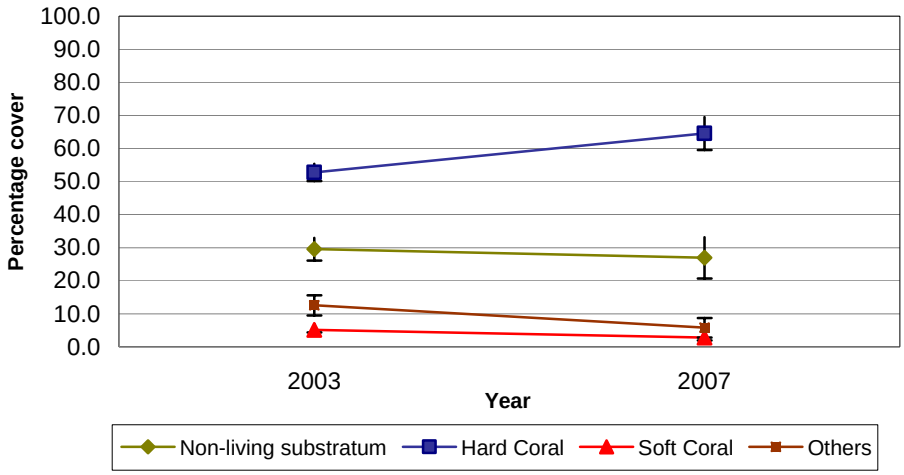

Figure 32. Changes in substrate (% mean ±SE) in San Isidro-Dau Marine Sanctuary from 2003 to 2007 (7-8m depth).

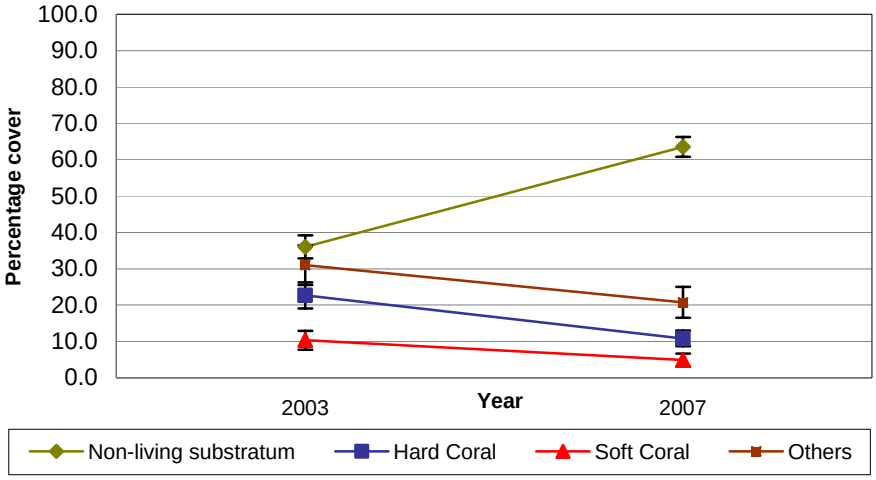

Figure 33. Changes in substrate (% mean ±SE) in San Isidro-Dau Marine Sanctuary from 2003 to 2007 (3-4m depth).

Target fish density is low, but appears to be increasing in both the sanctuary and the adjacent fishing ground (Figures 34 and 35; Tables 24 and 25). Within the site, the density for target fish is not significantly different ($p = 0.55$, $F = 2.49$, $df = 5$) between the two years of surveys. However, it is important to note that the observed non-significant increase is marginal. Among the numerically dominant fish are damsels and anthids; a school of fusiliers was also recorded (35 fish/500m^2). Fish biomass is also lower (17.52 ± 17 kg/500m^2) compared to Tawala, Balicasag and Bil-isan sites but higher than the rest (Figures 36 and 49).

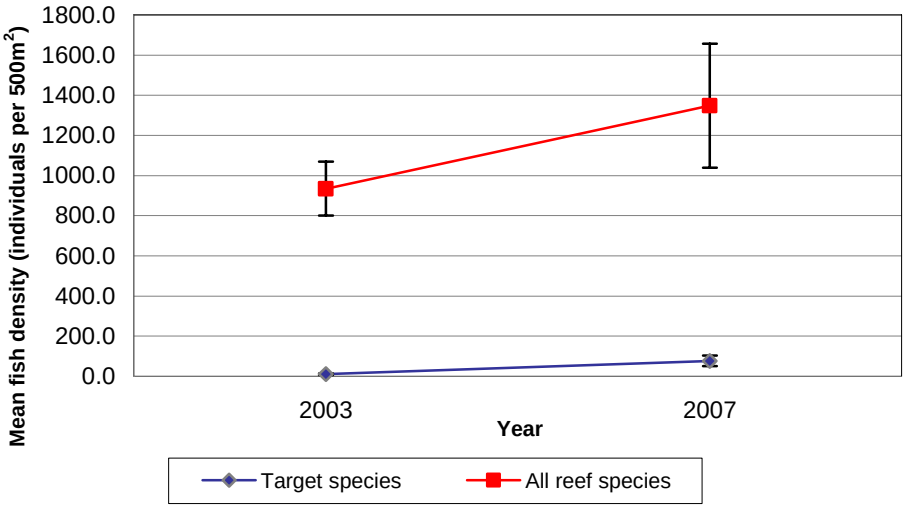

Figure 34. Mean (±SE) density (individuals/500m^2) at San Isidro-Dau Marine Sanctuary, Dauis from 2003 to 2007.

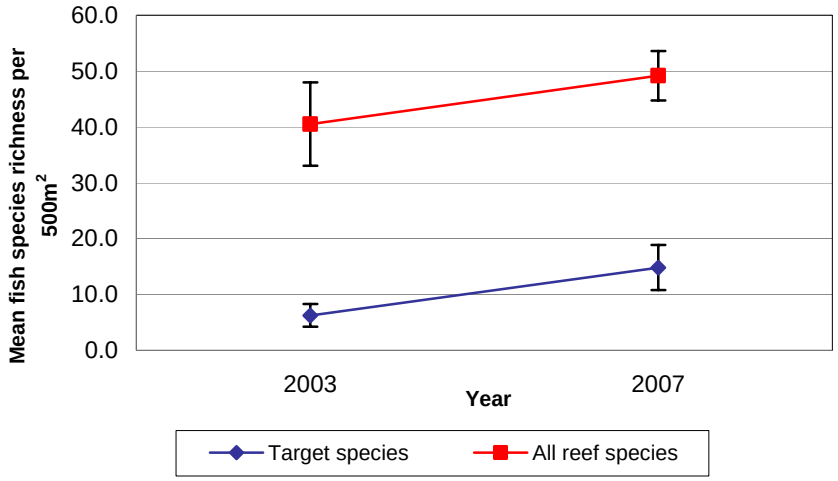

Figure 35. Mean (±SE) number of species/500m^2 at San Isidro-Dau Marine Sanctuary, Dauis from 2003 to 2007.

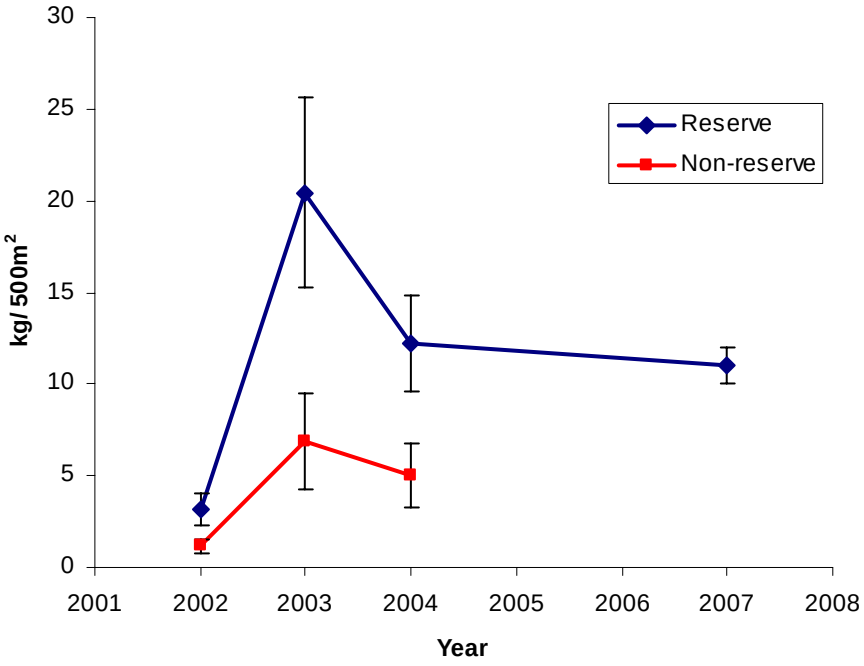

Figure 36. Mean Target Fish Biomass (kg/500m^2) in San Isidro-Dau Marine Sanctuary from 2002 to 2007.

BACLAYON

PAMILACAN ISLAND MARINE SANCTUARY, Baclayon

Site Description and Management. Similar with Balicasag, Pamilacan was surveyed by Silliman University in 1985 and survey results led to the declaration of the entire coral reef area surrounding Pamilacan Island a Marine Reserve with an 11.9 hectare Fish Sanctuary (White, et al., 2003). Pamilacan Island Fish Sanctuary encloses a rock and block area with an abundance

of giant clam species in the shallow area (3-4 m depth). The reef crest begins at about 5 meters depth and the slope extends down with dominantly rock and block features with small overhangs and ravine-like areas. The Pamilacan Fishermen's Association (PFA-an island people's organization) is commendable for their unwavering effort to enforce the law since its establishment. In the 2003 survey, the Pamilacan Island Fish Sanctuary obtained the highest management rating among the sites surveyed. It achieved a level 4 which is a "sustained phase". The management problems and issues identified during that time were the creation of a long-term management plan, capacity building activities for locals, and providing alternative livelihood options for the community.

Management Perceptions. The 2007 perception survey shows that the level of awareness about the fish sanctuary is very high and community support is positive. The Pamilacan Island Fish Sanctuary receives additional assistance from the Environmental Legal Assistance Center (ELAC), Department of Environment and Natural Resources (DENR) and Department of Tourism (DOT) for technical assistance.

Management efforts of the people's organization are consistent and have maintained a rating of level 4 on the management rating system. Priority management problems identified were internal politics within PFA, difficulty in implementation of the user-fee system, and the need for a guardhouse.

Trends in Coral Abundance and Reef Fish. Live hard coral inside Pamilacan Island Fish Sanctuary deep zone is fair (31.65%), and shows an increasing trend from 1984 to 2007. In contrast, a decreasing trend is displayed in the adjacent fishing ground that has poor cover all throughout 1984 to 2007 (2.9 – 11%). The shallow area is dominated by sand and silt and coral rubble (Figures 37 and 38; Table 26) and appears to be the long-term status quo.

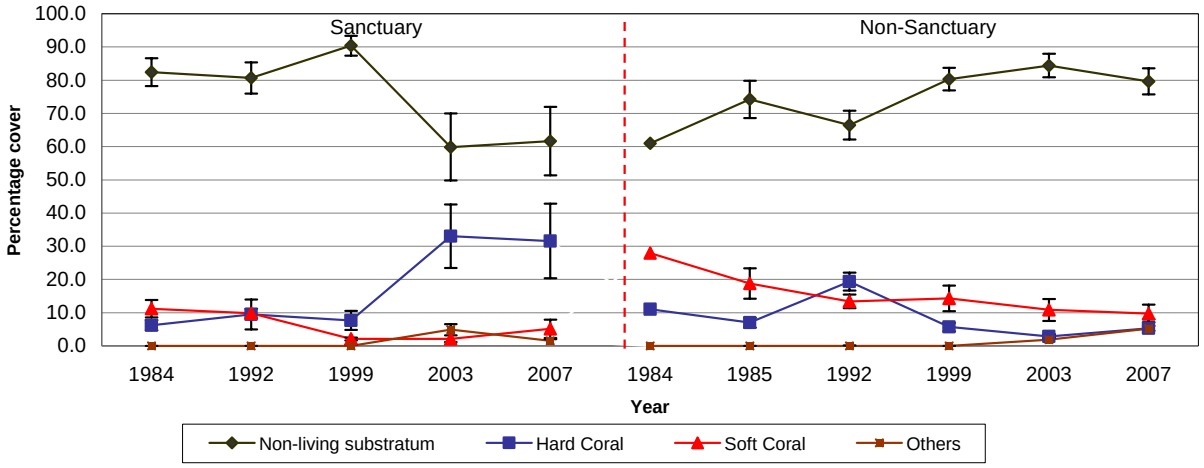

Figure 37. Changes in substrate (% mean ±SE) in Pamilacan Marine Sanctuary from 1984 to 2007 (7-8m depth).

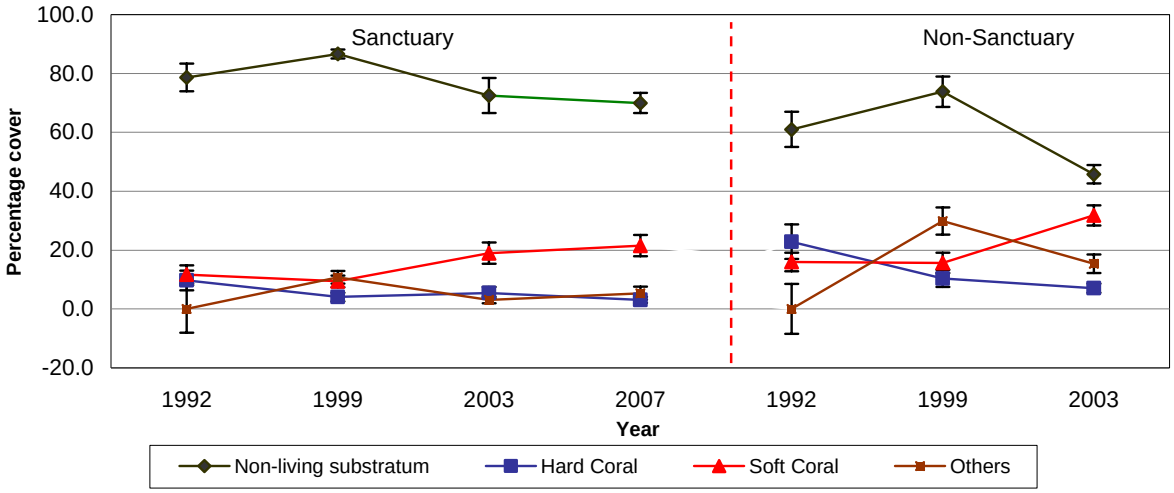

Figure 38. Changes in substrate (% mean ±SE) in Pamilacan Marine Sanctuary from 1999 to 2007 (3-4m depth).

Fish densities for both all reef and target species inside and outside Pamilacan Island sanctuary decreased from 1986 to 2007 by approximately 40% (Figures 39 and 40; Tables 28 and 29). Surgeonfishes, parrotfishes, fusiliers, snappers and goatfish densities all decreased. Aquarium target fishes such as butterflyfishes and angelfishes also decreased. It is important to note that target fish biomass in Pamilacan Island sanctuary is lower (7.9 kg/500m^2, Figure 41) compared to Balicasag Island Marine Sanctuary (target fish biomass: 34.177.9 kg/500m^2) while both MPAs are have same age. A steep decline in target fish biomass from 2003 (48 kg/500m^2) to 2007 (7.9 kg/500m^2 Figure. 41) strongly contrasts with the reported and perceived levels of MPA enforcement. This decline suggests that some major fishing has occurred inside the sanctuary but this needs to be verified.

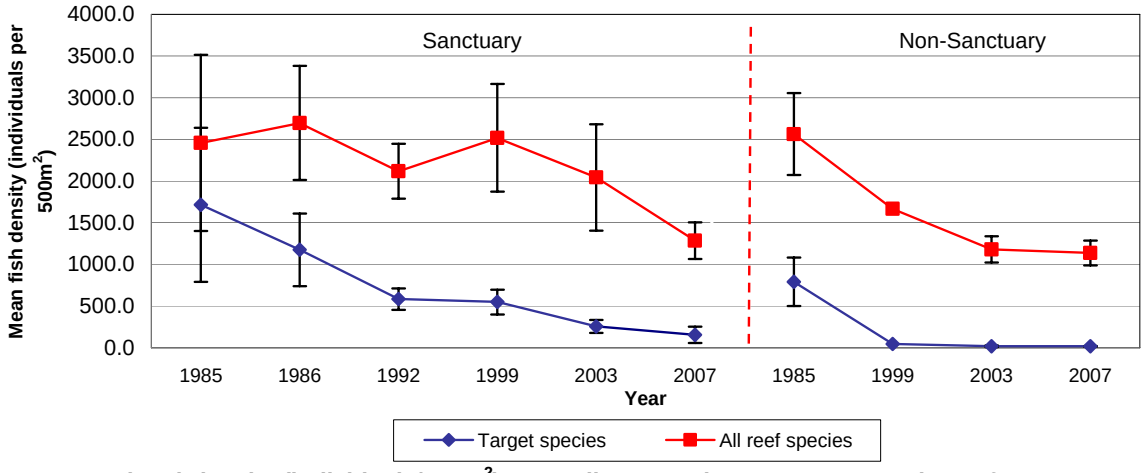

Figure 39. Mean (±SE) density (individuals/500m^2) at Pamilacan Marine Sanctuary, Baclayon from 1986 to 2007.

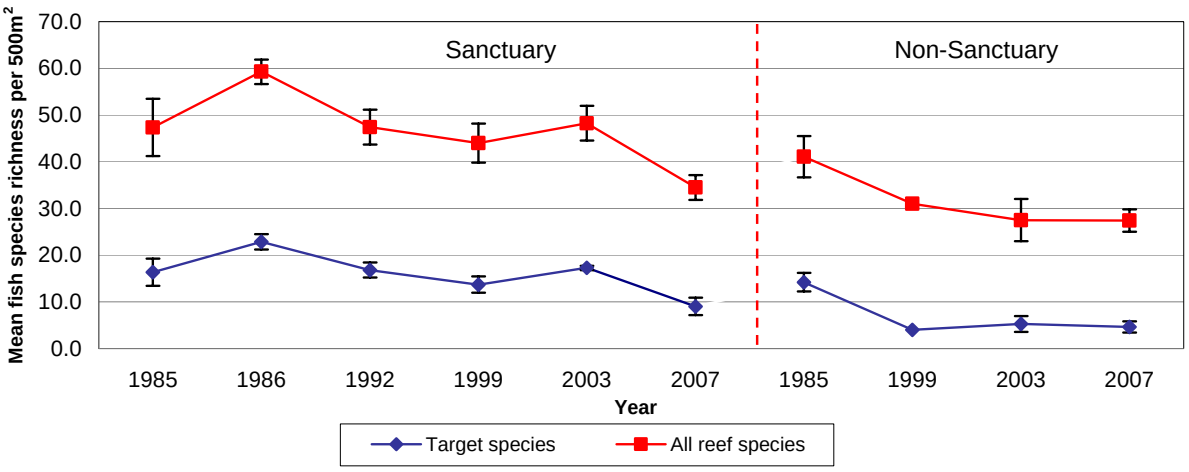

Figure 40. Mean (±SE) number of species/500m^2 at Pamilacan Marine Sanctuary, Dauis from 1985 to 2007.

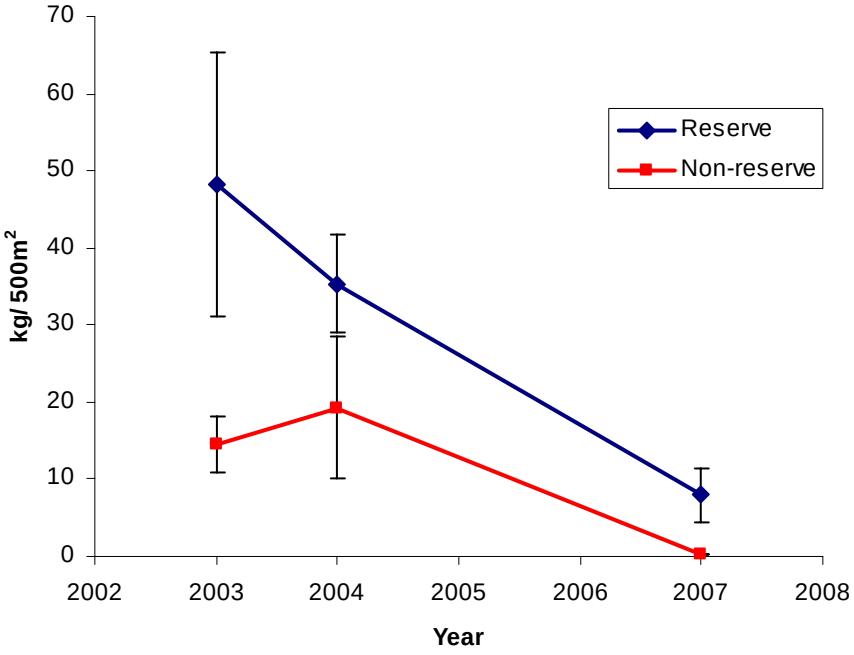

Figure 41. Mean Target Fish Biomass (kg/500m^2) in Pamilacan Marine Sanctuary from 2003 to 2007.

Table 1. Changes in substrate composition (% mean ±SE) in Balicasag Marine Sanctuary, Panglao from 1984 to 2007.

