Summary Field Report:
Saving Philippine Reefs

Coral Reef Surveys for Conservation in Calamianes Islands, Palawan, Philippines April, 2006

A joint project of:

Coastal Conservation and Education Foundation, In.
and the
Fisheries Improved for Sustainable Harvest (FISH) Project

With the participation and support of the
Expedition volunteers

Coastal Conservation and Education Foundation, Inc.

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FISH PHILIPPINES The Fisheries Improved for Sustainable Harvest Project

Summary Field Report
"Saving Philippines Reefs"

Coral Reef Monitoring Expedition to the Calamianes Islands, Palawan, Philippines April 8-16, 2006

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(formerly Sulu Fund for Marine Conservation, Inc.)

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Expedition Volunteers

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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 (FISH) Project operated 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 Vangie White.

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ABSTRACT

The Saving Philippine Reefs Project of the Coastal Conservation and Education Foundation, Inc. assessed the coral reef condition and updated the data of selected sites in the Calamianes Islands in Palawan with special consideration for the sites being assisted by the Fisheries for Improved Sustainable Harvest (FISH) Project of Tetra Tech, Inc. supported by the United States Agency for International Development (USAID). Information on the coral cover, other substratum, fish fauna, invertebrates and possible causes of coral damage were collected. This set of data is complimented by social information as indicated by the existing human activities observed within the MPA vicinity, a community perception survey and a management rating survey. Patterns of resource use and biophysical trends exhibited in surveyed sites with past data are provided.

Live hard coral (LHC) cover in the 10 surveyed sites ranges from fair to good. Culambuyan East (Busuanga) had the highest LHC with 61.3% both at the mean depth of 6.5 meters (scuba) and 3.2 meters (snorkel). Fish diversity (41.5 species/500m^2) and density (17,674.5 individuals/500m^2) were also the highest in the survey area. This reflects the long-term (10 years) effort of the private owner in guarding and protecting the site.

The remaining sites surveyed showed lower fish densities and species richness which indicates high fishing pressure. Low total counts of butterflyfish and angelfish indicate heavy collection of aquarium species as confirmed by interviews and existing data. Some fish families (Acanthuridae, Carangidae, Balistidae and Haemulidae, Anthiinae, *Amphiprion* spp.) were consistently absent or were present in very small numbers. This may be due to the high frequency of aquarium and commercial fishing that still occurs in the area. However, some fish species that are not commonly found in other locations in the Philippines were sited in the survey area. Examples of these rare species are *Altricthys* spp. (Pomacentridae), *Parachaetodon ocellatus* (Chaetodontidae), and *Bolbometopon muricatum* (Pomacentridae).

The Calamianes group of Islands is indeed an important eco-region and harbors a highly diverse marine and coastal environment. Historically and to the present, evidence shows that these resources have been threatened by unregulated fishing and general resource exploitation. Moreover, this area is home to indigenous peoples (*Tagbanua* tribe) whose lives have been and still are intimately associated with the environmental resources. A coordinated effort among all local governments and organizations within the Calamianes area is necessary for effective and lasting management results. Some recommendations are presented to guide and help improve MPA management and area-wide coral reef conservation initiatives.

ACKNOWLEDGEMENTS

This Saving Philippine Reefs Expedition and its outcome are credited to the 10 volunteers (see Appendix 2) from the United States, United Kingdom, Australia and the Philippines 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: Aileen Maypa, Co-principal investigator; Sheryll Tesch, Data and logistics coordinator; Anna Meneses, Researcher; Brian Stockwell, Scientific dive coordinator; Rafael Martinez, Geographical Information Systems Specialist; Ethan Lucas, Divemaster; and Vangie White, overall project coordinator for the trip.

The Fisheries Improved for Sustainable Harvest Project (FISH) supported by the United States Agency for International Development operates in selected areas in the Philippines has provided the overall context for the project to successfully proceed with support for the Principal Investigator.

Sangat Island Reserve and Resort, in Barangay Bintuan, Coron, Palawan and its resort manager, Andy Pownall, are acknowledged for being committed to marine conservation and sustainable development, and providing excellent service, accommodations, food, diving services and assistance with traditional Filipino hospitality.

Benjie Francisco and his helpful staff based in the FISH Project in Coron contributed in the assistance of the advanced team of the trip. They introduced the advanced team members to key officers and community people for identification of survey sites and collection of management history and site descriptions for the report.