TYPE OF SUBSTRATUM		Sanctuary											Non-Sanctuary										
		SCUBA						SNORKEL					SCUBA								SNORKEL			
	1983	1984	1992	1999	2003	2007	% Change 2003-2007	1992	1999	2003	2007	% Change 2003-2007	1983	1984	1985	1992	1999	2003	2007	% Change 2003-2007	1992	1999	2003	% Change 2003-2007
Non-living:																								
Sand and silt	2.95	~	10.5	1.6	0.6	0.8	36.4	15.7	6.3	3.9	12.1	207.9	14.1	~	56.0	8.2	20.0	5.6	13.4	138.8	4.8	20.0	14.3	-28.7
Coral rubble	35	~	9.9	13.1	3.2	4.8	47.4	12.0	13.7	11.8	10.8	-8.4	14.2	~	10.3	40.6	15.8	12.0	15.6	29.9	45.7	16.9	7.0	-58.7
Rock and block	25.3	~	32.5	12.9	6.6	4.1	-37.7	22.3	32.7	26.9	27.5	2.4	24.8	~	3.3	12.6	13.4	8.5	11.0	29.9	9.8	23.5	23.6	0.3
White dead standing coral	14.2	~	4.3	3.8	0.2	0.1	-62.5	5.3	3.5	1.3	1.8	37.1	4.7	~	1.8	6.4	1.3	0.2	0.4	150.0	8.8	2.5	0.6	-77.5
Dead coral with algae	0	~	~	14.0	13.2	4.9	-62.7	0.0	15.1	8.0	2.7	-66.6	0.0	~	0.0	~	11.0	6.4	9.5	49.6	0.0	10.9	5.1	-52.9
SUBTOTAL non-living	**77.4**	**67.0**	**57.2**	**45.4**	**23.8**	**14.7**	**-38.3**	**55.3**	**71.3**	**52.0**	**54.9**	**5.7**	**57.6**	**81.0**	**71.3**	**67.8**	**61.5**	**32.6**	**49.9**	**53.0**	**69.1**	**73.8**	**50.5**	**-31.6**
Living:																								
Hard coral:																								
Branching	7.6	~	~	20.4	11.0	15.0	36.4	16.8	~	7.1	9.8	37.6	12.9	~	10.6	~	17.0	16.0	12.5	-21.7	7.1	~	8.5	N/A
Massive	1.5	~	~	2.5	4.0	2.4	-39.6	6.4	~	9.1	7.1	-22.1	4.9	~	2.8	~	4.3	2.7	5.5	107.5	9.8	~	8.4	N/A
Flat/Encrusting	4.2	~	~	5.5	10.3	16.2	57.3	3.4	~	0.2	1.4	471.6	4.6	~	2.6	~	2.6	8.1	8.4	3.1	4.0	~	1.7	N/A
Foliose/Cup	3.55	~	~	17.9	9.3	14.3	53.6	3.5	~	2.4	1.3	-45.3	3.2	~	1.6	~	5.5	4.6	3.4	-26.6	4.3	~	0.6	N/A
Subtotal hard coral	**16.9**	**21.0**	**30.5**	**46.3**	**34.6**	**47.9**	**38.4**	**30.1**	**24.1**	**18.8**	**19.5**	**4.0**	**25.5**	**18.0**	**17.6**	**20.4**	**29.4**	**31.3**	**29.8**	**-5.1**	**25.1**	**20.3**	**19.3**	**-4.7**
Soft coral	5.75	12.0	12.3	8.2	25.0	22.1	-11.7	14.6	4.4	8.0	4.9	-37.9	16.9	1.0	11.2	11.6	9.0	21.0	12.1	-42.4	5.9	6.0	9.8	63.1
SUBTOTAL corals	**22.6**	**33.0**	**42.8**	**54.5**	**59.6**	**70.0**	**17.4**	**44.7**	**28.5**	**26.7**	**24.5**	**-8.5**	**42.4**	**19.0**	**28.7**	**32.0**	**38.4**	**52.4**	**41.9**	**-20.1**	**31.0**	**26.3**	**29.1**	**10.8**
Others:																								
Other animals	~	~	~	~	0.3	1.3	275.0	~	~	0.0	0.7	+	~	~	~	~	~	0.1	0.4	650.0	~	~	0.0	N/A
Seagrasses	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	2.5∞	0.0	0.1	+	0.0	0.0	0.0	0.0	3.8∞	0.0	0.0	N/A	0.0	8.3	0.1	-99.1
Algae																								
Fleshy	~	~	~	~	3.8	7.3	91.3	~	~	17.2	17.6	2.6	~	~	~	~	~	5.7	4.6	-19.2	~	~	16.5	N/A
Turf	~	~	~	~	0.5	0.7	33.3	~	~	0.8	1.2	52.6	~	~	~	~	~	0.4	1.0	185.7	~	~	0.4	N/A
Coralline	~	~	~	~	8.8	4.5	-48.7	~	~	2.6	1.0	-60.1	~	~	~	~	~	5.3	1.5	-71.8	~	~	1.6	N/A
Sponges	~	~	~	~	3.2	1.6	-50.0	~	~	0.8	0.1	-92.3	~	~	~	~	~	3.6	0.8	-79.1	~	~	1.8	N/A
SUBTOTAL others	**0.0**	**0.0**	**0.0**	**0.0**	**16.6**	**15.3**	**-7.7**	**0.0**	**0.0**	**21.3**	**20.6**	**-3.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**15.0**	**8.3**	**-45.1**	**0.0**	**8.3**	**20.4**	**145.5**
GRAND TOTAL	**100**	**100**	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**	**100**	**100**	**100**		**100**	**100**	**100**	
Other relevant information																								
Slope (degrees)	~	~	~	44.6	67.5	72.5		~	5.7	8.5	14.0		~	~	~	~	34.7	78.8	58.3		~	3.0	30.0	
Topography* (m)	1	1.0	2.9	4.7	2.3	3.3		1.0	1.4	0.5	1.0		1.6	1.2	1.2	0.6	2.6	2.2	1.7		1.8	1.4	1.5	
Depth range/average (m)	11	5.6	8.0	6.4	7.3	7.1		2.0	2.8	2.5	2.2		~	10.0	10.0	5.5	6.8	7.5	6.4		3.7	2.7	2.2	
Visibility (m)	~	~	24.0	24.0	18.4	16.6		~	21.6	18.0	19.1		~	~	22.5	20.0	22.7	17.0	15.3		20.0	20.8	17.0	
Sample size (Transects)	2	2	15	11	9	6		9	27	11	11		2	2	2	7	25	10	4		4	26	13	

* Mean distance between lowest and highest point on the horizontal transect line
∞ Data not included in grand total
~ No data

Table 2. Incidence of butterflyfish species in sites surveyed in 1999, 2003 and 2007.

Butterflyfish species	Common Name	BOHOL											
		Bolod Marine Sanctuary			Tawala Marine Sanctuary			Bil-isan Marine Sanctuary			Doljo Marine Sanctuary		
		1999	2003	2007	1999	2003	2007	1999	2003	2007	1999	2003	2007
Chaetodon adiergastos	Philippine butterflyfish	♣	♣	♣				♣			♣		
Chaetodon auriga	Threadfin butterflyfish		♣		♣	♣	♣					♣	
Chaetodon baronessa	Eastern triangular butterflyfish		♣	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon bennetti	Bluelashed butterflyfish												
Chaetodon citrinellus	Speckled butterflyfish												
Chaetodon ephippium	Saddle butterflyfish						♣					♣	
Chaetodon kleinii	Klein's butterflyfish		♣	♣	♣	♣	♣		♣		♣	♣	♣
Chaetodon lineolatus	Lined butterflyfish				♣		♣				♣		♣
Chaetodon lunula	Raccoon butterflyfish		♣			♣	♣					♣	
Chaetodon lunulatus	Redfin butterflyfish				♣	♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon melannotus	Blackback butterflyfish		♣				♣					♣	
Chaetodon mertensii	Merten's butterflyfish												
Chaetodon meyeri	Meyer's butterflyfish		♣								♣		
Chaetodon ocellicaudus	Spottail butterflyfish		♣			♣				♣	♣	♣	♣
Chaetodon octofasciatus	Eightband butterflyfish					♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon ornatissimus	Ornate butterflyfish							♣		♣	♣	♣	
Chaetodon oxycephalus	Spot-nape butterflyfish	♣	♣				♣					♣	
Chaetodon plebeius	Blueblotch butterflyfish												
Chaetodon punctatofasciatus	Spotband butterflyfish			♣	♣	♣	♣					♣	♣
Chaetodon rafflesi	Latticed butterflyfish		♣		♣	♣	♣		♣		♣	♣	♣
Chaetodon reticulatus	Mailed butterflyfish		♣		♣						♣		
Chaetodon selene	Yellowdotted butterflyfish												
Chaetodon semeion	Dotted butterflyfish						♣					♣	♣
Chaetodon speculum	Mirror butterflyfish		♣	♣								♣	
Chaetodon trifascialis	Chevron butterflyfish				♣	♣	♣			♣			
Chaetodon ulietensis	Pacific doublesaddle butterflyfish				♣								
Chaetodon unimaculatus	Teardrop butterflyfish												
Chaetodon vagabundus	Vagabond butterflyfish		♣	♣	♣	♣						♣	♣
Chaetodon xanthurus	Pearscale butterflyfish												
Chelmon rostratus	Beaked coralfish							♣					
Forcipiger flavisimmus	Forcepsfish		♣						♣				
Forcipiger longirostris	Longnose butterflyfish			♣								♣	
Hemitaurichthys polylepis	Pyramid butterflyfish		♣										♣
Heniochus acuminatus	Pennant coralfish										♣		
Heniochus chrysostomus	Threeband pennantfish				♣				♣		♣	♣	
Heniochus diphreutes													
Heniochus singularius	Singular bannerfish	♣				♣					♣	♣	
Heniochus varius	Horned bannerfish	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣
Parachaetodon ocellatus	Sixspine butterflyfish									♣			
Coradion chrysozonus	Goldengirdled coralfish			♣	♣				♣			♣	♣
Coradion melanopus	Twospot coralfish								♣				
Total per site		**4**	**16**	**9**	**14**	**13**	**15**	**7**	**10**	**8**	**15**	**21**	*13*

♣ - Indicates the presence of species in the area

Table 2. (continued) Incidence of butterflyfish species in sites surveyed in 1999, 2003 and 2007.

Butterflyfish species	Common Name	BOHOL									
		San Isidro-Dau Marine Sanctuary		Balicasag Marine Sanctuary				Pamilacan Marine Sanctuary			
		2003	2007	1992	1999	2003	2007	1992	1999	2003	2007
Chaetodon adiergastos	Philippine butterflyfish			♣	♣	♣	♣	♣		♣	
Chaetodon auriga	Threadfin butterflyfish	♣			♣			♣	♣	♣	♣
Chaetodon baronessa	Eastern triangular butterflyfish	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon bennetti	Bluelashed butterflyfish			♣	♣	♣		♣			
Chaetodon citrinellus	Speckled butterflyfish			♣				♣		♣	
Chaetodon ephippium	Saddle butterflyfish		♣								
Chaetodon kleinii	Klein's butterflyfish			♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon lineolatus	Lined butterflyfish		♣	♣	♣	♣		♣		♣	
Chaetodon lunula	Raccoon butterflyfish	♣	♣	♣	♣	♣	♣	♣		♣	
Chaetodon lunulatus	Redfin butterflyfish	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣
Chaetodon melannotus	Blackback butterflyfish		♣	♣	♣	♣	♣	♣	♣	♣	
Chaetodon mertensii	Merten's butterflyfish										
Chaetodon meyeri	Meyer's butterflyfish			♣		♣		♣			
Chaetodon ocellicaudus	Spottail butterflyfish				♣	♣	♣				
Chaetodon octofasciatus	Eightband butterflyfish	♣	♣								
Chaetodon ornatissimus	Ornate butterflyfish	♣		♣	♣	♣		♣	♣	♣	
Chaetodon oxycephalus	Spot-nape butterflyfish				♣	♣					
Chaetodon plebeius	Blueblotch butterflyfish			♣					♣		
Chaetodon punctofasciatus	Spotband butterflyfish	♣	♣		♣	♣	♣	♣	♣		
Chaetodon rafflesi	Latticed butterflyfish	♣	♣	♣	♣	♣	♣	♣		♣	
Chaetodon reticulatus	Mailed butterflyfish			♣	♣						
Chaetodon selene	Yellowdotted butterflyfish										
Chaetodon semeion	Dotted butterflyfish										
Chaetodon speculum	Mirror butterflyfish			♣		♣	♣	♣		♣	
Chaetodon trifascialis	Chevron butterflyfish		♣	♣	♣	♣	♣				♣
Chaetodon ulietensis	Pacific doublesaddle butterflyfish			♣	♣	♣	♣	♣	♣	♣	
Chaetodon unimaculatus	Teardrop butterflyfish					♣		♣			
Chaetodon vagabundus	Vagabond butterflyfish	♣	♣	♣	♣	♣	♣	♣	♣	♣	
Chaetodon xanthurus	Pearscale butterflyfish										
Chelmon rostratus	Beaked coralfish										
Forcipiger flavisimmus	Forcepsfish	♣		♣	♣	♣	♣	♣	♣	♣	♣
Forcipiger longirostris	Longnose butterflyfish				♣				♣	♣	
Hemitaurichthys polylepis	Pyramid butterflyfish			♣	♣	♣	♣	♣	♣	♣	♣
Heniocus acuminatus	Pennant coralfish				♣	♣					
Heniochus chrysostomus	Threeband pennantfish				♣	♣	♣	♣			
Heniochus diphreutes											♣
Heniochus singularius	Singular bannerfish			♣	♣	♣	♣	♣			
Heniochus varius	Horned bannerfish	♣	♣	♣	♣	♣	♣	♣	♣	♣	♣
Parachaetodon ocellatus	Sixspine butterflyfish										
Coradion chrysozonus	Goldengirdled coralfish										
Coradion melanopus	Twospot coralfish				♣						
Total per site		**11**	**12**	**22**	**26**	**25**	**18**	**23**	**14**	**18**	**9**

♣ - Indicates the presence of species in the area

Table 3. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Balicasag Marine Sanctuary in 2007.

FAMILY	Sanctuary								Non-Sanctuary							
	n = 6								n = 4							
	# of species	SE	Count per size class (Abundance)				Total abundance	SE	# of species	SE	Count per size class (Abundance)				Total abundance	SE
			1-10 cm**	11-20 cm	21-30 cm	>30 cm					1-10 cm**	11-20 cm	21-30 cm	>30 cm		
Surgeonfish (*Acanthurids*)*	3.3	1.0	9.0	10.5	2.5	1.3	23.3	10.3	2.0	1.2	1.3	3.5	1.5	0.0	6.3	4.7
Rabbitfish (*Siganids*)*	1.3	0.8	0.0	1.5	2.7	0.0	4.2	2.6	1.0	0.7	0.0	1.5	0.5	0.0	2.0	1.4
Groupers (*Serranids*)*	2.2	0.7	0.0	2.7	3.0	1.3	7.0	3.9	0.8	0.8	0.0	0.8	0.5	0.0	1.3	1.3
Barramundi Cod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	3.2	0.6	0.0	22.3	101.8	1.7	125.8	70.6	2.5	0.5	0.0	0.3	1.3	4.8	6.3	3.0
Sweetlips (*Haemulids*)	1.0	0.4	0.0	0.0	1.3	0.7	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (*Lethrinids*)*	0.8	0.4	0.0	0.0	2.2	0.3	2.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jacks (*Carangids*)*	1.2	0.3	0.0	1.7	2.8	1.0	5.5	3.9	1.5	0.3	0.0	5.0	1.8	1.0	7.8	4.2
Fusiliers (*Caesionids*)*	2.3	0.3	944.0	806.3	50.0	0.0	1800.3	479.9	1.3	0.5	75.0	262.5	0.0	0.0	337.5	195.1
Spinecheeks (*Nemipterids*)*	1.2	0.6	1.7	4.0	0.0	0.0	5.7	2.7	0.5	0.5	0.8	1.0	0.0	0.0	1.8	1.8
Goatfish (*Mullids*)*	1.7	0.8	3.8	9.7	2.2	0.0	15.7	7.1	1.0	0.7	0.0	3.8	0.8	0.0	4.5	2.6
Parrotfish (*Scarids*)*	2.2	1.2	0.0	6.7	5.7	2.7	15.0	8.2	2.3	1.3	0.0	3.3	0.3	0.3	3.8	1.9
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.8	0.2	0.0	6.7	10.0	2.2	18.8	10.2	0.3	0.3	0.0	1.0	0.0	0.0	1.0	1.0
Triggerfish (*Balistids*)	2.3	0.5	0.0	5.5	2.0	0.2	7.7	2.6	0.5	0.3	0.0	1.0	0.0	0.3	1.3	0.9
Butterflyfish (*Chaetodontids*)	3.5	1.0	3.7	7.2	1.8	0.0	12.7	4.4	2.8	1.0	1.0	3.5	0.0	0.0	4.5	1.9
Angelfish (*Pomacanthids*)	2.3	0.6	5.0	3.5	1.0	0.2	9.7	4.3	2.3	0.9	4.8	1.3	0.3	0.0	6.3	2.5
Wrasses (*Labrids*)	10.7	3.0	559.8	25.5	4.3	0.0	589.7	341.2	8.8	2.5	74.5	8.3	0.5	0.0	83.3	58.2
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	15.8	2.3	1778.0	0.3	0.0	0.0	1778.3	581.7	15.3	1.5	1210.8	0.0	0.0	0.0	1210.8	378.4
Fairy Basslets (*Anthids*)	3.0	0.0	2782.0	0.0	0.0	0.0	2782.0	150.0	2.5	0.3	2906.8	0.0	0.0	0.0	2906.8	537.8
Moorish Idol (*Zanclids*)	0.7	0.2	0.0	2.0	0.7	0.0	2.7	1.0	0.5	0.3	0.0	0.8	0.0	0.0	0.8	0.5
Total (all reef species)	**59.5**	**13.1**	**6087.0**	**916.0**	**194.0**	**11.5**	**7208.5**	**1339.5**	**45.5**	**9.2**	**4274.8**	**297.3**	**7.3**	**6.3**	**4585.5**	**956.6**
Total (target reef species)*	**21.2**	**6.0**	**949.5**	**872.0**	**184.2**	**86.8**	**2092.5**	**639.9**	**13.0**	**5.7**	**75.8**	**282.5**	**6.5**	**6.0**	**370.8**	**202.1**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 4. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Balicasag Marine Sanctuary from 1986 to 2007.

FAMILY	Sanctuary						% Difference in abundance 2003-2007	Non-Sanctuary				% Difference in abundance 2003-2007
	1985	1986	1992	1999	2003	2007		1985	1999	2003	2007	
	n = 3	n = 6	n = 3	n = 5	n = 4	n = 6		n = 7	n = 5	n = 4	n = 4	
Surgeonfish (*Acanthurids*)*	254.0	152.5	145.3	21.0	14.3	23.3	63.7	657.1	27.0	10.8	6.3	-41.9
Rabbitfish (*Siganids*)*	2.3	~	0.7	1.2	8.0	4.2	-47.9	0.4	1.6	5.5	2.0	-63.6
Groupers (*Serranids*)*	2.7	3.1	1.3	2.6	3.3	7.0	115.4	1.9	3.0	2.0	1.3	-37.5
Barramundi Cod	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Snapper (*Lutjanids*)*	0.7	19.6	16.0	65.2	111.5	125.8	12.9	0.7	3.2	1.0	6.3	525.0
Sweetlips (*Haemulids*)	0.0	0.1	1.0	0.4	0.0	2.0	+	0.4	0.2	0.5	0.0	-100.0
Emperors (*Lethrinids*)*	0.3	#	0.0	0.0	0.0	2.5	+	0.4	0.0	1.5	0.0	-100.0
Jacks (*Carangids*)*	15.3	16.0	11.0	5.8	77.5	5.5	-92.9	7.7	3.2	1.0	7.8	675.0
Fusiliers (*Caesionids*)*	1424.0	1548.5	749.0	409.4	1100.0	1800.3	63.7	752.1	143.6	239.5	337.5	40.9
Spinecheeks (*Nemipterids*)*	1.0	#	0.0	0.0	0.0	5.7	+	4.4	1.8	0.0	1.8	+
Goatfish (*Mullids*)*	17.0	37.3	17.0	8.6	1.8	15.7	795.2	46.7	11.0	2.5	4.5	80.0
Parrotfish (*Scarids*)*	385.0	117.9	65.0	85.8	10.0	15.0	50.0	170.1	33.0	16.3	3.8	-76.9
Bumphead parrotfish	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	2.0	4.3	1.0	113.4	54.8	18.8	-65.6	0.0	2.8	1.3	1.0	-20.0
Triggerfish (*Balistids*)	6.3	6.8	9.0	10.4	3.0	7.7	155.6	12.7	3.6	1.3	1.3	0.0
Butterflyfish (*Chaetodontids*)	38.7	20.6	21.3	17.6	8.0	12.7	58.3	30.7	17.4	9.5	4.5	-52.6
Angelfish (*Pomacanthids*)	11.3	15.5	35.0	12.2	166.5	9.7	-94.2	16.0	12.8	8.8	6.3	-28.6
Wrasses (*Labrids*)	48.7	71.9	82.0	49.4	161.8	589.7	264.6	186.3	84.0	161.8	83.3	-48.5
Humphead wrasse	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	443.0	781.2	510.0	2288.8	713.8	1778.3	149.2	1395.0	2024.0	1048.5	1210.8	15.5
Fairy Basslets (*Anthids*)	1634.0	2072.6	898.0	1199.8	1745.3	2782.0	59.4	1486.9	937.4	1575.0	2906.8	84.6
Moorish Idol (*Zanclids*)	5.0	11.3	17.0	6.8	2.8	2.7	-3.0	8.1	4.6	3.0	0.8	-75.0
Total (all reef species)	**4291.3**	**4879.2**	**2579.6**	**4298.4**	**4182.0**	**7208.5**	**72.4**	**4777.9**	**3314.2**	**3089.5**	**4585.5**	**48.4**
Total (target reef species)*	**2104.3**	**1899.3**	**1007.3**	**713.4**	**1380.5**	**2092.5**	**51.6**	**1642.1**	**230.4**	**281.5**	**370.8**	**31.7**

Emperors and Spinecheeks combined with Snapper in 1986 data

* Target species/families

% change = {(Yr_2/Yr_1)-1} x 100

(-) = decrease

(+) = increase

~ No data available

Table 5. Mean (±SE) fish species (species/500m^2) and percentage change between years in Balicasag Marine Sanctuary from 1992 to 2007.

FAMILY	Sanctuary						% Difference in species 2003-2007	Non-Sanctuary				% Difference in species 2003-2007
	1985	1986	1992	1999	2003	2007		1985	1999	2003	2007	
	n = 3	n = 7	n = 3	n = 5	n = 4	n = 6		n = 7	n = 5	n = 4	n = 4	
Surgeonfish (*Acanthurids*)*	14.0	12.6	9.3	5.0	4.5	3.3	-25.9	10.3	4.4	4.3	2.0	-52.9
Rabbitfish (*Siganids*)*	1.0	0.3	0.7	0.4	1.8	1.3	-23.8	0.1	0.4	1.5	1.0	-33.3
Groupers (*Serranids*)*	1.3	2.3	1.3	1.6	2.3	2.2	-3.7	1.3	1.4	1.5	0.8	-50.0
Barramundi Cod	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Snapper (*Lutjanids*)*	0.7	2.7	1.7	3.4	3.0	3.2	5.6	0.4	1.4	1.0	2.5	150.0
Sweetlips (*Haemulids*)	0.0	0.1	0.3	0.4	0.0	1.0	+	0.1	0.2	0.5	0.0	-100.0
Emperors (*Lethrinids*)*	0.3	0.4	0.0	0.0	0.0	0.8	+	0.1	0.0	0.5	0.0	-100.0
Jacks (*Carangids*)*	1.3	1.0	0.3	1.6	1.5	1.2	-22.2	0.6	0.8	0.8	1.5	100.0
Fusiliers (*Caesionids*)*	2.7	2.9	2.3	2.6	2.3	2.3	3.7	2.4	1.0	1.3	1.3	0.0
Spinecheeks (*Nemipterids*)*	0.3	0.1	0.0	0.0	0.0	1.2	+	1.0	0.6	0.0	0.5	+
Goatfish (*Mullids*)*	1.0	0.9	1.0	0.4	1.3	1.7	33.3	1.0	0.8	1.0	1.0	0.0
Parrotfish (*Scarids*)*	1.0	1.0	1.0	1.0	2.8	2.2	-21.2	1.0	1.0	4.0	2.3	-43.8
Bumphead parrotfish	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.7	0.4	0.3	1.4	1.3	0.8	-33.3	0.0	0.4	1.0	0.3	-75.0
Triggerfish (*Balistids*)	2.3	2.7	1.7	2.2	1.5	2.3	55.6	2.7	1.2	0.8	0.5	-33.3
Butterflyfish (*Chaetodontids*)	9.3	8.7	5.3	5.8	1.8	3.5	100.0	7.0	5.2	4.8	2.8	-42.1
Angelfish (*Pomacanthids*)	3.3	2.7	2.7	2.8	5.0	2.3	-53.3	4.0	2.4	2.3	2.3	0.0
Wrasses (*Labrids*)	5.3	6.0	4.0	7.4	8.0	10.7	33.3	7.1	9.2	8.8	8.8	0.0
Humphead wrasse	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	9.0	9.9	8.7	14.4	9.8	15.8	62.4	11.6	12.6	14.0	15.3	8.9
Fairy Basslets (*Anthids*)	2.0	2.7	2.0	2.2	3.0	3.0	0.0	2.3	2.2	2.3	2.5	11.1
Moorish Idol (*Zanclids*)	1.0	1.0	1.0	1.0	0.8	0.7	-11.1	1.0	1.0	1.0	0.5	-50.0
Total (all reef species)	**56.7**	**58.4**	**43.6**	**53.6**	**50.3**	**59.5**	**18.4**	**54.1**	**46.2**	**51.0**	**45.5**	**-10.8**
Total (target reef species)*	**24.3**	**24.7**	**18.2**	**17.8**	**20.5**	**21.2**	**3.3**	**18.4**	**12.4**	**17.3**	**13.0**	**-24.6**

Emperors and Spinecheeks combined with Snapper in 1986 data

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 6. Changes in substrate composition (% mean ±SE) in Bolod Marine Sanctuary, Panglao from 1996 to 2007.

TYPE OF SUBSTRATUM	Sanctuary									Non-Sanctuary		
	SCUBA					SNORKEL				SCUBA		
	1996^	1999	2003	2007	% Change 2003-2007	1999	2003	2007	% Change 2003-2007	2003	2007	% Change 2003-2007
Non-living:												
Sand and silt	48.7	42.1	14.8	36.8	147.6	26.5	18.5	27.5	48.8	41.5	23.8	-42.8
Coral rubble	6.9	6.4	4.5	1.0	-77.8	7.0	3.2	2.8	-12.1	9.3	2.7	-71.2
Rock and block	5.9	31.1	19.0	11.6	-39.2	36.1	18.1	26.3	45.2	4.3	20.7	386.3
White dead standing coral	~	0.8	1.2	0.5	-58.3	1.6	0.5	0.1	-75.8	0.3	0.1	-66.7
Dead coral with algae	1.8	1.9	4.1	6.0	46.3	2.2	2.5	1.1	-57.9	7.0	6.3	-9.5
SUBTOTAL non-living	**63.3**	**82.3**	**43.7**	**55.8**	**27.8**	**73.4**	**42.7**	**57.8**	**35.1**	**62.3**	**53.5**	**-14.1**
Living:												
Hard coral:												
Branching	~	4.5	16.8	12.3	-26.4	~	12.1	5.4	-55.3	10.3	16.3	58.5
Massive	~	2.2	11.6	6.2	-46.7	~	9.5	4.9	-47.7	7.0	10.1	44.0
Flat/Encrusting	~	0.9	5.7	2.9	-48.8	~	0.9	0.8	-9.9	2.8	6.0	118.2
Foliose/Cup	~	0.4	1.2	1.0	-16.0	~	0.7	0.2	-66.7	3.8	1.0	-73.3
Subtotal hard coral	**12.1**	**8.0**	**35.2**	**22.4**	**-36.4**	**15.6**	**23.1**	**11.4**	**-50.8**	**23.8**	**33.3**	**40.4**
Soft coral	11.5	9.8	17.5	16.3	-6.7	11.2	20.4	11.8	-42.1	6.5	7.0	7.7
SUBTOTAL corals	**23.6**	**17.8**	**52.7**	**38.8**	**-26.5**	**26.8**	**43.5**	**23.2**	**-46.7**	**30.3**	**40.3**	**33.3**
Others:												
Other animals	~	~	1.0	1.7	75.4	~	0.0	0.3	+	0.0	1.0	+
Seagrasses	~	0.0	0.0	0.3	+	2.8∞	0.4	3.4	777.5	0.0	0.0	N/A
Algae												
Fleshy	~	~	1.3	0.5	-62.7	~	11.8	14.3	20.9	5.8	1.1	-81.2
Turf	~	~	0.0	0.1	+	~	0.2	0.1	-71.0	0.0	0.3	+
Coralline	~	~	0.8	2.0	150.0	~	0.3	0.9	255.6	1.5	3.6	138.9
Sponges	~	~	0.5	0.9	83.3	~	1.1	0.2	-84.1	0.3	0.3	0.0
SUBTOTAL others	**~**	**~**	**3.6**	**5.4**	**50.9**	**0.0**	**13.7**	**19.1**	**39.3**	**7.5**	**6.2**	**-17.8**
GRAND TOTAL		**100**	**100**	**100**		**100**	**100**	**100**		**100**	**100**	
Other relevant information												
Slope (degrees)	~	9.5	80.0	21.0		7.6	6.9	0.7		15.0	48.0	
Topography* (m)	~	1.7	2.5	1.7		1.4	1.3	0.8		1.5	2.6	
Depth range/average (m)	5.7	5.6	7.3	7.0		3.5	2.9	2.5		7.5	6.5	
Visibility (m)	~	21.7	16.1	14.0		22.2	15.9	13.0		17.0	13.3	
Sample size (Transects)	1	11	10	6		14	12	12		2	6	

* Mean distance between lowest and highest point on the horizontal transect line
∞ Data not included in grand total
~ No data

^ - Silliman University Marine Laboratory, 1996

Table 7. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Bolod Marine Sanctuary in 2007.

FAMILY	Sanctuary								Non-Sanctuary							
	n = 6								n = 6							
	# of species	SE	Count per size class (Abundance)				Total abundance	SE	# of species	SE	Count per size class (Abundance)				Total abundance	SE
			1-10 cm**	11-20 cm	21-30 cm	>30 cm					1-10 cm**	11-20 cm	21-30 cm	>30 cm		
Surgeonfish (*Acanthurids*)*	1.7	0.6	4.2	1.8	0.0	0.0	6.0	2.6	1.0	0.4	3.5	3.5	0.0	0.0	7.0	4.0
Rabbitfish (*Siganids*)*	0.8	0.5	0.0	1.7	0.0	0.0	1.7	1.1	0.7	0.4	0.0	1.3	0.0	0.0	1.3	0.8
Groupers (*Serranids*)*	1.0	0.4	0.7	1.2	0.2	0.0	2.0	0.9	0.5	0.2	0.3	0.0	0.2	0.0	0.5	0.3
Barramundi Cod	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	0.7	0.3	0.0	0.3	0.2	0.0	0.5	0.3	0.8	0.3	0.0	0.5	0.7	0.2	1.3	1.0
Sweetlips (*Haemulids*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (*Lethrinids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jacks (*Carangids*)*	0.7	0.2	0.0	0.7	0.3	0.0	1.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (*Caesionids*)*	0.3	0.2	3.3	15.0	0.0	0.0	18.3	11.7	0.3	0.3	6.7	5.0	0.0	0.0	11.7	11.7
Spinecheeks (*Nemipterids*)*	1.3	0.4	1.3	3.3	0.0	0.0	4.7	1.6	1.0	0.4	0.7	1.8	0.0	0.0	2.5	1.3
Goatfish (*Mullids*)*	1.8	0.3	2.0	3.2	0.5	0.0	5.7	0.8	1.5	0.4	1.5	1.7	0.0	0.0	3.2	1.0
Parrotfish (*Scarids*)*	3.0	0.8	0.7	3.0	1.5	0.2	5.3	1.7	2.2	0.8	1.3	1.8	0.8	0.0	4.0	1.1
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (*Balistids*)	1.0	0.5	0.0	1.7	0.2	0.0	1.8	0.9	1.0	0.5	0.0	1.0	0.3	0.0	1.3	1.0
Butterflyfish (*Chaetodontids*)	2.5	0.9	3.5	2.8	0.2	0.0	6.5	2.5	1.8	0.7	2.0	1.0	0.0	0.0	3.0	1.1
Angelfish (*Pomacanthids*)	1.3	0.5	3.2	0.8	0.0	0.0	4.0	1.7	1.8	0.2	3.8	0.7	0.3	0.0	4.8	1.3
Wrasses (*Labrids*)	8.5	1.5	23.5	5.3	0.5	0.0	29.3	9.5	6.5	1.1	18.7	8.0	0.5	0.0	27.2	6.1
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	14.8	1.1	1265.7	0.3	0.0	0.0	1266.0	213.0	186.2	172.8	696.3	0.0	0.0	0.0	696.3	118.5
Fairy Basslets (*Anthids*)	1.5	0.4	520.2	0.0	0.0	0.0	520.2	189.2	59.8	58.0	630.5	8.3	0.0	0.0	638.8	168.7
Moorish Idol (*Zanclids*)	0.3	0.2	0.8	0.7	0.0	0.0	1.5	1.0	0.7	0.2	0.2	1.0	0.0	0.0	1.2	0.4
Total (all reef species)	**41.3**	**2.9**	**8.0**	**30.5**	**2.7**	**0.2**	**41.3**	**16.1**	**265.8**	**233.9**	**1365.5**	**35.7**	**2.8**	**0.2**	**1404.2**	**215.3**
Total (target reef species)*	**11.3**	**2.9**	**8.0**	**30.5**	**2.7**	**0.2**	**41.3**	**16.1**	**8.0**	**2.7**	**10.5**	**15.7**	**1.7**	**0.2**	**28.0**	

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 8. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Bolod Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in abundance 2003-2007	Non-Sanctuary
	1999	2003	2007		2007
	n = 2	n = 4	n = 6		n = 6
Surgeonfish (*Acanthurids*)*	3.0	0.8	6.0	700.0	7.0
Rabbitfish (*Siganids*)*	0.0	0.0	1.7	+	1.3
Groupers (*Serranids*)*	0.5	0.3	2.0	700.0	0.5
Barramundi Cod	~	0.0	0.3	+	0.0
Snapper (*Lutjanids*)*	3.5	0.0	0.5	+	1.3
Sweetlips (*Haemulids*)	1.0	0.0	0.0	N/A	0.0
Emperors (*Lethrinids*)*	0.0	112.5	0.0	-100.0	0.0
Jacks (*Carangids*)*	0.5	3.3	1.0	-69.2	0.0
Fusiliers (*Caesionids*)*	0.0	8.5	18.3	115.7	11.7
Spinecheeks (*Nemipterids*)*	9.0	5.8	4.7	-18.8	3.0
Goatfish (*Mullids*)*	11.5	7.3	5.7	-21.8	3.2
Parrotfish (*Scarids*)*	5.0	4.8	5.3	12.3	4.0
Bumphead parrotfish	~	56.5	0.0	-100.0	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	45.5
Triggerfish (*Balistids*)	0.0	6.0	1.8	-69.4	1.3
Butterflyfish (*Chaetodontids*)	7.0	0.0	6.5	+	3.3
Angelfish (*Pomacanthids*)	12.5	32.0	4.0	-87.5	10.5
Wrasses (*Labrids*)	117.5	1.3	29.3	2246.7	27.2
Humphead wrasse	~	0.0	0.0	N/A	1.0
Damselfish (*Pomacentrids*)	1316.0	1533.3	1266.0	-17.4	704.7
Fairy Basslets (*Anthids*)	273.5	363.8	520.2	43.0	638.8
Moorish Idol (*Zanclids*)	0.0	1.8	1.5	-14.3	1.2
Total (all reef species)	**1760.5**	**2137.5**	**1874.8**	**-12.3**	**1465.5**
Total (target reef species)*	**34.0**	**164.5**	**41.3**	**-74.9**	**89.3**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 9. Mean (±SE) fish species (species/500m^2) and percentage change between years in Bolod Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in species 2003-2007	Non-sanctuary
	1999	2003	2007		2007
	n = 2	n = 4	n = 6		n = 6
Surgeonfish (*Acanthurids*)*	1.5	1.8	1.7	-4.8	1.0
Rabbitfish (*Siganids*)*	0.0	1.0	0.8	-16.7	0.7
Groupers (*Serranids*)*	0.5	0.8	1.0	33.3	0.5
Barramundi Cod	~	0.0	0.0	N/A	0.0
Snapper (*Lutjanids*)*	1.5	0.3	0.7	166.7	0.8
Sweetlips (*Haemulids*)	0.5	0.0	0.0	N/A	0.0
Emperors (*Lethrinids*)*	0.0	0.0	0.0	N/A	0.0
Jacks (*Carangids*)*	0.5	0.0	0.7	+	0.0
Fusiliers (*Caesionids*)*	0.0	0.5	0.3	-33.3	0.3
Spinecheeks (*Nemipterids*)*	1.0	1.8	1.3	-23.8	1.0
Goatfish (*Mullids*)*	1.0	2.5	1.8	-26.7	1.5
Parrotfish (*Scarids*)*	0.5	3.5	3.0	-14.3	2.2
Bumphead parrotfish	~	0.0	0.0	N/A	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	0.0
Triggerfish (*Balistids*)	0.0	1.8	1.0	-42.9	1.0
Butterflyfish (*Chaetodontids*)	3.0	5.0	2.5	-50.0	1.8
Angelfish (*Pomacanthids*)	3.0	2.0	1.3	-33.3	1.8
Wrasses (*Labrids*)	6.5	11.0	8.5	-22.7	6.5
Humphead wrasse	~	0.0	0.0	N/A	0.0
Damselfish (*Pomacentrids*)	12.5	20.0	14.8	-25.8	186.2
Fairy Basslets (*Anthids*)	1.0	1.3	1.5	20.0	59.8
Moorish Idol (*Zanclids*)	0.0	0.8	0.3	-55.6	0.7
Total (all reef species)	**33.0**	**53.8**	**41.3**	**-23.1**	**265.8**
Total (target reef species)*	**7.0**	**12.0**	**11.3**	**-5.6**	**8.0**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 10. Changes in substrate composition (% mean ±SE) in Tawala Marine Sanctuary, Panglao from 1999 to 2007.

TYPE OF SUBSTRATUM	Sanctuary								Non-Sanctuary
	SCUBA			% Change 2003-2007	SNORKEL			% Change 2003-2007	SCUBA
	1999	2003	2007		1999	2003	2007		2007
Non-living:									
Sand and silt	5.6	7.1	3.5	-51.0	33.9	19.1	20.2	5.8	0.7
Coral rubble	8.8	9.8	16.3	66.8	11.5	6.4	2.3	-63.8	3.3
Rock and block	20.2	3.8	1.8	-51.9	30.3	32.4	17.8	-45.0	7.3
White dead standing coral	2.1	0.3	0.0	-100.0	0.6	0.1	0.7	772.7	1.0
Dead coral with algae	7.3	5.3	13.3	150.0	4.5	1.8	1.3	-26.6	5.3
SUBTOTAL non-living	**44.0**	**26.4**	**35.0**	**32.7**	**80.8**	**59.7**	**42.4**	**-29.1**	**17.7**
Living:									
Hard coral:									
Branching	38.8	45.7	35.3	-22.7	~	5.2	6.2	18.7	52.5
Massive	7.0	8.9	5.7	-36.4	~	3.2	3.9	21.1	6.5
Flat/Encrusting	2.4	7.0	6.3	-9.2	~	0.5	0.3	-38.5	9.2
Foliose/Cup	3.6	6.8	13.2	95.1	~	2.8	1.0	-65.6	3.2
Subtotal hard coral	**51.8**	**68.3**	**60.5**	**-11.5**	**8.1**	**11.7**	**11.3**	**-3.3**	**71.3**
Soft coral	4.2	1.9	1.5	-21.7	11.2	18.9	44.8	136.7	6.2
SUBTOTAL corals	**56.0**	**70.3**	**62.0**	**-11.8**	**19.3**	**30.6**	**56.1**	**83.2**	**77.5**
Others:									
Other animals	~	0.1	0.5	500.0	~	0.0	0.1	+	0.2
Seagrasses	0.0	0.0	0.0	N/A	0.0	0.7	0.0	-100.0	0.0
Algae									
Fleshy	~	0.3	1.0	300.0	~	7.1	1.0	-86.1	1.2
Turf	~	0.3	0.2	-50.0	~	0.2	0.0	-100.0	0.3
Coralline	~	2.3	1.0	-56.5	~	1.0	0.2	-84.5	2.8
Sponges	~	0.4	0.3	-18.4	~	0.7	0.2	-66.2	0.3
SUBTOTAL others	**0.0**	**3.4**	**3.0**	**-11.1**	**0.0**	**9.6**	**1.5**	**-84.3**	**4.8**
GRAND TOTAL	**100**	**100**	**100**		**100**	**100**	**100.0**		**100.0**
Other relevant information									
Slope (degrees)	12.6	74.2	68.3		2.7	5.0	8.0		53.3
Topography* (m)	1.7	1.9	3.0		1.1	1.2	0.8		1.5
Depth range/average (m)	4.6	7.3	8.0		3.0	2.5	2.8		6.3
Visibility (m)	21.5	21.7	13.7		20.3	19.3	18.0		14.7
Sample size (Transects)	13	12	6		15	12	11		3

* Mean distance between lowest and highest point on the horizontal transect line
~ No data

Table 11. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Tawala Marine Sanctuary in 2007.