Jojo Mazo assisted the expedition team in orienting the volunteers on the history and management of the sanctuary and acting as a guide during the community surveys. Philippe Dalmais and Pierre Douar of the Palawan Wildlife Association, Philippines are acknowledged for their warm hospitality and assistance in providing inputs on the management history and status of the Cuaming Marine Sanctuary in Culion.

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

Alan T. White
Principal Investigator

LIST OF ACRONYMS AND ABBREVIATIONS

CA	-	coralline algae
CB	-	branching coral
CCEF	-	Coastal Conservation and Education Foundation, Inc.
CE	-	encrusting coral / flat coral
CF	-	foliose coral / cup coral
CM	-	massive coral
DC	-	white dead standing coral
DCA	-	dead coral with algae
FISH Project	-	Fisheries Improved for Sustainable Harvest Project
FVC	-	fish visual census
kg.	-	kilograms
LHC	-	live hard coral
m	-	meters
MA	-	fleshy algae / macroalgae
MAC	-	Marine Aquarium Council
MDS	-	multidimensional scaling
MOA	-	memorandum of agreement
MPA	-	marine protected area
N/A	-	not applicable
PWAF	-	Palawan Wildlife Association Foundation
OT	-	other animals
R	-	rubble
RCK	-	rock and block
S	-	sand
SD	-	standard deviation
SE	-	standard error
SG	-	seagrass
SI	-	silt
SP	-	sponge
spp.	-	species
SPR	-	Saving Philippine Reefs
TA	-	turf algae
USAID	-	United States Agency for International Development
UVC	-	underwater visual census
Yr.	-	year

SAVING PHILIPPINE REEFS PROJECT
A Coral Reef Monitoring Expedition to Calamianes Islands, Palawan, Philippines

INTRODUCTION

The Saving Philippine Reefs (SPR) Project is a reef monitoring expedition initiated in the early 1980s by Dr. Alan White and colleagues. The primary goal of this project is to improve the quality and quantity of information available on coral reefs for use in improving management and creation of appropriate policies for protection and sustainable use of coastal resources. The SPR Project has been doing regular coral reef monitoring assessments mostly within the vicinity of marine protected areas (MPAs) located in selected sites in the provinces of Cebu, Negros Oriental, Siquijor, Bohol, Batangas, and Palawan since 1992.

One of these sites is located in the diverse and abundant reefs of Calamianes Islands in the municipalities of Coron, Culion, and Busuanga in the province of Palawan. This year, the expedition base was on the Sangat Island Reserve in the northern part of the Calamianes Islands, 2 kilometers off the coast of Busuanga. The resort on the reserve island approaches eco-tourism by providing a simple, yet elegant setting of accommodations and amenities to guests looking for natural, relaxing, and stress-free vacations. Many of their own employees belong to the local Tagbanua tribe who continue to retain their distinctive culture and add to the pristine beauty of the undeveloped character of the region that consists of their ancestral tribal lands.

Management History of Calamianes Islands

The Calamianes group of islands is located in the northernmost portion of Palawan Province and is comprised of the four municipal islands of Busuanga, Coron, Culion and Linapacan. The Calamianes Islands cover an area of approximately 3,600 km^2 with close to 1,400 km of shoreline.

The Calamianes is endowed with extensive fringing coral reefs, mangrove forests, sandy beaches, geologic shoreline karst and cliff formations and numerous protected bays and inlets that provide a diverse array of marine and coastal habitats. The Calamianes Islands represent one of the most biodiverse rich groups of islands in the Philippines owing to the incredible range of islands, shorelines, habitats, geologic structures, oceanographic currents and interfaces with offshore systems in the South China Sea and the northern Sulu Sea. Coral reef and sea grass beds border virtually all of the islands and contain 70% of all the coral and sea grass species recorded in the Philippines. Fisheries are primarily reef and mangrove dependent within the near-shore waters and produce valuable catch for the live fish trade, subsistence and sale in Luzon-region markets. Offshore fisheries are generally small pelagic and include squid and cuttlefish. They depend on ocean currents in relation to the islands and offshore reefs of the South China Sea, west of Calamianes.

Coron Island is declared as an ancestral domain and protected area and identified as a tribal ancestral zone by virtue of its being part of the environmentally critical areas network. The

Tagbanuas have been on the island since historical times and exercise indigenous resource management practices anchored mainly in their culture and beliefs.