FAMILY	Sanctuary								Non-Sanctuary							
	n = 3								n = 3							
	# of species	SE	Count per size class (Abundance)				Total abundance	SE	# of species	SE	Count per size class (Abundance)				Total abundance	SE
			1-10 cm**	11-20 cm	21-30 cm	>30 cm					1-10 cm**	11-20 cm	21-30 cm	>30 cm		
Surgeonfish (*Acanthurids*)*	1.7	0.3	0.0	1.3	0.0	2.7	4.0	2.1	2.3	0.3	1.3	1.3	0.3	0.0	3.0	0.0
Rabbitfish (*Siganids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.3	0.3
Groupers (*Serranids*)*	1.0	0.6	0.0	0.3	0.0	0.7	1.0	0.6	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Barramundi Cod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	2.0	0.6	0.0	0.0	1.3	2.7	4.0	1.5	0.7	0.3	0.0	0.7	0.0	0.0	0.7	0.3
Sweetlips (*Haemulids*)	0.3	0.3	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (*Lethrinids*)*	1.0	0.0	0.0	0.0	0.3	0.7	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jacks (*Carangids*)*	1.3	0.3	0.0	0.0	0.0	18.0	18.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (*Caesionids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	13.3	76.7	0.0	0.0	90.0	58.6
Spinecheeks (*Nemipterids*)*	0.7	0.7	0.0	2.0	0.0	0.0	2.0	2.0	0.7	0.3	0.7	0.7	0.0	0.0	1.3	0.7
Goatfish (*Mullids*)*	0.3	0.3	0.0	0.3	0.0	0.0	0.3	0.3	1.0	0.0	0.0	1.7	0.0	0.0	1.7	0.3
Parrotfish (*Scarids*)*	1.7	0.3	0.0	0.3	1.7	0.0	2.0	0.6	1.7	0.3	0.0	2.7	1.0	0.0	3.7	0.9
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.7	0.3	0.0	0.0	13.3	6.7	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (*Balistids*)	1.3	0.3	0.0	2.3	0.3	0.0	2.7	0.9	1.0	0.0	0.0	1.7	0.0	0.0	1.7	0.7
Butterflyfish (*Chaetodontids*)	3.0	1.0	2.3	4.0	0.0	0.0	6.3	2.6	3.7	1.7	6.0	0.7	0.0	0.0	6.7	4.2
Angelfish (*Pomacanthids*)	3.0	1.0	4.0	1.7	0.3	0.0	6.0	2.5	2.7	0.3	2.0	1.7	0.7	0.0	4.3	1.9
Wrasses (*Labrids*)	4.0	1.2	0.7	3.7	0.0	0.0	4.3	1.2	8.7	1.3	97.7	2.3	1.3	0.0	101.3	56.7
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	13.3	0.7	3236.3	0.7	0.0	0.0	3237.0	352.8	12.0	1.2	1645.0	0.0	0.0	0.0	1645.0	457.6
Fairy Basslets (*Anthids*)	2.0	0.0	415.0	0.0	0.0	0.0	415.0	152.6	2.0	0.0	288.7	0.0	0.0	0.0	288.7	125.4
Moorish Idol (*Zanclids*)	0.7	0.3	0.0	0.7	0.0	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (all reef species)	**38.0**	**1.2**	**3658.3**	**17.3**	**17.3**	**32.3**	**3725.3**	**429.8**	**38.3**	**1.2**	**2054.7**	**91.3**	**3.3**	**0.0**	**2149.3**	**629.4**
Total (target reef species)*	**10.7**	**0.3**	**0.0**	**4.3**	**16.7**	**32.3**	**53.3**	**6.4**	**8.7**	**1.3**	**14.0**	**85.0**	**1.3**	**0.0**	**100.3**	**59.09**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 12. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Tawala Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in abundance 2003-2007	Non-Sanctuary
	1999	2003	2007		2007
	n = 2	n = 4	n = 3		n = 3
Surgeonfish (*Acanthurids*)*	12.5	23.0	4.0	-82.6	3.0
Rabbitfish (*Siganids*)*	3.0	8.3	0.0	-100.0	0.3
Groupers (*Serranids*)*	1.5	1.5	1.0	-33.3	1.0
Barramundi Cod	13.0	0.0	0.0	N/A	0.0
Snapper (*Lutjanids*)*	~	8.8	4.0	-54.3	0.7
Sweetlips (*Haemulids*)	0.0	0.8	1.0	33.3	0.0
Emperors (*Lethrinids*)*	0.0	1.5	1.0	-33.3	0.0
Jacks (*Carangids*)*	5.0	0.5	18.0	3500.0	0.0
Fusiliers (*Caesionids*)*	34.5	162.5	0.0	-100.0	90.0
Spinecheeks (*Nemipterids*)*	4.5	0.3	2.0	700.0	1.3
Goatfish (*Mullids*)*	1.5	2.0	0.3	-83.3	1.7
Parrotfish (*Scarids*)*	33.0	24.0	2.0	-91.7	3.7
Bumphead parrotfish	~	0.0	0.0	N/A	0.0
Rudderfish (*Kyphosids*)*	16.5	0.0	20.0	+	0.0
Triggerfish (*Balistids*)	2.0	3.3	2.7	-17.9	1.7
Butterflyfish (*Chaetodontids*)	13.0	9.8	6.3	-35.0	6.7
Angelfish (*Pomacanthids*)	17.0	5.8	6.0	4.3	4.3
Wrasses (*Labrids*)	47.5	49.8	4.3	-91.3	101.3
Humphead wrasse	~	0.0	0.0	N/A	0.0
Damselfish (*Pomacentrids*)	1421.0	1507.3	3237.0	114.8	1645.0
Fairy Basslets (*Anthids*)	162.0	75.0	415.0	453.3	288.7
Moorish Idol (*Zanclids*)	2.0	1.8	0.7	-61.9	0.0
Total (all reef species)	**1789.5**	**1885.5**	**3725.3**	**97.6**	**2149.3**
Total (target reef species)*	**125.0**	**233.0**	**53.3**	**-77.1**	**100.3**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 13. Mean (±SE) fish species (species/500m^2) and percentage change between years in Tawala Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in species 2003-2007	Non-Sanctuary
	1999	2003	2007		2007
	n = 2	n = 4	n = 3		n = 3
Surgeonfish (*Acanthurids*)*	2.5	3.5	1.7	-52.4	2.3
Rabbitfish (*Siganids*)*	2.0	2.8	0.0	-100.0	0.3
Groupers (*Serranids*)*	1.5	1.0	1.0	0.0	1.0
Barramundi Cod	2.5	0.0	0.0	N/A	0.0
Snapper (*Lutjanids*)*	~	2.5	2.0	-20.0	0.7
Sweetlips (*Haemulids*)	0.0	0.8	0.3	-55.6	0.0
Emperors (*Lethrinids*)*	0.0	0.8	1.0	33.3	0.0
Jacks (*Carangids*)*	1.0	0.3	1.3	433.3	0.0
Fusiliers (*Caesionids*)*	1.5	0.5	0.0	-100.0	0.7
Spinecheeks (*Nemipterids*)*	0.5	0.3	0.7	166.7	0.7
Goatfish (*Mullids*)*	0.5	0.5	0.3	-33.3	1.0
Parrotfish (*Scarids*)*	1.0	5.5	1.7	-69.7	1.7
Bumphead parrotfish	~	0.0	0.0	N/A	0.0
Rudderfish (*Kyphosids*)*	0.5	0.0	0.7	+	0.0
Triggerfish (*Balistids*)	1.5	1.3	1.3	6.7	1.0
Butterflyfish (*Chaetodontids*)	4.5	5.0	3.0	-40.0	3.7
Angelfish (*Pomacanthids*)	3.0	2.5	3.0	20.0	2.7
Wrasses (*Labrids*)	5.5	8.8	4.0	-54.3	8.7
Humphead wrasse	~	0.0	0.0	N/A	0.0
Damselfish (*Pomacentrids*)	20.0	16.0	13.3	-16.7	12.0
Fairy Basslets (*Anthids*)	2.0	0.8	2.0	166.7	2.0
Moorish Idol (*Zanclids*)	1.0	1.0	0.7	-33.3	0.0
Total (all reef species)	**51.0**	**53.5**	**38.0**	**-29.0**	**38.3**
Total (target reef species)*	**13.5**	**18.3**	**10.7**	**-41.6**	**8.7**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 14. Changes in substrate composition (% mean ±SE) in Doljo Marine Sanctuary, Panglao from 1996 to 2007.

TYPE OF SUBSTRATUM	Sanctuary									Non-Sanctuary			
	SCUBA					SNORKEL				SCUBA			SNORKEL
	1996^	1999	2003	2007	% Change 2003-2007	1999	2003	2007	% Change 2003-2007	2003	2007	% Change 2003-2007	2003
Non-living:													
Sand and silt	3.6	18.4	13.9	10.3	-25.5	32.4	17.9	18.8	5.4	13.4	10.8	-19.1	17.1
Coral rubble	16.6	28.1	32.4	24.0	-25.9	13.5	8.2	4.4	-46.1	27.1	33.9	25.1	9.7
Rock and block	1.9	4.0	5.7	3.7	-35.5	20.3	13.3	20.8	57.1	3.6	4.8	33.3	11.9
White dead standing coral	~	1.5	0.3	0.2	-46.7	1.7	0.3	1.3	371.4	0.8	0.0	-100.0	0.7
Dead coral with algae	17.8	9.2	11.6	15.2	31.2	8.7	5.4	2.4	-55.1	8.0	6.5	-18.2	6.0
SUBTOTAL non-living	**39.9**	**61.2**	**63.8**	**53.3**	**-16.4**	**76.6**	**45.0**	**47.8**	**6.2**	**52.8**	**56.0**	**6.2**	**45.3**
Living:													
Hard coral:													
Branching	~	26.6	22.6	30.7	35.9	~	18.4	22.0	20.1	31.6	19.0	-39.9	19.8
Massive	~	5.0	3.1	1.7	-45.6	~	10.0	9.5	-4.8	3.2	2.6	-17.5	10.0
Flat/Encrusting	~	0.8	1.0	1.8	75.0	~	0.2	1.4	739.6	1.7	6.7	294.1	0.6
Foliose/Cup	~	6.2	1.3	4.3	246.7	~	2.7	1.0	-61.5	2.1	3.6	75.6	0.9
Subtotal hard coral	**51.0**	**38.6**	**27.9**	**38.4**	**37.8**	**22.3**	**31.2**	**34.0**	**9.0**	**38.5**	**31.9**	**-17.1**	**31.3**
Soft coral	0.0	0.3	0.5	0.5	0.0	1.5	3.7	3.9	7.0	0.8	1.1	46.7	3.0
SUBTOTAL corals	**51.0**	**38.9**	**28.4**	**38.9**	**37.2**	**23.8**	**34.9**	**37.9**	**8.8**	**39.3**	**33.0**	**-15.9**	**34.3**
Others:													
Other animals	~	~	0.3	0.1	-73.3	~	0.0	0.3	+	0.1	0.7	600.0	0.0
Seagrasses	0.0	19.0∞	5.5	4.3	-21.2	14.5∞	6.9	5.8	-17.0	2.8	2.2	-20.0	2.6
Algae													
Fleshy	~	~	1.1	1.7	48.1	~	11.9	6.7	-43.4	2.0	5.7	192.3	13.4
Turf	~	~	0.0	0.0	N/A	~	0.1	0.0	-100.0	0.9	0.4	-52.9	0.9
Coralline	~	~	0.6	1.2	107.4	~	0.3	1.0	203.0	1.8	1.0	-44.4	2.7
Sponges	~	~	0.3	0.5	60.0	~	0.9	0.5	-40.7	0.6	1.0	81.8	0.7
SUBTOTAL others	**0.0**	**0.0**	**7.8**	**7.8**	**-0.8**	**0.0**	**20.1**	**14.3**	**-29.0**	**8.0**	**11.0**	**37.5**	**20.4**
GRAND TOTAL		**100**	**100**	**100**		**100**	**100**	**100**		**100**	**100**		**100**
Other relevant information													
Slope (degrees)	~	10.8	26.3	37.0		3.4	5.0	4.6		37.5	51.0		2.0
Topography* (m)	~	2.5	1.0	1.8		1.6	0.0	1.1		1.0	2.3		1.0
Depth range/average (m)	10.0	6.4	7.2	6.3		2.8	2.5	2.8		7.3	7.6		2.5
Visibility (m)	~	23.8	20.4	21.8		22.0	20.0	21.8		24.9	20.6		21.8
Sample size (Transects)	1	13	8	6		14	9	11		10	5		16

* Mean distance between lowest and highest point on the horizontal transect line
∞ Data not included in grand total
~ No data

^ - Silliman University Marine Laboratory, 199

Table 15. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Doljo Marine Sanctuary in 2007.

FAMILY	Sanctuary								Non-Sanctuary							
	n = 6								n = 6							
	# of species	SE	Count per size class (Abundance)				Total abundance	SE	# of species	SE	Count per size class (Abundance)				Total abundance	SE
			1-10 cm**	11-20 cm	21-30 cm	>30 cm					1-10 cm**	11-20 cm	21-30 cm	>30 cm		
Surgeonfish (*Acanthurids*)*	1.8	0.5	1.2	14.8	1.7	0.0	17.7	8.2	1.5	0.4	0.5	2.5	0.2	0.0	3.2	0.8
Rabbitfish (*Siganids*)*	0.7	0.2	0.0	4.2	0.0	0.0	4.2	3.2	0.3	0.2	0.0	0.3	0.2	0.0	0.5	0.3
Groupers (*Serranids*)*	0.5	0.3	0.5	0.3	0.2	0.0	1.0	0.6	1.3	0.6	0.3	1.2	0.0	0.2	1.7	0.6
Barramundi Cod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	0.7	0.3	0.0	0.7	0.3	0.0	1.0	0.5	0.3	0.2	0.0	0.5	0.0	0.0	0.5	0.3
Sweetlips (*Haemulids*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (*Lethrinids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jacks (*Carangids*)*	0.3	0.2	0.0	0.2	0.2	0.0	0.3	0.2	0.5	0.2	0.0	0.8	0.2	0.3	1.3	0.8
Fusiliers (*Caesionids*)*	1.0	0.0	0.0	205.5	0.0	0.0	205.5	41.9	0.5	0.2	0.0	43.3	0.0	0.0	43.3	31.9
Spinecheeks (*Nemipterids*)*	0.8	0.3	0.3	1.0	0.0	0.0	1.3	0.5	0.8	0.2	0.7	0.5	0.0	0.0	1.2	0.3
Goatfish (*Mullids*)*	0.8	0.4	0.0	1.5	0.0	0.0	1.5	1.0	0.8	0.2	0.0	1.7	0.0	0.0	1.7	0.7
Parrotfish (*Scarids*)*	2.0	0.4	1.0	10.5	4.5	0.0	16.0	7.5	2.0	0.4	0.2	2.0	0.7	1.2	4.0	0.7
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (*Balistids*)	0.8	0.3	0.2	1.2	0.0	0.0	1.3	0.5	1.0	0.3	0.0	1.5	0.0	0.0	1.5	0.3
Butterflyfish (*Chaetodontids*)	1.3	0.5	2.0	0.5	0.0	0.0	2.5	1.0	2.8	0.3	2.7	2.0	0.0	0.0	4.7	1.0
Angelfish (*Pomacanthids*)	1.3	0.4	1.2	1.2	0.2	0.0	2.5	0.8	1.2	0.3	2.3	0.2	0.2	0.0	2.7	0.8
Wrasses (*Labrids*)	7.5	1.0	131.2	11.5	2.2	0.0	144.8	99.0	7.8	0.8	124.2	11.7	0.3	0.0	136.2	45.5
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	14.7	0.7	1038.5	0.0	0.0	0.0	1038.5	223.2	16.0	1.4	1662.2	0.0	0.0	0.0	1662.2	261.2
Fairy Basslets (*Anthids*)	1.8	0.2	765.5	0.0	0.0	0.0	765.5	192.7	1.8	0.2	845.3	0.0	0.0	0.0	845.3	289.0
Moorish Idol (*Zanclids*)	0.3	0.2	0.0	0.5	0.0	0.0	0.5	0.3	0.3	0.2	0.0	0.5	0.0	0.0	0.5	0.3
Total (all reef species)	**36.5**	**4.1**	**1941.5**	**253.5**	**9.2**	**0.0**	**2204.2**	**337.5**	**39.2**	**1.4**	**2638.3**	**68.7**	**1.7**	**1.7**	**2710.3**	**357.3**
Total (target reef species)*	**8.7**	**2.0**	**1.8**	**238.7**	**6.8**	**0.0**	**247.3**	**42.9**	**8.2**	**1.2**	**1.2**	**52.8**	**1.2**	**1.7**	**56.8**	**31.7**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 16. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Doljo Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in abundance 2003-2007	Non-Sanctuary		% Difference in abundance 2003-2007
	1999	2003	2007		2003	2007	
	n = 2	n = 4	n = 6		n = 4	n = 6	
Surgeonfish (*Acanthurids*)*	51.5	26.5	17.7	-33.3	2.5	3.2	26.7
Rabbitfish (*Siganids*)*	2.0	4.8	4.2	-12.3	6.5	0.5	-92.3
Groupers (*Serranids*)*	2.0	3.5	1.0	-71.4	3.3	1.7	-48.7
Barramundi Cod	~	0.0	0.0	N/A	0.0	0.0	N/A
Snapper (*Lutjanids*)*	2.0	2.5	1.0	-60.0	1.0	0.5	-50.0
Sweetlips (*Haemulids*)	0.0	0.0	0.0	N/A	0.3	0.0	-100.0
Emperors (*Lethrinids*)*	0.0	0.8	0.0	-100.0	0.3	0.0	-100.0
Jacks (*Carangids*)*	16.5	0.3	0.3	33.3	7.5	1.3	-82.2
Fusiliers (*Caesionids*)*	25.5	208.8	205.5	-1.6	52.5	43.3	-17.5
Spinecheeks (*Nemipterids*)*	21.0	0.3	1.3	433.3	0.5	1.2	133.3
Goatfish (*Mullids*)*	81.0	2.3	1.5	-33.3	0.0	1.7	+
Parrotfish (*Scarids*)*	33.0	27.5	16.0	-41.8	7.0	4.0	-42.9
Bumphead parrotfish	~	0.0	0.0	N/A	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	0.0	0.0	N/A
Triggerfish (*Balistids*)	2.0	2.5	1.3	-46.7	4.0	1.5	-62.5
Butterflyfish (*Chaetodontids*)	13.0	5.8	2.5	-56.5	5.8	4.7	-18.8
Angelfish (*Pomacanthids*)	7.0	5.8	2.5	-56.5	6.5	2.7	-59.0
Wrasses (*Labrids*)	88.5	387.0	144.8	-62.6	120.8	136.2	12.8
Humphead wrasse	~	0.0	0.0	N/A	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	1857.0	1773.5	1038.5	-41.4	2174.0	1662.2	-23.5
Fairy Basslets (*Anthids*)	642.0	760.0	765.5	0.7	243.8	845.3	246.8
Moorish Idol (*Zanclids*)	0.0	1.5	0.5	-66.7	1.5	0.5	-66.7
Total (all reef species)	**2844.0**	**3213.0**	**2204.2**	**-31.4**	**2637.5**	**2710.3**	**2.8**
Total (target reef species)*	**234.5**	**276.3**	**247.3**	**-10.5**	**80.8**	**56.8**	**-29.6**

* Target species/families

% change = {(Yr_2/Yr_1)-1} x 100

(-) = decrease

(+) = increase

~ No data available

Table 17. Mean (±SE) fish species (species/500m^2) and percentage change between years in Doljo Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in species 2003-2007	Non-Sanctuary		% Difference in species 2003-2007
	1999	2003	2007		2003	2007	
	n = 2	n = 4	n = 6		n = 4	n = 6	
Surgeonfish (*Acanthurids*)*	2.5	2.3	1.8	-18.5	1.5	1.5	0.0
Rabbitfish (*Siganids*)*	1.0	2.5	0.7	-73.3	1.3	0.3	-73.3
Groupers (*Serranids*)*	1.5	2.3	0.5	-77.8	1.8	1.3	-23.8
Barramundi Cod	~	0.0	0.0	N/A	0.0	0.0	N/A
Snapper (*Lutjanids*)*	0.5	1.0	0.7	-33.3	0.8	0.3	-55.6
Sweetlips (*Haemulids*)	0.0	0.0	0.0	N/A	0.3	0.0	-100.0
Emperors (*Lethrinids*)*	0.0	0.8	0.0	-100.0	0.3	0.0	-100.0
Jacks (*Carangids*)*	0.5	0.3	0.3	33.3	0.3	0.5	100.0
Fusiliers (*Caesionids*)*	1.5	1.5	1.0	-33.3	0.5	0.5	0.0
Spinecheeks (*Nemipterids*)*	1.0	0.3	0.8	233.3	0.5	0.8	66.7
Goatfish (*Mullids*)*	1.0	1.3	0.8	-33.3	0.0	0.8	+
Parrotfish (*Scarids*)*	1.0	3.0	2.0	-33.3	3.0	2.0	-33.3
Bumphead parrotfish	~	0.0	0.0	N/A	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	0.0	0.0	N/A
Triggerfish (*Balistids*)	0.5	1.3	0.8	-33.3	2.0	1.0	-50.0
Butterflyfish (*Chaetodontids*)	3.0	3.8	1.3	-64.4	2.0	2.8	41.7
Angelfish (*Pomacanthids*)	2.5	1.8	1.3	-23.8	3.0	1.2	-61.1
Wrasses (*Labrids*)	7.5	11.5	7.5	-34.8	10.5	7.8	-25.4
Humphead wrasse	~	0.0	0.0	N/A	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	20.0	17.0	14.7	-13.7	16.5	16.0	-3.0
Fairy Basslets (*Anthids*)	2.0	2.0	1.8	-8.3	1.8	1.8	4.8
Moorish Idol (*Zanclids*)	0.0	0.8	0.3	-55.6	0.5	0.3	-33.3
Total (all reef species)	**46.0**	**53.0**	**36.5**	**-31.1**	**46.3**	**39.2**	**-15.3**
Total (target reef species)*	**10.5**	**15.0**	**8.7**	**-42.2**	**10.0**	**8.2**	**-18.3**

* Target species/families

% change = {(Yr_2/Yr_1)-1} x 100

(-) = decrease

(+) = increase

~ No data available

Table 18. Changes in substrate composition (% mean ±SE) in Bilisan Marine Sanctuary, Panglao from 1999 to 2007.