Most tourism business establishments are simple and partially belong to non-native people. Coron town is the service center for visitors with more than 80% of the accommodation establishments in the Calamianes Islands. Properties operate under difficult infrastructure conditions: water, power and stock supplies are irregular. There are five dive shops operating in the area. Dives are made on World War II shipwrecks and thermocline diving in island lakes as well as on the many beautiful coral reefs of the area. (Werner & Allen, 2000)

Fishing is the major source of livelihood in the Calamianes Islands. About 47.4% or 34,600 individuals are engaged in fisheries and marine-based activities. The fishery consists of two main sectors, an artesanal one involving local residents engaged in subsistence-level activities and a commercial sector involving vessels from other areas. (Werner & Allen, 2000)

The Calamianes Islands is the center of the live reef-fish for food trade in the country with an estimated gross value at PhP 265 million in 2002. The major species targeted include groupers (*Serranidae*), wrasses (*Labridae*) and snappers (*Lutjanidae*). Fishers still use sodium cyanide to catch these fish while this is illegal and very detrimental to coral reefs. (Werner & Allen, 2000)

In all municipalities, pearl farms are an important business and cover at least 4,000 hectares of municipal waters or up to 15% of the Calamianes area. Coastal residents employed in pearl farms earn a minimum of PhP 5,000/month (FISH Project, 2006).

THIS EXPEDITION – 2006

Data Collected and Methods

The volunteers

Ten volunteers participated in the “Saving Philippine Reefs (SPR) Expedition” in Calamianes Islands, Palawan from April 8-16, 2006. They made financial contributions that covered their travel, accommodation and subsistence costs. The volunteers came from different backgrounds including biologists, entrepreneurs, business consultants and managers, education consultants, dental hygienists, and a computer science engineer. They are all experienced scuba divers and most had participated in previous SPR expeditions.

Study sites

Calamianes Islands

Coron municipality

1. Siete Picados Marine Sanctuary (MPA)
2. Sangat-Decalve Marine Sanctuary (MPA)
3. Sangat Island Coral Garden (part of Sangat Reserve)
4. Lusong Island Coral Garden (non-MPA/proposed MPA)
5. Sangat Resort House Reef (part of Sangat Reserve)

Culion municipality

1. Bugor Marine Sanctuary (MPA)
2. Cuaming Island (non-MPA/proposed MPA)
3. Punta Dinamita (non-MPA)

Busuanga municipality

1. Culambuyan Island – East (non-MPA/proposed MPA)
2. Culambuyan Island – West (non-MPA)

Substrate cover. Systematic snorkeling surveys were carried out in the shallow reef flat at 2-3 m depth covering a distance of 0.5 – 1 km 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 m 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., butterflyfish, giant clams, lobsters, Triton shells, Crown of thorns seastars 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 -10 m) 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 25 cm intervals along a 50 m transect. Data gathered during scuba surveys were the same type as those collected during snorkel surveys. Distance between transects was 5 – 10 m, however, were closer in some areas where the reef extent was narrow.

Fish estimates. Fish abundance and diversity were estimated using a 50 x 10 m visual census (UVC; n = 3 – 6) technique done by three fish visual census specialist (A. White, A.P. Maypa and B. Stockwell). Substrate transects were utilized during UVC. The abundance of target species, indicator species and numerically dominant and visually obvious were all counted. Biomass of target species was computed using Fishbase (2004) constants.

Data Analyses

Data Analyses

Fish biomass. Fish biomass was computed using the formula: $\mathbf{a} \cdot \mathbf{L}^{\mathbf{b}}$ (Fishbase 2004) and using the *a* and *b* constants in the same software. Biomass of target fish species were computed on the species level and summed up per family, based on 14 selected families: (1) target fish/commercially important food fish: Epinephilinae (Serranidae), Lethrinidae,

Lutjanudae, Acanthuridae, Caesionidae, Carangidae, Haemulidae, Nemipteridae, Mullidae, Scaridae, Siganidae and (3) aquarium fish: Balistidae spp., Chaetodontidae, Pomacanthidae).

Site groups. Selected fish parameters that serve as gauges of fishing pressure in Calamianes sites were compared with known marine protected areas (MPAs) and fishing grounds from previous SPR surveys. These groupings were based on ranks of three parameters: (1) mean fish species richness of all reef species, target species, butterflyfishes and angelfishes, (2) mean fish densities per $500m^2$ (target species, butterflyfishes, angelfishes) and total counts of butterfly species per site, generated by hierarchical cluster analysis and multidimensional scaling (MDS) ordination. A dendogram plot was produced using a Bray-Curtis Similarity Test with an average group linkage to generate cluster groups of similar community species richness and densities. The data were also plotted using MDS ordinations that were repeated ten times to increase the likelihood of minimizing the stress in a two-dimensional representation. The ordination resulted in a scatter plot in which each site was represented by a point, the distances between points following the same rank order as the pair wise dissimilarities in species richness and densities between sites. The parameter of each group, similarities within groups and dissimilarities between groups were identified by SIMPER analysis. All aforementioned tests were conducted with the statistical software, PRIMER (Clarke and Warwick 2001).

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

Community Interviews. For each site surveyed, at least two interviewers were dropped off at the shore to interview local residents, divers, resort owners, or local fishers in their 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 site or protected area.

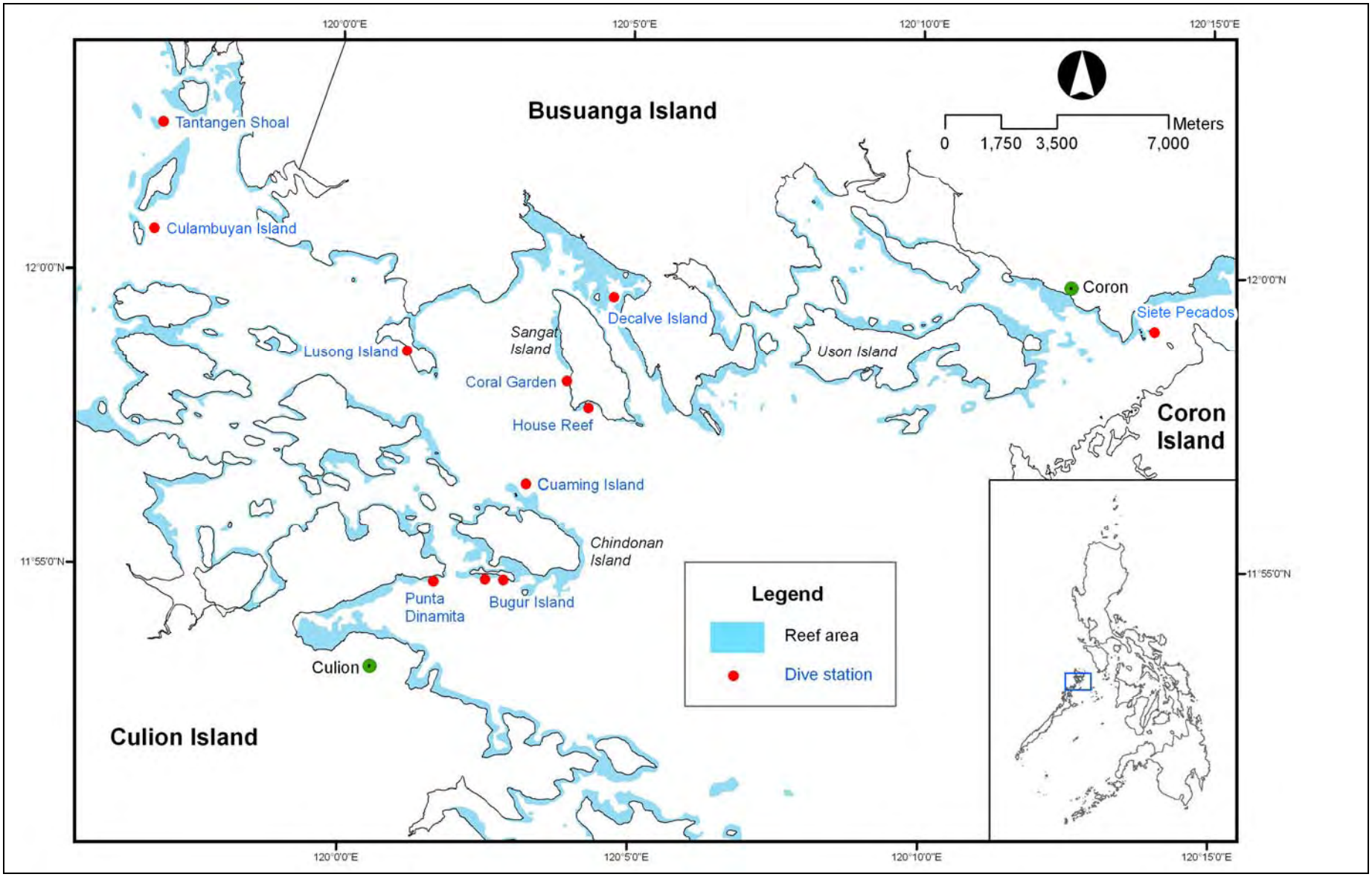


Figure 1. All dive sites and survey areas done in Saving Philippine Reefs Expedition, 2006, Calamianes Islands, Palawan.