TYPE OF SUBSTRATUM	Sanctuary								Non-Sanctuary			
	SCUBA				SNORKEL				SCUBA			SNORKEL
	1999	2003	2007	% Change 2003-2007	1999	2003	2007	% Change 2003-2007	2003	2007	% Change 2003-2007	2003
Non-living:												
Sand and silt	37.0	18.6	12.5	-32.8	47.8	12.8	24.5	91.5	21.1	8.9	-57.8	27.2
Coral rubble	33.0	41.4	23.5	-43.3	12.1	5.0	2.4	-51.1	37.6	11.3	-70.0	7.0
Rock and block	9.8	6.7	3.3	-51.3	16.8	6.8	17.6	157.3	8.7	5.3	-39.8	10.5
White dead standing coral	0.1	0.4	0.0	-100.0	1.0	0.4	2.9	688.1	0.1	0.1	50.0	0.2
Dead coral with algae	4.3	6.1	8.8	44.5	4.3	2.7	1.2	-56.0	4.5	8.4	87.0	2.9
SUBTOTAL non-living	**84.2**	**73.2**	**48.1**	**-34.3**	**82.0**	**27.7**	**48.6**	**75.5**	**71.9**	**33.9**	**-52.9**	**47.8**
Living:												
Hard coral:												
Branching	10.3	11.8	15.1	28.1	~	12.2	10.9	-10.3	10.5	13.5	28.6	5.1
Massive	3.4	5.9	6.4	7.9	~	7.5	8.1	7.8	5.8	6.9	19.7	3.4
Flat/Encrusting	1.2	1.7	7.2	316.1	~	1.9	0.7	-63.4	1.8	5.7	209.1	0.3
Foliose/Cup	0.8	0.9	4.0	323.5	~	1.2	1.3	9.1	0.8	4.7	460.0	0.4
Subtotal hard coral	**15.7**	**20.4**	**32.7**	**60.2**	**17.1**	**22.8**	**21.1**	**-7.7**	**18.9**	**30.8**	**62.3**	**9.3**
Soft coral	0.1	0.7	1.2	75.0	0.8	1.3	0.3	-77.5	0.7	0.6	-12.5	0.9
SUBTOTAL corals	**15.8**	**21.1**	**33.8**	**60.7**	**17.9**	**24.2**	**21.4**	**-11.6**	**19.6**	**31.3**	**59.8**	**10.2**
Others:												
Other animals	~	0.2	0.2	0.0	~	0.0	0.3	+	0.2	0.3	50.0	0.0
Seagrasses	17.9∞	0.9	0.3	-64.7	32.1∞	35.6	19.7	-44.8	4.0	2.0	-50.0	20.7
Algae												
Fleshy	~	2.3	14.1	518.3	~	11.4	9.1	-19.9	1.4	27.1	1850.0	15.2
Turf	~	0.4	0.3	-14.3	~	0.3	0.0	-100.0	0.8	0.2	-78.6	0.2
Coralline	~	1.1	1.8	65.0	~	0.6	0.3	-48.5	1.0	4.2	316.7	5.1
Sponges	~	0.8	1.3	60.0	~	0.3	0.7	161.4	1.1	1.1	-2.5	0.9
SUBTOTAL others	**0.0**	**5.7**	**18.1**	**216.0**	**0.0**	**48.2**	**30.1**	**-37.6**	**8.4**	**34.8**	**311.5**	**42.0**
GRAND TOTAL	**100**	**100**	**100**		**100**	**100**	**100**		**100**	**100**		**100**
Other relevant information												
Slope (degrees)	18.4	44.4	48.8		1.9	10.0	0.6		30.0	60.0		11.0
Topography* (m)	1.5	0.8	2.8		1.6	0.0	0.7		0.6	1.6		1.8
Depth range/average (m)	6.7	7.4	6.5		~	3.1	2.0		7.4	7.1		2.4
Visibility (m)	17.3	20.0	20.8		17.4	13.5	22.7		20.0	19.3		21.8
Sample size (Transects)	12	9.0	6.0		16	9	11		9	6		10.0

* Mean distance between lowest and highest point on the horizontal transect line
∞ Data not included in grand total
~ No data

Table 19. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Bilisan Marine Sanctuary in 2007.

FAMILY	Sanctuary								Non-Sanctuary							
	n = 6								n = 6							
	# of species	SE	Count per size class (Abundance) 1-10 cm**	11-20 cm	21-30 cm	>30 cm	Total abundance	SE	# of species	SE	Count per size class (Abundance) 1-10 cm**	11-20 cm	21-30 cm	>30 cm	Total abundance	SE
Surgeonfish (*Acanthurids*)*	1.2	0.3	0.3	1.7	0.0	0.2	2.2	0.5	1.8	0.5	2.3	4.8	0.0	0.0	7.2	2.4
Rabbitfish (*Siganids*)*	1.0	0.4	0.0	1.0	0.2	1.8	3.0	1.9	0.8	0.4	0.0	1.7	0.0	0.0	1.7	0.8
Groupers (*Serranids*)*	0.8	0.3	0.0	1.5	0.0	0.0	1.5	0.5	0.2	0.2	0.0	0.3	0.0	0.0	0.3	0.3
Barramundi Cod	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	0.5	0.2	0.0	0.2	0.0	0.2	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweetlips (*Haemulids*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (*Lethrinids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	1.5	1.0	0.0	2.5	1.6
Jacks (*Carangids*)*	0.3	0.2	0.0	0.0	0.2	0.2	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (*Caesionids*)*	0.7	0.4	58.3	7.0	0.0	0.0	65.3	57.3	0.7	0.3	0.0	28.0	0.0	0.0	28.0	16.5
Spinecheeks (*Nemipterids*)*	1.2	0.3	0.2	1.8	0.0	0.0	2.0	0.6	0.7	0.4	0.7	0.8	0.0	0.0	1.5	1.0
Goatfish (*Mullids*)*	1.3	0.4	0.3	2.7	0.2	0.0	3.2	1.4	1.0	0.5	0.3	2.3	0.2	0.0	2.8	1.5
Parrotfish (*Scarids*)*	4.8	1.0	0.2	6.8	5.5	2.8	15.3	3.0	1.8	0.5	0.0	7.8	2.8	0.0	10.7	3.5
Bumphead parrotfish	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (*Balistids*)	1.2	0.3	0.0	2.5	0.2	0.0	2.7	1.4	0.7	0.2	0.0	1.2	0.0	0.0	1.2	0.4
Butterflyfish (*Chaetodontids*)	2.0	0.4	0.7	3.0	0.0	0.0	3.7	1.5	2.0	0.6	1.0	3.3	0.0	0.0	4.3	1.6
Angelfish (*Pomacanthids*)	1.5	0.3	1.2	1.2	0.2	0.0	2.5	0.8	1.3	0.3	1.2	1.0	0.0	0.0	2.2	0.7
Wrasses (*Labrids*)	6.5	0.8	163.3	8.0	0.0	0.0	171.3	119.2	7.5	0.6	70.8	8.0	0.0	0.2	79.0	40.2
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	12.7	1.1	1170.2	0.0	0.0	0.0	1170.2	213.2	14.7	1.0	989.2	0.0	0.0	0.0	989.2	178.9
Fairy Basslets (*Anthids*)	1.8	0.3	468.2	0.2	0.0	0.0	468.3	177.5	1.3	0.2	431.2	0.0	0.0	0.0	431.2	160.4
Moorish Idol (*Zanclids*)	0.2	0.2	0.0	0.3	0.0	0.0	0.3	0.3	0.3	0.2	0.0	0.5	0.0	0.0	0.5	0.3
Total (all reef species)	**37.7**	**2.0**	**1862.8**	**38.5**	**6.3**	**5.2**	**1912.8**	**263.8**	**35.2**	**2.9**	**1496.7**	**61.3**	**4.0**	**0.2**	**1562.2**	**194.7**
Total (target reef species)*	**11.8**	**1.4**	**59.0**	**23.3**	**6.0**	**5.2**	**93.5**	**58.5**	**7.3**	**1.8**	**1.0**	**47.3**	**4.0**	**0.0**	**52.3**	**19.2**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 20. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Bilisan Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in abundance 2003-2007	Non-Sanctuary		% Difference in abundance 2003-2007
	1999	2003	2007		2003	2007	
	n = 4	n = 4	n = 6		n = 4	n = 6	
Surgeonfish (*Acanthurids*)*	52.5	1.3	2.2	73.3	8.3	7.2	-13.1
Rabbitfish (*Siganids*)*	22.5	3.5	3.0	-14.3	5.3	1.7	-68.3
Groupers (*Serranids*)*	6.5	0.8	1.5	100.0	1.3	0.3	-73.3
Barramundi Cod	~	0.0	0.3	+	0.0	0.0	N/A
Snapper (*Lutjanids*)*	5.8	0.0	0.3	+	0.0	0.0	N/A
Sweetlips (*Haemulids*)	0.3	0.0	0.0	N/A	0.0	0.0	N/A
Emperors (*Lethrinids*)*	0.0	0.0	0.0	N/A	0.0	2.5	+
Jacks (*Carangids*)*	0.3	0.0	0.3	+	0.3	0.0	-100.0
Fusiliers (*Caesionids*)*	24.0	25.8	65.3	153.7	40.0	28.0	-30.0
Spinecheeks (*Nemipterids*)*	7.5	2.8	2.0	-27.3	2.5	1.5	-40.0
Goatfish (*Mullids*)*	81.0	2.8	3.2	15.2	2.8	2.8	3.0
Parrotfish (*Scarids*)*	81.0	14.3	15.3	7.6	23.5	10.7	-54.6
Bumphead parrotfish	~	0.0	0.3	+	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	0.0	0.0	N/A
Triggerfish (*Balistids*)	6.0	1.3	2.7	113.3	2.3	1.2	-48.1
Butterflyfish (*Chaetodontids*)	11.0	5.0	3.7	-26.7	5.8	4.3	-24.6
Angelfish (*Pomacanthids*)	12.0	1.5	2.5	66.7	2.0	2.2	8.3
Wrasses (*Labrids*)	109.0	254.8	171.3	-32.7	237.0	79.0	-66.7
Humphead wrasse	~	0.0	0.0	N/A	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	1428.0	1118.0	1170.2	4.7	1045.5	989.2	-5.4
Fairy Basslets (*Anthids*)	265.8	263.8	468.3	77.6	181.3	431.2	137.9
Moorish Idol (*Zanclids*)	1.0	2.5	0.3	-86.7	0.3	0.5	100.0
Total (all reef species)	**2114.2**	**1697.8**	**1912.8**	**12.7**	**1557.8**	**1562.2**	**0.3**
Total (target reef species)*	**281.4**	**51.0**	**93.5**	**83.3**	**83.5**	**52.3**	**-37.3**

* Target species/families

% change = {(Yr_2/Yr_1)-1} x 100

(-) = decrease

(+) = increase

~ No data available

Table 21. Mean (±SE) fish species (species/500m^2) and percentage change between years in Bilisan Marine Sanctuary from 1999 to 2007.

FAMILY	Sanctuary			% Difference in species 2003-2007	Non-Sanctuary		% Difference in species 2003-2007
	1999	2003	2007		2003	2007	
	n = 4	n = 4	n = 6		n = 4	n = 6	
Surgeonfish (*Acanthurids*)*	5.0	0.3	1.2	366.7	1.3	1.8	46.7
Rabbitfish (*Siganids*)*	1.8	1.0	1.0	0.0	1.3	0.8	-33.3
Groupers (*Serranids*)*	1.3	0.5	0.8	66.7	1.0	0.2	-83.3
Barramundi Cod	~	0.0	0.0	N/A	0.0	0.0	N/A
Snapper (*Lutjanids*)*	1.8	0.0	0.5	+	0.0	0.0	N/A
Sweetlips (*Haemulids*)	0.3	0.0	0.0	N/A	0.0	0.0	N/A
Emperors (*Lethrinids*)*	0.0	0.0	0.0	N/A	0.0	0.3	+
Jacks (*Carangids*)*	0.3	0.0	0.3	+	0.3	0.0	-100.0
Fusiliers (*Caesionids*)*	1.5	0.8	0.7	-11.1	1.5	0.7	-55.6
Spinecheeks (*Nemipterids*)*	1.0	1.0	1.2	16.7	0.8	0.7	-11.1
Goatfish (*Mullids*)*	1.0	1.8	1.3	-23.8	2.0	1.0	-50.0
Parrotfish (*Scarids*)*	1.0	3.3	4.8	48.7	3.5	1.8	-47.6
Bumphead parrotfish	~	0.0	0.0	N/A	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	N/A	0.0	0.0	N/A
Triggerfish (*Balistids*)	1.5	0.8	1.2	55.6	1.3	0.7	-46.7
Butterflyfish (*Chaetodontids*)	2.0	3.0	2.0	-33.3	2.3	2.0	-11.1
Angelfish (*Pomacanthids*)	3.5	1.0	1.5	50.0	1.5	1.3	-11.1
Wrasses (*Labrids*)	9.0	9.8	6.5	-33.3	10.5	7.5	-28.6
Humphead wrasse	~	0.0	0.0	N/A	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	16.3	14.8	12.7	-14.1	16.5	14.7	-11.1
Fairy Basslets (*Anthids*)	1.5	1.5	1.8	22.2	1.8	1.3	-23.8
Moorish Idol (*Zanclids*)	0.5	0.8	0.2	-77.8	0.3	0.3	33.3
Total (all reef species)	**49.3**	**40.0**	**37.7**	**-5.8**	**45.5**	**35.2**	**-22.7**
Total (target reef species)*	**15.0**	**8.5**	**11.8**	**39.2**	**11.5**	**7.3**	**-36.2**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 22. Changes in substrate composition (% mean ±SE) in San Isidro-Dau Marine Sanctuary, Dauis from 2003 to 2007.

TYPE OF SUBSTRATUM	Sanctuary						Non-Sanctuary	
	SCUBA		% Change 2003-2007	SNORKEL		% Change 2003-2007	SCUBA	SNORKEL
	2003	2007		2003	2007		2003	2003
Non-living:								
Sand and silt	8.3	5.8	-30.3	15.5	15.9	2.6	22.9	19.5
Coral rubble	5.8	5.3	-8.7	6.2	6.9	11.8	7.2	5.1
Rock and block	7.2	9.3	30.4	11.0	39.5	260.5	6.1	10.3
White dead standing coral	0.3	0.0	-100.0	0.2	0.3	24.3	0.2	0.0
Dead coral with algae	8.1	6.6	-18.3	3.2	0.9	-71.4	9.2	2.2
SUBTOTAL non-living	**29.6**	**26.9**	**-8.9**	**36.0**	**63.5**	**76.2**	**45.5**	**37.1**
Living:								
Hard coral:								
Branching	26.7	34.1	27.9	13.2	5.6	-57.6	22.6	3.1
Massive	11.7	12.5	7.0	8.1	4.1	-49.1	11.2	4.4
Flat/Encrusting	11.2	12.2	9.1	0.9	0.9	3.4	4.6	0.0
Foliose/Cup	3.3	5.8	76.9	0.4	0.2	-56.8	3.4	0.7
Subtotal hard coral	**52.8**	**64.5**	**22.3**	**22.6**	**10.8**	**-52.1**	**41.8**	**8.2**
Soft coral	5.2	2.8	-45.1	10.3	4.9	-52.4	3.5	5.7
SUBTOTAL corals	**57.9**	**67.3**	**16.3**	**33.0**	**15.8**	**-52.2**	**45.3**	**13.8**
Others:								
Other animals	0.7	1.0	39.1	0.0	0.3	+	0.4	0.0
Seagrasses	0.5	0.0	-100.0	1.4	4.0	185.7	1.0	5.5
Algae								
Fleshy	3.4	0.5	-85.2	28.2	16.3	-42.1	0.8	34.5
Turf	0.4	0.0	-100.0	0.2	0.0	-100.0	1.8	0.1
Coralline	6.0	3.8	-37.5	0.8	0.1	-92.6	4.6	8.7
Sponges	1.5	0.5	-66.0	0.4	0.1	-83.8	0.6	0.2
SUBTOTAL others	**12.5**	**5.8**	**-54.1**	**31.0**	**20.8**	**-33.1**	**9.3**	**49.1**
GRAND TOTAL	**100**	**100**		**100**	**100**		**100**	**100**
Other relevant information								
Slope (degrees)	88.0	69.2		8.2	16.7		70.0	5.0
Topography* (m)	1.9	2.4		2.3	1.1		0.8	~
Depth range/average (m)	7.7	7.4		3.0	3.1		7.3	2.0
Visibility (m)	13.2	13.5		15.2	19.8		14.0	13.0
Sample size (Transects)	16	6		19	11		6	5

* Mean distance between lowest and highest point on the horizontal transect line
~ No data

Table 23. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in San Isidro-Dau Marine Sanctuary in 2007.

FAMILY	Sanctuary							
	n = 6							
	# of species	SE	Count per size class (Abundance)				Total abundance	SE
			1-10 cm**	11-20 cm	21-30 cm	>30 cm		
Surgeonfish (*Acanthurids*)*	2.2	0.5	2.7	3.7	1.5	0.0	7.8	3.1
Rabbitfish (*Siganids*)*	1.5	0.7	0.0	2.8	0.7	0.0	3.5	1.6
Groupers (*Serranids*)*	1.2	0.6	0.7	1.8	0.7	0.0	3.2	1.9
Barramundi Cod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (*Lutjanids*)*	0.3	0.2	0.0	1.2	0.0	0.2	1.3	0.9
Sweetlips (*Haemulids*)	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Emperors (*Lethrinids*)*	0.7	0.4	0.0	1.2	0.0	0.3	1.5	1.1
Jacks (*Carangids*)*	0.3	0.2	0.0	0.0	1.0	0.0	1.0	0.6
Fusiliers (*Caesionids*)*	1.0	0.4	5.0	26.7	4.2	0.0	35.8	15.6
Spinecheeks (*Nemipterids*)*	1.5	0.4	1.0	2.8	0.0	0.0	3.8	1.5
Goatfish (*Mullids*)*	1.8	0.5	1.5	4.5	1.0	0.0	7.0	3.0
Parrotfish (*Scarids*)*	4.2	0.7	0.0	7.8	5.3	1.7	14.8	3.2
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (*Balistids*)	1.3	0.4	0.3	2.0	0.3	0.0	2.7	1.1
Butterflyfish (*Chaetodontids*)	3.7	0.9	4.0	3.3	0.3	0.0	7.7	1.9
Angelfish (*Pomacanthids*)	2.2	0.3	4.2	1.5	0.3	0.0	6.0	0.7
Wrasses (*Labrids*)	9.5	1.2	22.3	7.5	2.2	0.0	32.0	8.9
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (*Pomacentrids*)	15.7	1.6	835.3	0.0	0.0	0.0	835.3	238.9
Fairy Basslets (*Anthids*)	1.5	0.2	383.0	0.0	0.0	0.0	383.0	54.5
Moorish Idol (*Zanclids*)	0.5	0.2	0.0	0.8	0.0	0.0	0.8	0.4
Total (all reef species)	**49.2**	**4.4**	**1260.0**	**67.8**	**17.5**	**2.2**	**1347.5**	**308.7**
Total (target reef species)*	**14.8**	**4.0**	**9.2**	**51.0**	**14.3**	**2.2**	**76.7**	**26.4**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 24. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in San Isidro-Dau Marine Sanctuary from 2003 to 2007.

FAMILY	Sanctuary		% Difference in abundance 2003-2007	Non-Sanctuary
	2003	2007		2003
	n = 4	n = 6		n = 4
Surgeonfish (*Acanthurids*)*	2.5	7.8	213.3	2.8
Rabbitfish (*Siganids*)*	0.8	3.5	366.7	0.5
Groupers (*Serranids*)*	0.5	3.2	533.3	0.3
Barramundi Cod	0.0	0.0	N/A	0.0
Snapper (*Lutjanids*)*	1.0	1.3	33.3	0.5
Sweetlips (*Haemulids*)	0.0	0.2	+	0.0
Emperors (*Lethrinids*)*	1.3	1.5	20.0	0.0
Jacks (*Carangids*)*	0.0	1.0	+	0.0
Fusiliers (*Caesionids*)*	0.0	35.8	+	15.0
Spinecheeks (*Nemipterids*)*	0.8	3.8	411.1	4.5
Goatfish (*Mullids*)*	0.8	7.0	833.3	6.3
Parrotfish (*Scarids*)*	3.0	14.8	394.4	3.5
Bumphead parrotfish	0.0	0.0	N/A	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	N/A	0.0
Triggerfish (*Balistids*)	2.0	2.7	33.3	0.0
Butterflyfish (*Chaetodontids*)	6.8	7.7	13.6	7.8
Angelfish (*Pomacanthids*)	5.0	6.0	20.0	5.3
Wrasses (*Labrids*)	78.3	32.0	-59.1	181.0
Humphead wrasse	0.0	0.0	N/A	0.0
Damselfish (*Pomacentrids*)	662.8	835.3	26.0	907.3
Fairy Basslets (*Anthids*)	167.5	383.0	128.7	303.8
Moorish Idol (*Zanclids*)	1.8	0.8	-52.4	1.5
Total (all reef species)	**934.5**	**1347.5**	**44.2**	**1439.8**
Total (target reef species)*	**10.5**	**76.7**	**630.2**	**33.3**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 25. Mean (±SE) fish species (species/500m^2) and percentage change between years in San Isidro-Dau Marine Sanctuary from 2003 to 2007.

FAMILY	Sanctuary		% Difference in species 2003-2007	Non-sanctuary
	2003	2007		2003
	n = 4	n = 6		n = 4
Surgeonfish (*Acanthurids*)*	1.8	2.2	23.8	1.0
Rabbitfish (*Siganids*)*	0.5	1.5	200.0	0.3
Groupers (*Serranids*)*	0.5	1.2	133.3	0.3
Barramundi Cod	0.0	0.0	N/A	0.0
Snapper (*Lutjanids*)*	0.5	0.3	-33.3	0.3
Sweetlips (*Haemulids*)	0.0	0.2	+	0.0
Emperors (*Lethrinids*)*	0.5	0.7	33.3	0.0
Jacks (*Carangids*)*	0.0	0.3	+	0.0
Fusiliers (*Caesionids*)*	0.0	1.0	+	0.8
Spinecheeks (*Nemipterids*)*	0.5	1.5	200.0	1.3
Goatfish (*Mullids*)*	0.3	1.8	633.3	1.3
Parrotfish (*Scarids*)*	1.8	4.2	138.1	2.0
Bumphead parrotfish	0.0	0.0	N/A	0.0
Rudderfish (*Kyphosids*)*	0.0	0.0	N/A	0.0
Triggerfish (*Balistids*)	1.3	1.3	6.7	0.0
Butterflyfish (*Chaetodontids*)	3.3	3.7	12.8	3.0
Angelfish (*Pomacanthids*)	3.0	2.2	-27.8	1.5
Wrasses (*Labrids*)	10.3	9.5	-7.3	10.8
Humphead wrasse	0.0	0.0	N/A	0.0
Damselfish (*Pomacentrids*)	14.3	15.7	9.9	18.5
Fairy Basslets (*Anthids*)	1.5	1.5	0.0	1.5
Moorish Idol (*Zanclids*)	0.8	0.5	-33.3	0.3
Total (all reef species)	**40.5**	**49.2**	**21.4**	**42.5**
Total (target reef species)*	**6.3**	**14.8**	**137.3**	**7.0**

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 26. Changes in substrate composition (% mean ±SE) in Pamilacan Marine Sanctuary, Baclayon from 1984 to 2007.

TYPE OF SUBSTRATUM	Sanctuary											Non-Sanctuary										
	SCUBA						SNORKEL					SCUBA							SNORKEL			
	1984	1992	1999	2003	2007	% Change 2003-2007	1992	1999	2003	2007	% Change 2003-2007	1984	1985	1992	1999	2003	2007	% Change 2003-2007	1992	1999	2003	% Change 2003-2007
Non-living:																						
Sand and silt	30.8	17.8	21.3	14.5	20.7	42.5	22.8	19.7	18.1	15.0	-17.1	~	37.6	32.1	34.5	52.6	61.0	16.0	25.4	31.9	16.9	-47.0
Coral rubble	31.1	21.4	12.6	18.8	6.5	-65.4	20.0	18.5	6.8	14.9	119.6	~	15.0	13.0	21.3	23.2	8.0	-65.5	15.5	10.5	3.7	-65.1
Rock and block	19.2	38.8	53.4	24.2	29.0	19.7	33.3	45.3	47.4	39.4	-16.8	~	21.0	19.1	19.0	6.4	9.8	51.3	17.3	27.2	24.3	-10.8
White dead standing coral	1.4	2.7	0.1	0.3	0.1	-75.0	2.5	0.0	0.0	0.6	1900.0	~	0.7	2.3	0.2	0.3	0.0	-100.0	2.8	0.6	0.1	-91.7
Dead coral with algae	0.0	~	3.0	2.1	5.4	163.5	0.0	3.1	0.1	0.0	-100.0	~	0.0	~	5.3	1.8	0.9	-50.3	0.0	3.6	0.9	-75.0
SUBTOTAL non-living	**82.4**	**80.7**	**90.4**	**59.9**	**61.7**	**3.0**	**78.7**	**86.6**	**72.5**	**70.0**	**-3.5**	**61.0**	**74.2**	**66.5**	**80.3**	**84.4**	**79.7**	**-5.6**	**61.0**	**73.8**	**45.8**	**-38.0**
Living:																						
Hard coral:																						
Branching	2.8	~	6.1	25.6	26.5	3.5	4.4	~	3.1	2.3	-27.6	~	3.3	~	3.8	2.4	3.2	32.6	14.3	~	3.0	N/A
Massive	3.3	~	0.8	3.6	2.2	-39.1	3.9	~	1.9	0.6	-69.4	~	2.2	~	1.7	0.4	0.9	135.7	4.6	~	3.8	N/A
Flat/Encrusting	0.2	~	0.4	2.9	2.7	-9.4	0.7	~	0.4	0.2	-36.1	~	1.0	~	0.2	0.0	1.0	+	0.8	~	0.2	N/A
Foliose/Cup	0.0	~	0.4	0.9	0.3	-73.5	0.7	~	0.1	0.0	-100.0	~	0.5	~	0.0	0.1	0.3	125.0	3.2	~	0.1	N/A
Subtotal hard coral	**6.3**	**9.5**	**7.7**	**33.1**	**31.6**	**-4.5**	**9.7**	**4.1**	**5.5**	**3.1**	**-44.0**	**11.0**	**7.0**	**19.4**	**5.7**	**2.9**	**5.3**	**84.6**	**22.9**	**10.4**	**7.1**	**-31.9**
Soft coral	11.2	9.8	2.1	2.2	5.2	138.5	11.7	9.4	19.0	21.5	13.5	28.0	18.8	13.4	14.3	10.8	9.8	-10.1	16.0	15.7	31.8	102.5
SUBTOTAL corals	**17.5**	**19.3**	**9.8**	**35.2**	**36.8**	**4.3**	**21.4**	**13.5**	**24.4**	**24.6**	**0.6**	**39.0**	**25.8**	**32.8**	**20.0**	**13.7**	**15.1**	**9.8**	**38.8**	**26.1**	**38.9**	**48.9**
Others:																						
Other animals	~	~	~	0.4	0.5	28.6	~	~	0.0	1.3	+	~	~	~	~	0.3	0.4	50.0	~	~	0.0	N/A
Seagrasses	0.0	0.0	0.0	0.0	0.0	N/A	0.0	10.8	0.3	1.1	243.4	0.0	0.0	0.0	0.0	0.2	0.0	-100.0	0.0	29.9	4.6	-84.8
Algae																						
Fleshy	~	~	~	0.2	0.3	12.5	~	~	1.1	2.9	156.0	~	~	~	~	0.1	3.3	2825.0	~	~	6.8	N/A
Turf	~	~	~	1.2	0.2	-85.7	~	~	0.7	0.0	-100.0	~	~	~	~	0.7	0.2	-77.3	~	~	1.4	N/A
Coralline	~	~	~	1.6	0.0	-100.0	~	~	0.2	0.1	-71.0	~	~	~	~	0.1	0.5	800.0	~	~	1.2	N/A
Sponges	~	~	~	1.6	0.7	-57.1	~	~	0.6	0.1	-89.4	~	~	~	~	0.4	0.9	106.3	~	~	1.4	N/A
SUBTOTAL others	**0.0**	**0.0**	**0.0**	**4.9**	**1.6**	**-67.6**	**0.0**	**10.8**	**3.1**	**5.4**	**77.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.8**	**5.3**	**184.6**	**0.0**	**29.9**	**15.4**	**-48.7**
GRAND TOTAL	**100**	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**	**100**	**100**		**100**	**100**	**100**	
Other relevant information																						
Slope (degrees)	~	~	11.7	76.9	39.0		~	~	5.7	12.5		~	~	~	0.7	8.3	12.0		~	2.0	3.3	
Topography* (m)	0.8	2.0	2.2	1.6	1.0		1.5	0.8	0.0	0.4		1.0	1.0	1.0	2.4	7.0	0.9		1.5	1.4	1.5	
Depth range/average (m)	7.2	6.0	5.9	7.0	7.3		3.8	2.6	2.9	2.0		6.7	7.5	7.5	5.4	7.1	7.3		3.2	2.8	2.6	
Visibility (m)	~	20.0	19.0	14.9	13.2		~	19.9	16.3	10.4		~	~	~	31.2	15.0	13.8		~	28.8	16.9	
Sample size (Transects)	2	16	18	9	6		11	11	10	10		4	4	3	6	9	6		11	14	12	

* Mean distance between lowest and highest point on the horizontal transect line
∞ Data not included in grand total (S26)
~ No data

Table 27. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Pamilacan Marine Sanctuary in 2007.

FAMILY	Sanctuary n = 6								Non-Sanctuary n = 5							
	# of species	SE	Count per size class (Abundance) 1-10 cm**	11-20 cm	21-30 cm	>30 cm	Total abundance	SE	# of species	SE	Count per size class (Abundance) 1-10 cm**	11-20 cm	21-30 cm	>30 cm	Total abundance	SE
Surgeonfish (*Acanthurids*)*	2.8	0.3	2.0	8.3	3.2	0.8	14.3	5.3	0.6	0.4	0.0	0.2	0.0	0.0	0.2	0.20
Rabbitfish (*Siganids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.8	0.80
Groupers (*Serranids*)*	0.5	0.3	0.0	0.3	0.2	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Barramundi Cod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Snapper (*Lutjanids*)*	0.3	0.2	0.0	0.2	0.2	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Sweetlips (*Haemulids*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Emperors (*Lethrinids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	1.0	0.0	0.0	1.0	1.00
Jacks (*Carangids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Fusiliers (*Caesionids*)*	0.5	0.3	30.0	91.7	0.0	0.0	121.7	98.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Spinecheeks (*Nemipterids*)*	0.7	0.2	1.8	0.8	0.0	0.0	2.7	1.4	0.8	0.5	0.6	1.6	0.0	0.0	2.2	1.43
Goatfish (*Mullids*)*	1.2	0.4	1.5	1.3	0.3	0.0	3.2	1.4	2.4	0.4	0.2	8.4	1.6	0.0	10.2	2.54
Parrotfish (*Scarids*)*	3.0	0.7	0.0	6.7	6.2	0.5	13.3	4.5	0.6	0.4	0.6	0.6	0.4	0.0	1.6	1.03
Bumphead parrotfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Triggerfish (*Balistids*)	0.5	0.2	0.0	1.2	0.0	0.0	1.2	0.7	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.20
Butterflyfish (*Chaetodontids*)	2.5	0.8	1.3	3.7	0.0	0.0	5.0	1.9	1.4	0.6	1.8	1.2	0.0	0.0	3.0	1.34
Angelfish (*Pomacanthids*)	1.3	0.4	5.2	1.2	0.0	0.0	6.3	3.8	1.6	0.2	7.6	1.2	0.0	0.0	8.8	2.56
Wrasses (*Labrids*)	6.3	0.5	101.7	10.5	0.2	0.0	112.3	55.4	8.8	1.5	60.6	13.4	1.2	0.0	75.2	26.64
Humphead wrasse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Damselfish (*Pomacentrids*)	13.3	2.0	525.5	1.5	0.0	0.0	527.0	175.3	9.2	0.4	729.0	0.0	0.0	0.0	729.0	140.60
Fairy Basslets (*Anthids*)	1.3	0.2	477.2	0.0	0.0	0.0	477.2	101.1	1.6	0.2	303.6	0.0	0.0	0.0	303.6	32.63
Moorish Idol (*Zanclids*)	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Total (all reef species)	**34.5**	**2.6**	**1146.2**	**127.5**	**10.2**	**1.3**	**1285.2**	**219.7**	**27.4**	**2.4**	**1104.0**	**28.6**	**3.2**	**0.0**	**1135.8**	**149.13**
Total (target reef species)*	**9.0**	**1.9**	**33.3**	**109.3**	**10.0**	**1.3**	**154.0**	**99.1**	**4.6**	**1.2**	**1.4**	**12.6**	**2.0**	**0.0**	**16.0**	**3.96**

* Target species/families

** Surgeonfish in this size class are not included as targets

Table 28. Mean (±SE) density (individuals/500m^2) and percentage change of fish families between years in Pamilacan Marine Sanctuary from 1986 to 2007.

FAMILY	Sanctuary						% Difference in abundance 2003-2007	Non-Sanctuary				% Difference in abundance 2003 2007
	1985	1986	1992	1999	2003	2007		1985	1999	2003	2007	
	n = 3	n=6	n = 3	n = 5	n = 4	n = 6		n = 11	n = 1	n = 4	n = 5	
Surgeonfish (*Acanthurids*)*	244.7	279.1	262.8	179.3	28.5	14.3	-49.7	225.4	35.0	0.3	0.2	-20.0
Rabbitfish (*Siganids*)*	4.0	~	0.2	1.0	0.3	0.0	-100.0	1.3	0.0	0.0	0.8	+
Groupers (*Serranids*)*	0.3	2.1	3.0	1.3	1.0	0.5	-50.0	0.5	0.0	0.3	0.0	-100.0
Barramundi Cod	~	~	~	~	0.0	0.0	N/A		~	0.0	0.0	N/A
Snapper (*Lutjanids*)*	2.0	12.5	7.0	0.7	0.5	0.3	-33.3	5.6	3.0	0.0	0.0	N/A
Sweetlips (*Haemulids*)	0.0	4.8	2.0	0.0	0.8	0.0	-100.0	1.0	0.0	0.0	0.0	N/A
Emperors (*Lethrinids*)*	0.0	#	7.2	0.0	1.0	0.0	-100.0	0.4	0.0	0.0	1.0	+
Jacks (*Carangids*)*	3.0	2.7	0.0	0.0	11.5	0.0	-100.0	0.8	0.0	0.0	0.0	N/A
Fusiliers (*Caesionids*)*	1205.0	765.2	173.2	225.3	175.5	121.7	-30.7	419.7	0.0	7.5	0.0	-100.0
Spinecheeks (*Nemipterids*)*	6.0	#	4.4	3.7	0.8	2.7	255.6	7.1	0.0	0.0	2.2	+
Goatfish (*Mullids*)*	185.0	47.3	52.2	8.0	2.0	3.2	58.3	24.3	9.0	3.0	10.2	240.0
Parrotfish (*Scarids*)*	65.0	60.6	71.4	129.0	38.3	13.3	-65.1	103.7	0.0	6.8	1.6	-76.3
Bumphead parrotfish	~	~	~	~	0.0	0.0	N/A		~	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	N/A
Triggerfish (*Balistids*)	2.0	2.5	3.6	7.3	1.5	1.2	-22.2	6.2	0.0	0.0	0.2	+
Butterflyfish (*Chaetodontids*)	35.0	34.0	25.0	18.7	7.0	5.0	-28.6	34.1	4.0	3.3	3.0	-7.7
Angelfish (*Pomacanthids*)	8.7	22.6	23.6	9.3	4.5	6.3	40.7	16.2	9.0	5.5	8.8	60.0
Wrasses (*Labrids*)	38.0	42.1	111.0	44.7	126.0	112.3	-10.8	55.4	87.0	92.3	75.2	-18.5
Humphead wrasse	~	~	~	~	0.0	0.0	N/A		~	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	387.0	965.1	888.0	1458.3	1182.5	527.0	-55.4	1316.7	1381.0	1002.8	729.0	-27.3
Fairy Basslets (*Anthids*)	263.0	445.6	475.2	428.7	457.5	477.2	4.3	336.4	138.0	57.5	303.6	428.0
Moorish Idol (*Zanclids*)	9.0	8.7	7.2	2.3	3.5	0.2	-95.2	7.5	0.0	0.0	0.0	N/A
Total (all reef species)	**2457.7**	**2694.9**	**2117.0**	**2517.6**	**2042.5**	**1285.2**	**-37.1**	**2562.2**	**1666.0**	**1179.0**	**1135.8**	**-3.7**
Total (target reef species)*	**1715.0**	**1174.3**	**583.4**	**548.3**	**254.5**	**154.0**	**-39.5**	**789.8**	**47.0**	**17.8**	**16.0**	**-9.9**

** MCDP 1986

Emperors and Spinecheeks combined with Snapper in 1986 data

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 29. Mean (±SE) fish species (species/500m^2) and percentage change between years in Pamilacan Marine Sanctuary from 1986 to 2007.

FAMILY	Sanctuary						% Difference in species 2003-2007	Non-Sanctuary				% Difference in species 2003-2007
	1985	1986	1992	1999	2003	2007		1985	1999	2003	2007	
	n =	n = 5	n = 3	n = 5	n = 4	n = 6		n = 11	n = 1	n = 4	n = 5	
Surgeonfish (*Acanthurids*)*	9.3	12.1	8.2	8.3	4.8	2.8	-40.4	7.0	2.0	0.3	0.6	140.0
Rabbitfish (*Siganids*)*	0.7	0.7	0.2	0.3	0.3	0.0	-100.0	0.4	0.0	0.0	0.0	N/A
Groupers (*Serranids*)*	0.3	1.6	1.4	0.7	0.8	0.5	-33.3	0.5	0.0	0.3	0.0	-100.0
Barramundi Cod	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Snapper (*Lutjanids*)*	0.7	1.9	1.8	0.7	0.5	0.3	-33.3	1.3	1.0	0.0	0.0	N/A
Sweetlips (*Haemulids*)	0.0	0.6	0.4	0.0	0.5	0.0	-100.0	0.3	0.0	0.0	0.0	N/A
Emperors (*Lethrinids*)*	0.0	0.3	0.8	0.0	0.8	0.0	-100.0	0.2	0.0	0.0	0.2	+
Jacks (*Carangids*)*	0.3	0.7	0.0	0.0	1.0	0.0	-100.0	0.1	0.0	0.0	0.0	N/A
Fusiliers (*Caesionids*)*	2.3	2.4	1.2	1.0	0.8	0.5	-33.3	1.4	0.0	0.3	0.0	-100.0
Spinecheeks (*Nemipterids*)*	0.7	0.6	0.8	0.7	0.8	0.7	-11.1	1.1	0.0	0.0	0.8	+
Goatfish (*Mullids*)*	1.0	1.0	1.0	1.0	1.0	1.2	16.7	1.0	1.0	2.3	2.4	6.7
Parrotfish (*Scarids*)*	1.0	1.0	1.0	1.0	6.3	3.0	-52.0	1.0	0.0	2.3	0.6	-73.3
Bumphead parrotfish	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Rudderfish (*Kyphosids*)*	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	N/A
Triggerfish (*Balistids*)	1.3	1.3	0.8	2.0	0.8	0.5	-33.3	1.5	0.0	0.0	0.2	+
Butterflyfish (*Chaetodontids*)	7.7	11.1	6.0	5.7	3.0	2.5	-16.7	5.4	1.0	1.8	1.4	-20.0
Angelfish (*Pomacanthids*)	6.0	2.7	3.2	3.0	2.0	1.3	-33.3	2.4	1.0	1.8	1.6	-8.6
Wrasses (*Labrids*)	4.3	6.0	5.4	4.3	7.5	6.3	-15.6	5.3	7.0	9.3	8.8	-4.9
Humphead wrasse	~	~	~	~	0.0	0.0	N/A	~	~	0.0	0.0	N/A
Damselfish (*Pomacentrids*)	9.0	12.4	12.8	13.3	15.5	13.3	-14.0	10.5	16.0	8.8	9.2	5.1
Fairy Basslets (*Anthids*)	1.7	1.9	1.6	1.3	1.8	1.3	-23.8	1.3	2.0	0.8	1.6	113.3
Moorish Idol (*Zanclids*)	1.0	1.0	0.8	0.7	0.5	0.2	-66.7	0.7	0.0	0.0	0.0	N/A
Total (all reef species)	**47.3**	**59.3**	**47.4**	**44.0**	**48.3**	**34.5**	**-28.5**	**41.1**	**31.0**	**27.5**	**27.4**	**-0.4**
Total (target reef species)*	**16.3**	**22.9**	**16.8**	**13.7**	**17.3**	**9.0**	**-47.8**	**14.2**	**4.0**	**5.3**	**4.6**	**-12.4**

** MCDP 1986

Emperors and Spinecheeks combined with Snapper in 1986 data

* Target species/families

% change = $\{(Yr_2/Yr_1)-1\} \times 100$

(-) = decrease

(+) = increase

~ No data available

Table 30. MPA Management Rating for all sites surveyed in Bohol.

Municipality	Dauis	Baclayon	Panglao				
MPA NAME / CRITERIA OR ACTIVITY SATISFIED	San Isidro-Dau	Pamilacan Island	Bolod	Tawala	Doljo	Bil-isan	Balicasag Island
Level I: MPA Initiated: Passing (Year 1) (6 points required)							
MPA concept accepted	1	1	1	1	1	1	1
Site surveyed using standard/accepted methods with baseline assessment complete, preferably conducted in a participatory process	1	1	1	1	1	1	1
Site selected	1	1	1	1	1	1	1
Education program raising awareness about MPA functions and benefits started	1	1	1	1	1	1	1
Social acceptance sought	1	1	1	1	1	1	1
Management body membership tentatively determined	1	1	1	1	1	1	1
Preliminary management plan drafted	1	1	1	1	1	1	1
Totals	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Level II: MPA Established: Fair (Year 1 or 2) (16 points required)							
Community acceptance gained and documented	1	1	1	1	1	1	1
Ordinance passed and approved by the Municipal Council	1	1	1	1	1	1	1
Management body formally organized and recognized	1	1	1	1	1	1	1
Management plan adopted by community and LGU or PAMB	1	1	1	1	1	1	1
Management activities started	1	1	1	1	1	1	1
Biophysical monitoring includes local participation	1	1	1	1	1	1	1
IEC activities conducted to raise understanding on MPA rules and regulations	1	1	1	1	1	1	1
Anchor buoys, marker buoys and/or boundary markers installed	1	1	1	1	1	1	1
MPA rules and guidelines posted at strategic locations	1	1	1	1	1	1	1
MPA outpost or other structures constructed	1	1	1	1	0	1	0
Totals	**10**	**10**	**10**	**10**	**9**	**10**	**9**
Level III: MPA Enforced: Good (Year 2 or older) (24 points required)							
Education program sustained public awareness and compliance	0	0	0	0	0	0	0
Regular biophysical monitoring measuring habitat condition and changes conducted	1	1	1	1	1	1	1
Collaborative patrolling and surveillance conducted by mandated enforcement group and local community volunteers	0	1	1	1	1	1	1
MPA billboard signs, boundary markers and anchor buoys maintained	1	1	1	1	1	1	1
Management body active	1	1	1	1	1	1	1

Municipality	Dauis	Baclayon	Panglao				
MPA NAME / CRITERIA OR ACTIVITY SATISFIED	San Isidro-Dau	Pamilacan Island	Bolod	Tawala	Doljo	Bil-isan	Balicasag Island
Budget from local gov't or from other sources allocated and is accessible for MPA mgmt	1	1	1	1	1	1	1
Fishing effectively stopped inside of sanctuary zone	0	0	0	1	0	1	1
Illegal and destructive fishing reduced outside of MPA	1	1	1	1	1	1	1
Totals	**5**	**6**	**6**	**7**	**6**	**7**	**7**
Level IV: MPA Sustained: Very Good (Year 3 or older) (30 points required)							
MPA management plan updated in a participatory process	1	1	1	0	1	1	1
Annual biophysical monitoring and feedback of results supervised by the managing body and implemented for 2 years or more	1	1	1	1	1	1	1
Budget from government or from other sources allocated and was accessed for 2 or more consecutive years	1	1	1	1	1	1	1
Management body trained and capacitated to run the MPA independently	1	1	1	1	1	1	1
Enforcement system fully operational	1	1	1	1	1	1	1
Illegal and destructive activities stopped inside and within the vicinity of MPA	0	0	1	1	0	1	1
Environment friendly enterprise and/or user fees collected as a sustainable financing strategy	0	0	0	0	0	0	0
Totals	**5**	**5**	**6**	**5**	**5**	**6**	**6**
Level V: MPA Institutionalized: Excellent (Year 4 or older) (40 points required)							
Information and education program on MPAs maintained over the years	0	0	0	0	0	0	0
Ordinance passed by the Provincial Council giving MPA stronger political support	0	0	0	0	0	0	0
Management plan refined for adaptive management	0	0	0	0	0	0	0
Management plan incorporated in the LGU development plan	1	1	1	1	1	1	1
Evaluation of impacts on ecology & socio-economy conducted & feedback of results completed	0	0	0	0	0	0	0
Revenues from enterprise and/or user fees sustained and accounted for	0	0	0	0	0	0	0
Totals	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Points accumulated	**28**	**29**	**30**	**30**	**28**	**31**	**30**
Rating level achieved	**III**	**III**	**IV**	**IV**	**III**	**IV**	**IV**
Implementation phase	Enforced	Enforced	Sustained	Sustained	Enforced	Sustained	Sustained
Performance in management	Good	Good	Very Good	Very Good	Good	Very Good	Very Good

* The MPA Rating System is used by the Marine Protected Area Project supported by the Pew Fellows Program, NOAA and CIDA as a tool for evaluating MPA management progress. This system is adopted by the members of the MPA Management Monitoring Network in the Philippines

Table 31. Basic information and management rating of marine sanctuaries surveyed in Bohol.

MUNICIPALITY	PANGLAO				
MPA NAME / BASIC INFO	Balicasag	Bolod	Tawala	Doljo	Bil-isan
DATE ESTABLISHED	1985	1998	1998	1986	1998
MPA SIZE	Core zone: 5.40 hectares	Core zone: 3.86 hectares	Core zone: 5.40 hectares	Core zone: 7.32 hectares	Core zone: 8.16 hectares
CORE ZONE REGULATIONS	NOT ALLOWED: No entry or passage of motorized boats and vessels (w/ exemptions); No taking, disturbing or killing of fish and other marine life and aquatic products; No swimming, snorkeling and diving. POLICIES: Research works permitted by DENR, DA-BFAR and other national agencies subject to the approval of the Municipal Government. (MO No.2 Series of 2005)				
BUFFER ZONE REGULATIONS	NOT ALLOWED: No take zone, except for marginal fishers from the barangay where the MPA is located. Only hook and line and spear fishing is allowed; No fish corrals, cages and pens w/in 200 meters from buffer zone. POLICIES: Educational field trips/guided tours approved and w/ appropriate fees as maybe imposed by MPA Management Team & PO; Diving & snorkeling w/ permission from mayor/barangay captain & MPA Management Team w/ fee. Maximum of 15 pax/day. A group of 5 divers/snorkelers at a time, max. of 2hrs/group. (MO No.2 Series of 2005)				
GENERAL PROHIBITIONS	No disposal of wastes; No removal and destruction of MPA structures; No docking of boats and dropping of anchors. (MO No.2 Series of 2005)				
USER FEES	Diving & snorkeling are only allowed in the buffer zone. Fees in peso: Diving-150 (foreigner), 50 (local); Diving w/ camera-150; Diving w/ video-250; Snorkeling-25; Sight seeing-5; Research fee-50. (MO No.2 Series of 2005)				
MANAGING GROUP	BIUPOP	Barangay	Barangay	PO	PO
ASSISTING GROUP					
MGMT RATING	Level 3, MPA is enforceded	Level 1, MPA is initiated	Level 2, MPA is established	Level 2, MPA is established	Level 1, MPA is initiated
MGMT ASSESSMENT	Good	Passing	Fair	Fair	Passing

** Management Rating is part of the MPA Database System promoted by the CCE Foundation (Appendix 6).*

MUNICIPALITY	DAUIS	BACLAYON
MPA NAME / BASIC INFO	Dao-San Isidro	Pamilacan Island
DATE ESTABLISHED	2002	1985
MPA SIZE	Core zone: 11.1 hectares	Core zone: 11.90 hectares --> The entire coral reef area surrounding Pamilacan Island is a marine reserve. (MO No. 8 Series of 1985)
CORE ZONE REGULATIONS	NOT ALLOWED: No entry & passage of boats & vessels, except in emergency situations; No taking, disturbing or killing of fish and other marine life and aquatic products; No swimming, snorkeling and diving. POLICIES: Research works permitted by DENR, DA-BFAR and other national agencies subject to the approval of the Municipal & Barangay Government, MPA Management Team & PO; Diving & snorkeling w/ permission from mayor/barangay captain & MPA Management Team w/ fee. Maximum of 15 pax/day. A group of 5 divers/snorkelers at a time, max. of 2hrs/group. (MO No.7 Series of 2005)	No fishing or collecting of any marine organism; Anchoring of boats is permitted only in the traditional sandy beach areas; Breeding stock for giant *Tridacna* clams & other marine organisms w/ potential economic value for the locals be placed & protected from collection. (MO No. 8 Series of 1985)
BUFFER ZONE REGULATIONS	NOT ALLOWED: No take zone, except for small fishers from the barangay where the MPA is located. Only hook and line w/ 5 hooks is allowed; No fish corrals, cages and pens w/in 200 meters from buffer zone; No seaweed farm/culture w/in 200 meters from buffer zone. POLICIES: Educational field trips/guided tours approved and w/ appropriate fees as maybe imposed by MPA Management Team & PO; Recreation activities authorized by MPA Management Team & PO w/ appropriate fees. (MO No.7 Series of 2005)	This is also called a traditional fishing area where all illegal & destructive fishing is strictly prohibited. Fishing methods allowed are hook & line, bamboo traps, gill nets, spearfishing w/out underwater breathing device, non-destructive netting, and traditional gleaning. (MO No. 8 Series of 1985)
GENERAL PROHIBITIONS	Wearing of gloves is not allowed when diving & snorkeling; No disposal of wastes; No removal and destruction of MPA structures; No dropping of anchors. (MO No.7 Series of 2005)	None mentioned
USER FEES	Fees in peso. Dauis residents have 50% discount: Diving-100; Diving w/ camera-300; Diving w/ video-500; Snorkeling-50; Sight seeing-10; Mooring fee (if necessity calls)-200/boat Research fee-50/research/day. (MO No.7 Series of 2005)	None
MANAGING GROUP	Barangay + PO	PO
ASSISTING GROUP		
MGMT RATING	Level 1, MPA is initiated	Level 4, MPA is sustained
MGMT ASSESSMENT	Passing	Very good

** Management Rating is part of the MPA Database System promoted by the CCE Foundation (Appendix 6).*

Table 32. Synthesis of community interview infomation collected for sites surveyed in Bohol.

Municipality	Dauis	Baclayon	Panglao	Panglao
MPA Name	**Dao-San Isidro**	**Pamilacan Island**	**Bolod**	**Tawala**
No. of respondents	3	6	5	2
Education attainment	High school (1) and college (2)	Elementary (1); high school (4), and; college (1).	Elementary (1); high school (3), and; college (1).	Elementary (2)
Common livelihood	Elected official, resort employee, and development worker	Elected official; fishing; boat rental, and; catering.	Elected official; grill cook and; maintenance work.	Elected officials
Additional livelihood	Livestock raising	Livestock raising; fishing, and; boat rental for dolphin-watching.	Fishing; livestock raising; coconut wine-making, and; small store business.	Carpentry and farming
Average monthly income	4,500	5,375	4,800	500
Affiliation	San Isidro Fisherfolk Organization; Dao Farmers and Fishermen's Association, and; PADAYON	Pamilacan Fishermen Association, and; PIDWO	Barangay Council; *Matinabangang Pondok sa Barangay sa Bolod* (MAPOBO)	Farmers' Association
Knowledge				
Yes	3	6	5	2
No	0	0	0	0
Attitude				
Positive	3	6	5	2
Negative	0	0	0	0
Fish catch perception				
Increase	3	4	3	2
Decrease	0	2	1	0
Undecided	0	0	1	0
Change related to MPA				
Yes	3	4	3	2
No	0	1	0	0
Undecided	0	1	2	0
Tourism activities				
Beneficial	1	4	2	2
Non-beneficial	2	2	1	0
Undecided	0		2	0
Common livelihood other than fishing	Farming; Construction work; Carpentry; employed,and; store business.	Livestock raising; farming (ex. onion, corn), and; coconut wine-making.	Farming; construction work; carpentry; boat rental, and; employed.	Employed in resorts; carpentry; metal craft; boatman, and; dolphin-watching guide.
Assessment of MPA Management	Average (3)	Average (3); good (1), and; excellent (2).	Average (1); Good (2)	Average (1); Good (1)

Table 32. Synthesis of community interview infomation collected for sites surveyed in Bohol.

Municipality	Dauis	Baclayon	Panglao	Panglao
MPA Name	**Dao-San Isidro**	**Pamilacan Island**	**Bolod**	**Tawala**
Problems/difficulties in management	Materials for the guardhouse (e.g. flashlights); no budget for maintenance; no honorarium for guard; Sustainability, and; *Barangay* Dao is not doing its share of work.	Lost of trust on some officers; there are still violators from Pamilacan, and; commercial fishing.	Illegal fishing (spear & poison fishing); Badjao fishers; Lack of support from the Municipal Government.	Dealing with dive violators
Suggestions for management	Implementation of user-fee to raise funds; commitment from all members, and; there's need to resolve conflict between Dao and San Isidro.	Change officers; implement a user-fee system; guardhouse for enforcement, and; trainings for the local government.	Teamwork is needed to improve management & enforcement; land from government, and; outpost and boat for enforcement.	Pumpboat for enforcement
Linkages	BMT; FCB; Life Foundation ,and; Philipppine Australian Community Assistance Program (PACAP).	SUML; BMT-PADAYON; ELAC; BEMO; DOT, and; DENR.	Municipality of Panglao; Diveshop operators; SUML; SUAKCREM, and; BIDEF.	BMT; WWF; BEMO, and; Canadian Executive Service Organization.
CRM problems/issues	Budget; weak law enforcement, and; multiple resource use conflict.	Weak law enforcement; lack of institution support, and; politics.	Budget; weak law enforcement, and; politics.	Weak law enforcement; budget, and; lack of institutional support.
Threats to fishery resources	Illegal/destructive fishing; illegal foreshore development, and; lack of community awareness and support.	Commercial fishing; increasing population, and; exploitation.	Illegal/ destructive fishing; Increasing population, and; commercial fishing.	illegal/destructive fishing, and; Increasing population.

Table 32. Synthesis of community interview infomation collected for sites surveyed in Bohol.

Municipality	Panglao	Panglao	Panglao
MPA Name	**Doljo**	**Bil-isan**	**Balicasag Island**
No. of respondents	4	6	4
Education attainment	High school (2); College (2)	Elementary (3); high school (1); college (1), and; vocational (1).	Elementary (2); high school (1), and; college (1).
Common livelihood	Elected official; fishing; maintenance boy, and; resort manager.	Fishing; *Brgy* health worker, and; resort employee.	Fishing
Additional livelihood	Vending; motorcycle transport	Carpentry; Fishing	Boat rental; construction work, and; vending.
Average monthly income	3,700	2,375	3,700
Affiliation	*Barangay* Council; Doljo-Panglao Fishermen's Association, and; Youth Group.	Bil-isan Fishermen Association (BIFA); Panglao People's Organization Federation; *Barangay* Health Workers Group, and; Deep Blue Dive Shop.	Balicasag Island United Association for Progress (BIUPOP), and; coastal warden.
Knowledge			
Yes	4	6	4
No	0	0	0
Attitude			
Positive	4	6	4
Negative	0	0	0
Fish catch perception			
Increase	1	6	4
Decrease	2	0	0
Undecided	1	0	0
Change related to MPA			
Yes	2	6	4
No	1	0	0
Undecided	1	0	0
Tourism activities			
Beneficial	2	1	4
Non-beneficial	2	5	0
Undecided	0	0	0
Common livelihood other than fishing	Seaweed culture; copra-making, and; motorcycle transport.	Coconut wine-making	Resort employee; vending souvenirs, and; farming crops.
Assessment of MPA Management	Poor (3); Good (1)	Average (3); Good (3)	Good (4)

Table 32. Synthesis of community interview infomation collected for sites surveyed in Bohol.

Municipality	Panglao	Panglao	Panglao
MPA Name	**Doljo**	**Bil-isan**	**Balicasag Island**
Problems/difficulties in management	PO cannot control beach-goers; Needs technical assistance; Financial training needed; ***Problems of Ananyana:*** *PO is inconsistent with enforcement; Cannot understand the objective of the sanctuary; buoys were installed without coordination with Ananyana; there was an instance when sea urchins were collected from the sanctuary by beach goers*	Lack of basic materials (e.g. kitchen wares, thermos, flashlights, binoculars, snorkels), and; No honorarium for guards.	Tourists knows nothing about the regulations; lack of budget, and lack of budget.
Suggestions for management	Need help in MPA-management; need honorarium for guards, guardhouse, and pumpboat for enfoecement; MPA should be relocated to a better ecological site.	Provide honorarium for guards; Equipment like flashlight, camera, typewritter; Alternative livelihood, and: for PO members to work harder.	Boat for enforcement; need for public education on user-fee system, and; guard sanctuary well.
Linkages	Panglao; BMT-PADAYON, Youth Council; Feed the Children.	Local Governments; BMT-PADAYON; WWF, and; BEMO.	BMT; BANGON; WWF, and; Philippine Naval Forces.
CRM problems/issues	Weak law enforcement; lack of institution support, and; lack of coordination with direct stakeholders resulting to conflict.	Weak law enforcement; politics, and; budget.	Budget; lack of institutional support, and; weak law enforcement.
Threats to fishery resources	Illegal/ destructive fishing; commercial fishing, and; weak law enforcement.	Exploitation of resources; commercial fishig, and; increasing population.	Illegal /destructive fishing; commercial fishing, and; lack of community awareness & support.

SUMMARY OF RESULTS AND TRENDS

Live hard coral in the Bohol sites ranged from poor (e.g. Bolod MPA) to good (e.g. Tawala MPA, 7-8m depth). An increasing overall trend is shown in the deep (7-8m depth) areas while the shallow areas have decreased slightly over time (Figures 42 and 43).

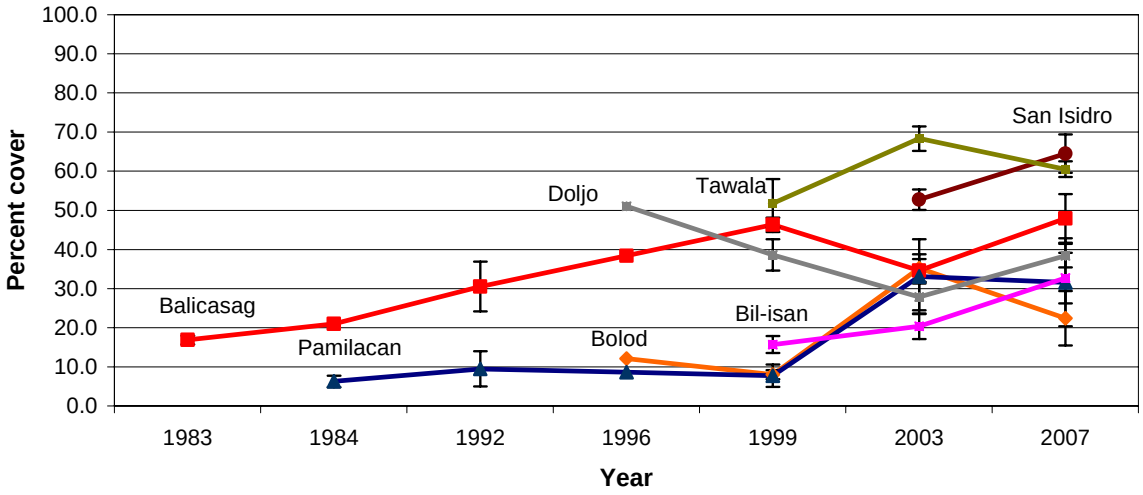

Figure 42. Changes in live hard coral cover (%mean ±SE) in sites in Bohol from 1983 to 2007 (7-8m depth).

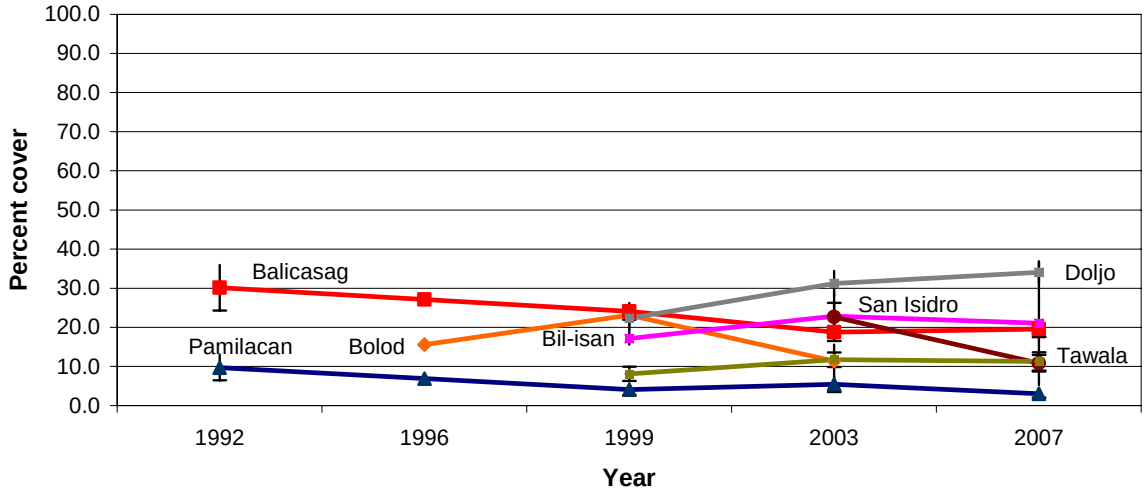

Figure 43. Changes in live hard coral cover (%mean ±SE) in sites in Bohol from 1983 to 2007 (2-4m depth).

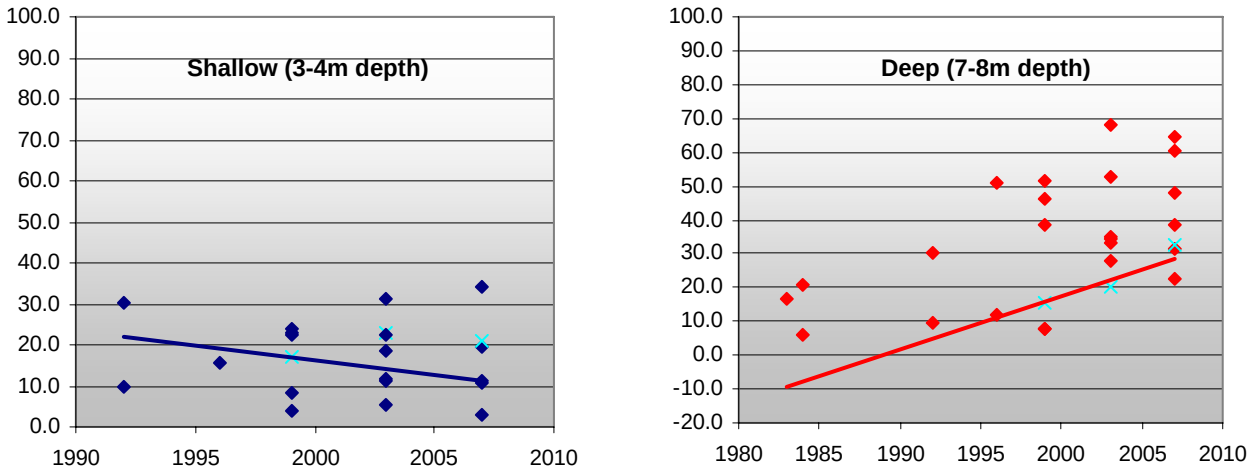

Figure 44. Trend of average living coral cover for all sites surveyed in Bohol, 1983 – 2007.

The observed patterns suggest poor enforcement of MPA policies in most of the sites with several exceptions. The decline of live coral cover in shallow areas may be partly due to the episode of El Nino bleaching in 1998, but anthropogenic stresses are the primary factor in these areas (Tables 29 and 31). The increasing trend of coral cover at 7-8m suggests that habitat damaging activities such as fishing and dropping of anchors are better controlled than in the past. Fish densities and biomass have decreased in most sites (Figure 44), except in Balicasag and Tawala MPAs (Figures 16, 26, 31, 36 and 41).

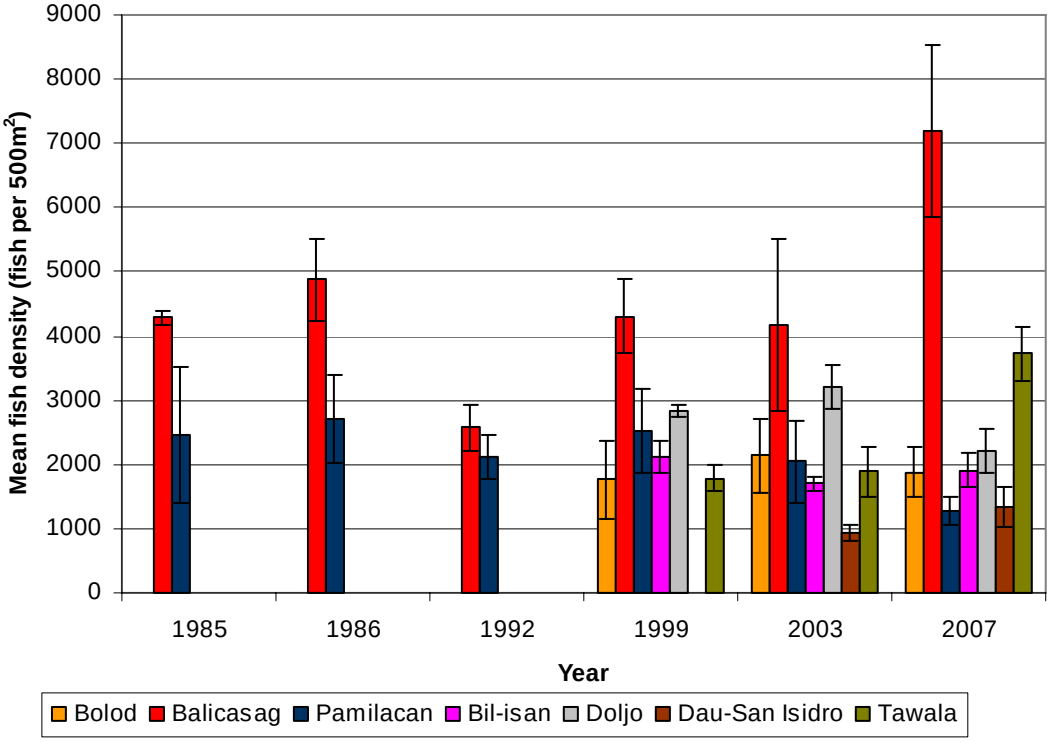

Figure 45. Mean (±SE) density (individuals/500m^2) of all reef species at all surveyed sites in Bohol.

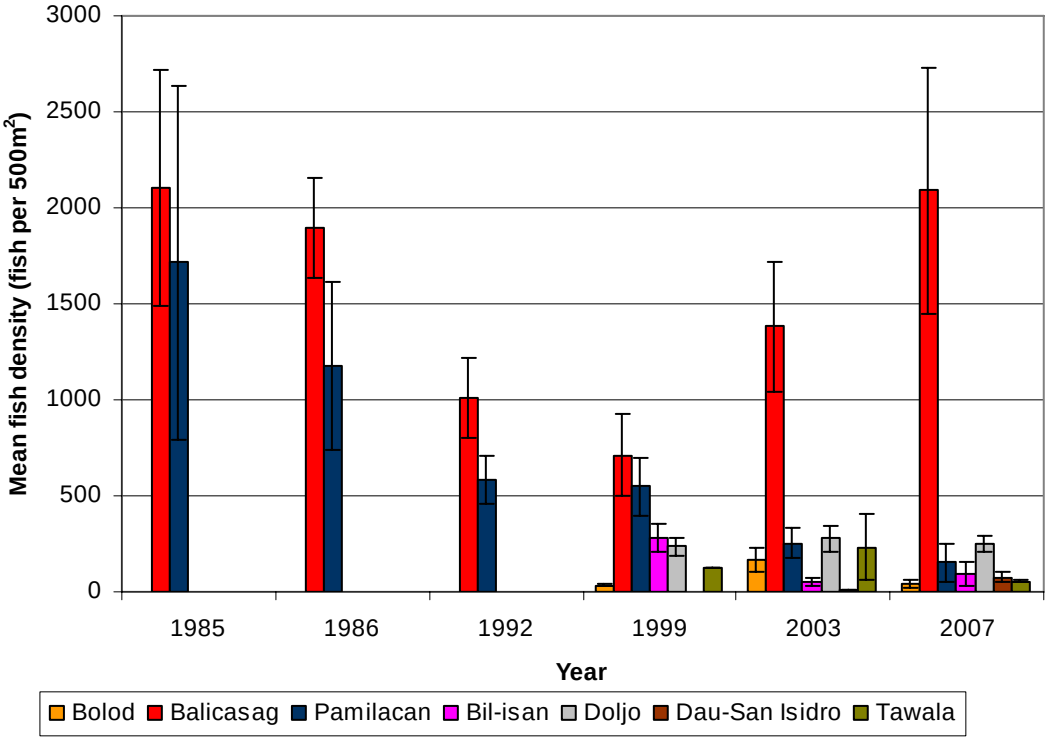

Figure 46. Mean (±SE) density (individuals/500m^2) of target species at all surveyed sites in Bohol.

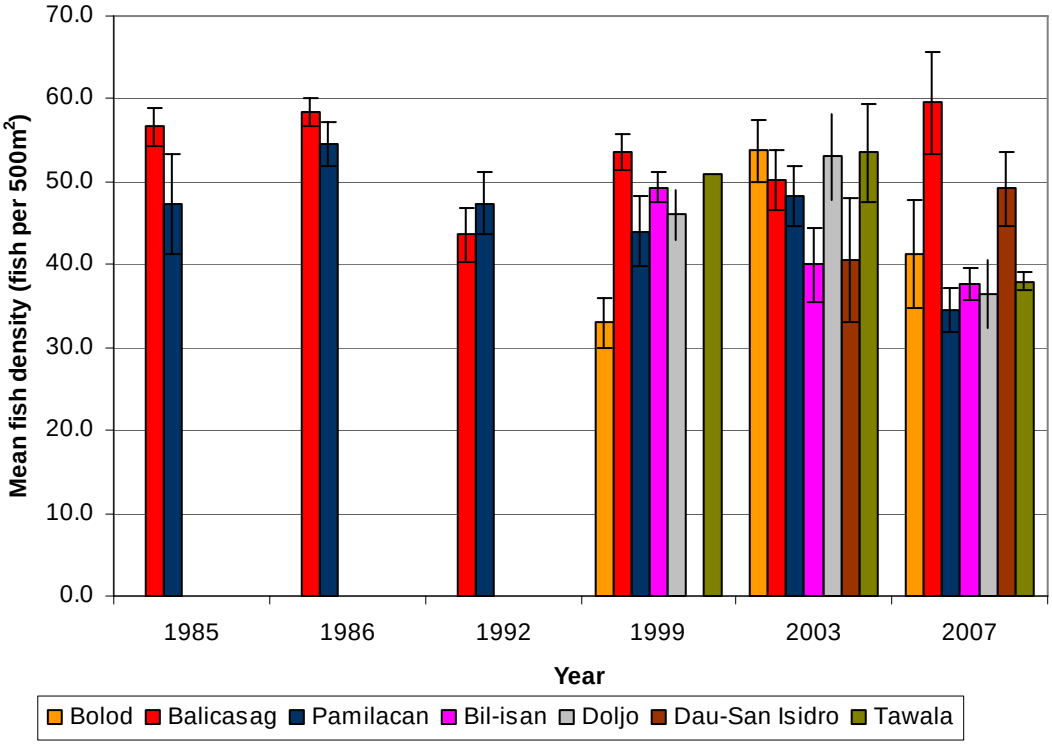

Figure 47. Mean (±SE) species richness (species/500m^2) of all reef species at all surveyed sites in Bohol.

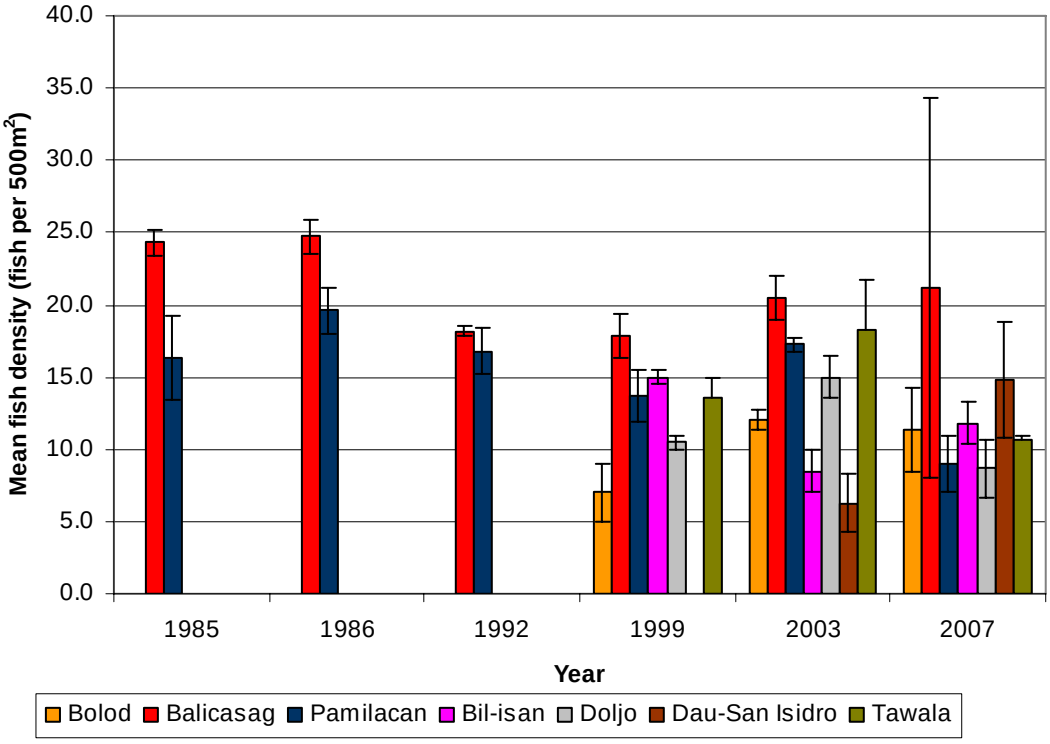

Figure 48. Mean (±SE) species richness (species/500m^2) of target species at all surveyed sites in Bohol.

With regard to fish abundance and species richness, many studies document higher fish densities and/or biomass in the areas with good enforcement compared to those sanctuaries that are poorly managed even with existing differences in live hard coral cover and other habitat differences (e.g. Russ *et al*. 2005, White *et al*. 2006). An example is the Municipality of Dauin in Negros Oriental, also located in the Central Philippines. Dauin has nine MPAs in the mainland with similar age and size to the Bohol sites (except Balicasag MPA which was established in 1986). Dauin is known for its strict MPA enforcement fully supported by the incumbent mayor and the people's organizations managing each MPA (Maypa and Reboton, 2005). Fish densities and biomass in these MPAs are considerably higher (e.g. Poblacion MPA, target fish density = 8,984.3 ± 1,504 fish/500m^2 in Maypa and Reboton 2005; see Russ et al. 2005) compared to Bohol sites (e.g. Pamilacan MPA target fish density: 154 fish/500m^2, biomass: 11.36 ± kg/500m^2; Tawala MPA: 3,725.3 fish/500m^2, biomass: 60.07 ± 1.6 kg/500m^2). However, it is important to note that species richness may not be a very reliable measure when observers vary and differences are strong enough.

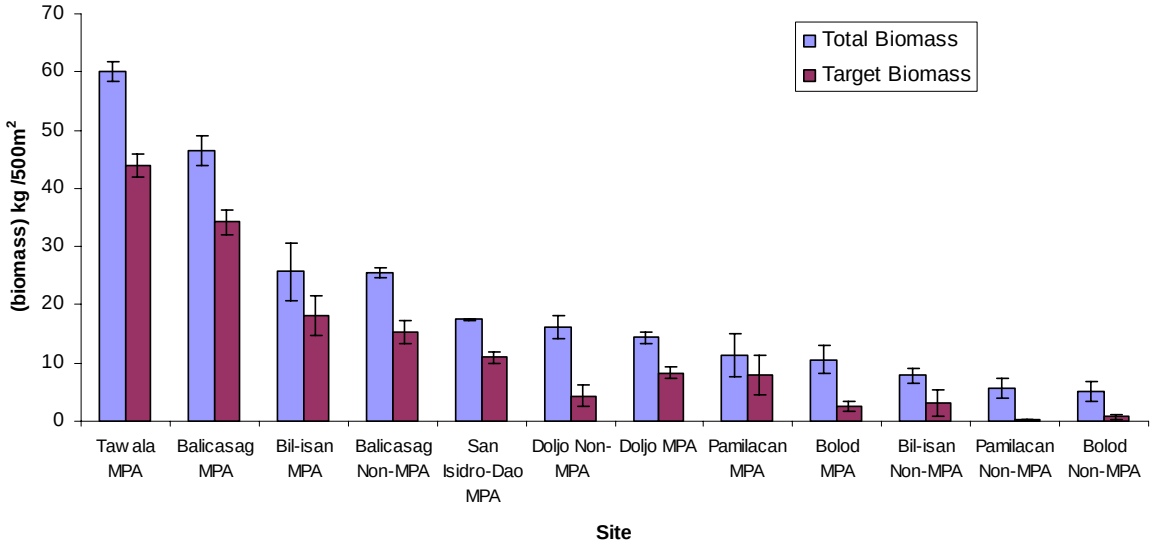

Figure 49. Total and Target fish biomass (kg/500m^2) between survey sites in Bohol, Philippines.

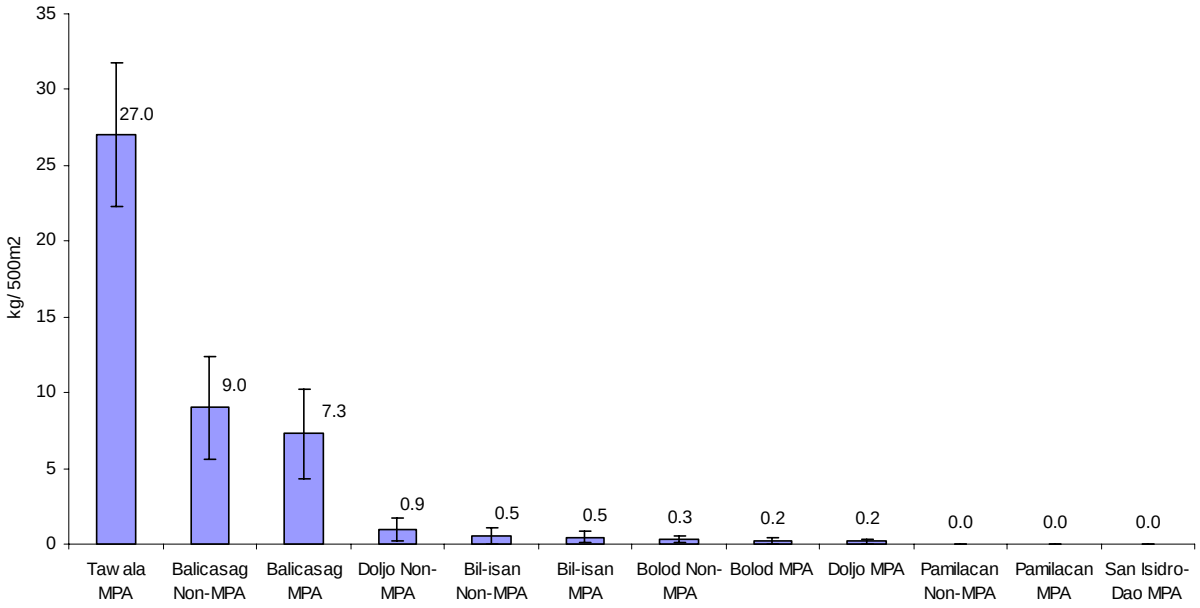

Figure 50. Predator fish biomass (kg/500m^2) between survey sites in Bohol, Philippines.

The results of our interviews with fishers, dive resort operators, people's organization members and officers, and *barangay* officials regarding their management perceptions document management and enforcement problems (Table 31). Poaching allegedly occurs in most of the sanctuaries. In most MPAs, the lack of enforcement is perceived as a consequence of poor institutional support in providing honoraria to sanctuary wardens. The encroachment of commercial fishers in municipal waters appears to be a long-standing threat in Bohol among other perceived problems (Green *et al*. 2003). Another important issue is the size and boundaries of the sanctuaries or core zones. Although all of the sanctuaries surveyed have

boundaries that totally enclose the reef to some distance offshore, the actual boundary enforcement has wavered so that some boundaries only enclose the reef flat and not the entire reef crest and drop off where most reef fish reside. In effect, fishing is occurring within the intended core zone, which is excluded by the poor placement of boundary markers. This recent development reflects a lack of strict adherence to the original municipal ordinances resulting in wrong interpretation by the locals and tourists. For example, the snorkeling line at the Balicasag MPA along the reef crest may be confused by fishers as the MPA boundary and justify their fishing on the reef slope.

RECOMMENDATIONS FOR IMPROVED MANAGEMENT

The declining trends in fish densities and biomass in most sites indicate a need to improve enforcement and require strong support from the local governments. It has been a recurrent lesson in coastal resource management that successful MPAs have to be strongly supported by the mayor and management bodies. To improve the marine protected areas in the BMT area, we recommend the following:

1. **Refine MPA management by resolving conflicts among management groups and between stakeholders.** Conflict resolution is a tough task. It often requires a good facilitator who can communicate well and can facilitate discussions to evaluate matters and arrive at a fair compromise between parties. We've gathered that Dau-San Isidro and Pamilacan management groups are having internal problems, and DPFA in Doljo is struggling in management due to conflicts. It is recommended that the respective municipal governments intervene to facilitate discussions to resolve existing conflicts. Community and *barangay* leaders need to lobby for the mayor's support to address such problems and ensure long-term support from the municipal government.

2. **Empower MPA management groups**. It was observed that some of the management groups are weak in MPA management and enforcement. The municipal government through PADAYON should make additional efforts to develop leadership and teamwork capacity of officers and members of the MPA management groups.

3. **Strengthen partnership of LGUs and community management groups**. Results of the perception survey indicate that the municipal governments are not providing necessary support to MPAs. However, the formation of PADAYON in support of MPAs by the mayors of Panglao, Dauis and Baclayon is an indication that the assumption is not entirely true. A few actions needed to augment what is lacking.

    a) <u>LGU adoption of the MPA management plans</u>. Budget and technical assistance can be allocated and provided systematically by the LGU if the management plans have administrative approval. PADAYON could monitor progress of activities and could assist management groups in accomplishing targets.

    b) <u>Initiate networking activities among MPAs within the BMT area involving the management groups.</u> On the ground-level, it will be beneficial to initiate networking activities in the form of periodic meetings that allows management groups to share their experiences and lessons learned. This will motivate the management groups to work persistently towards an area-wide common goal. Moreover, common MPA IEC programs and enforcement strategies could also

be adopted by member MPAs. These networking activities could be facilitated and supported by the municipal governments of Panglao, Dauis, and Baclayon. Direct interaction between the mayors and the management groups could eliminate discord.

4. **Develop a simple and practical user-fee system implementation framework coupled with strong institutional support.** Panglao and Dauis are supposed to collect user-fees as stipulated in their MPA Ordinances. The municipal government is not yet prepared to implement this, and so collection is still on hold. To successfully carry out this system, the municipal government through PADAYON should develop a user-fee system implementation guidelines and necessary rules and regulations to be followed. Good coordination must be established with the *barangay* governments and people's organizations to effectively carry out the implementation framework.

5. **Assess MPA boundaries**. It has been observed that the offshore MPA boundaries enclose mostly the reef flat or crest and not the slope. Fishers were observed fishing along the MPA slopes. This is detrimental to the fish stocks inside the MPA since many of the larger sizes of fish reside along the crest to slope. If the larger sizes are depleted, this will lead to a non-functional MPA.

   PADAYON needs to review the actual technical MPA boundaries and make sure the placement of the marker buoys are properly done. In addition, it needs to evaluate the location of core zone whether it encloses habitats that require protection, and where protection efforts will be worthwhile.

6. **Setting a minimum size for all no-take sanctuaries in the Bohol Marine Triangle of 10 hectares would serve to improve opportunities for fish densities and biomass to increase substantially inside the MPAs**. This would improve benefits to fishers outside of the sanctuaries and ensure that boundaries are sufficiently far offshore to protect an entire coral reef area, including the reef slope into deeper water.

7. **Education and awareness campaigns for the sanctuaries with a decreasing trend in management initiative and activities.** It is vital for such sanctuaries which aim at reviving or retraining management bodies in terms of sanctuary planning and implementation.

8. **Regular implementation and updating of the management rating system for each site** and incorporation of coral and fish parameters to reflect the current management status and needs. Such results can assist management groups in creating proper policies and actions for MPA improvement.

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