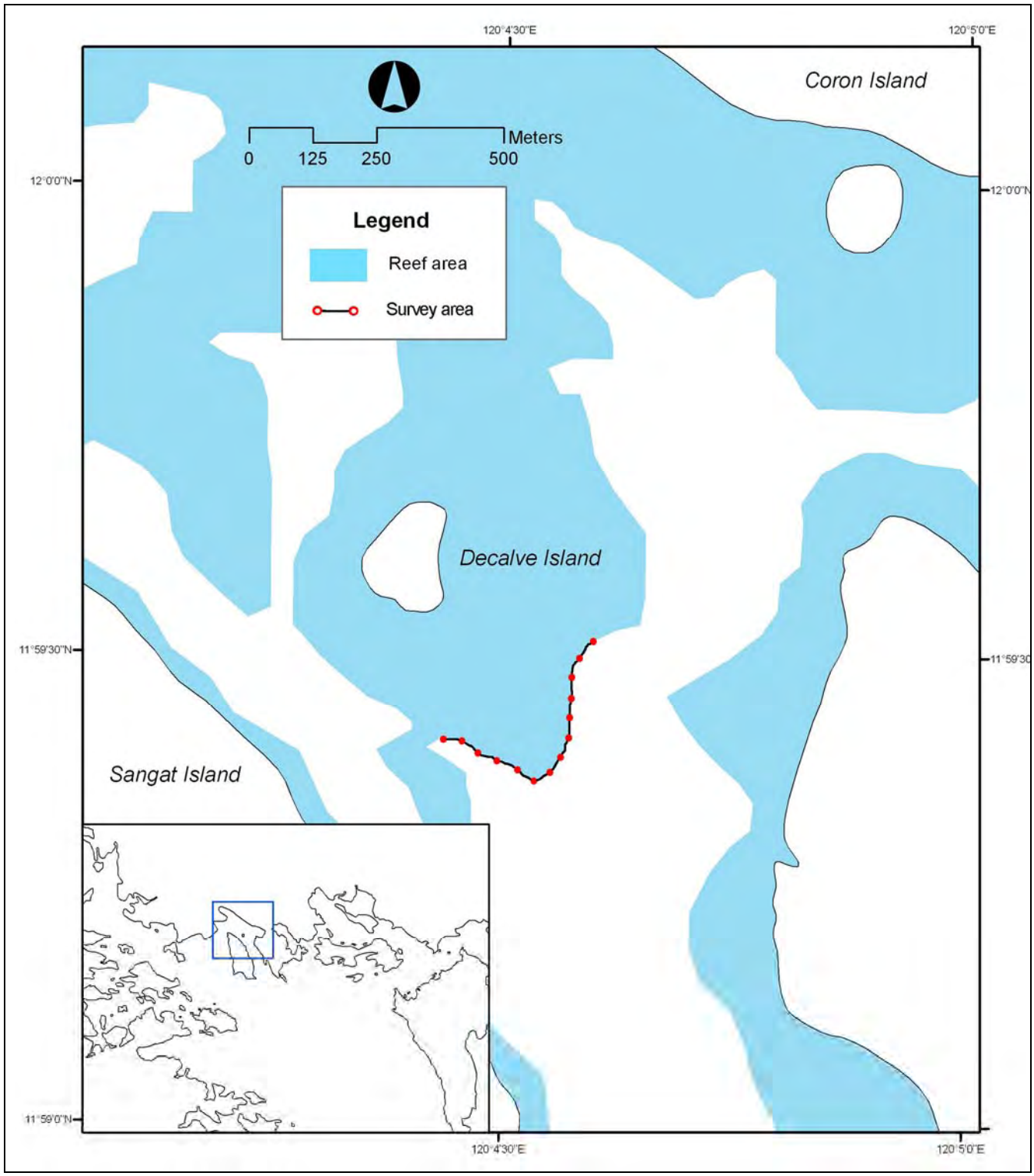


Figure 2. Survey area at Sangat-Decalve Marine Sanctuary in Coron, Palawan, 2006.

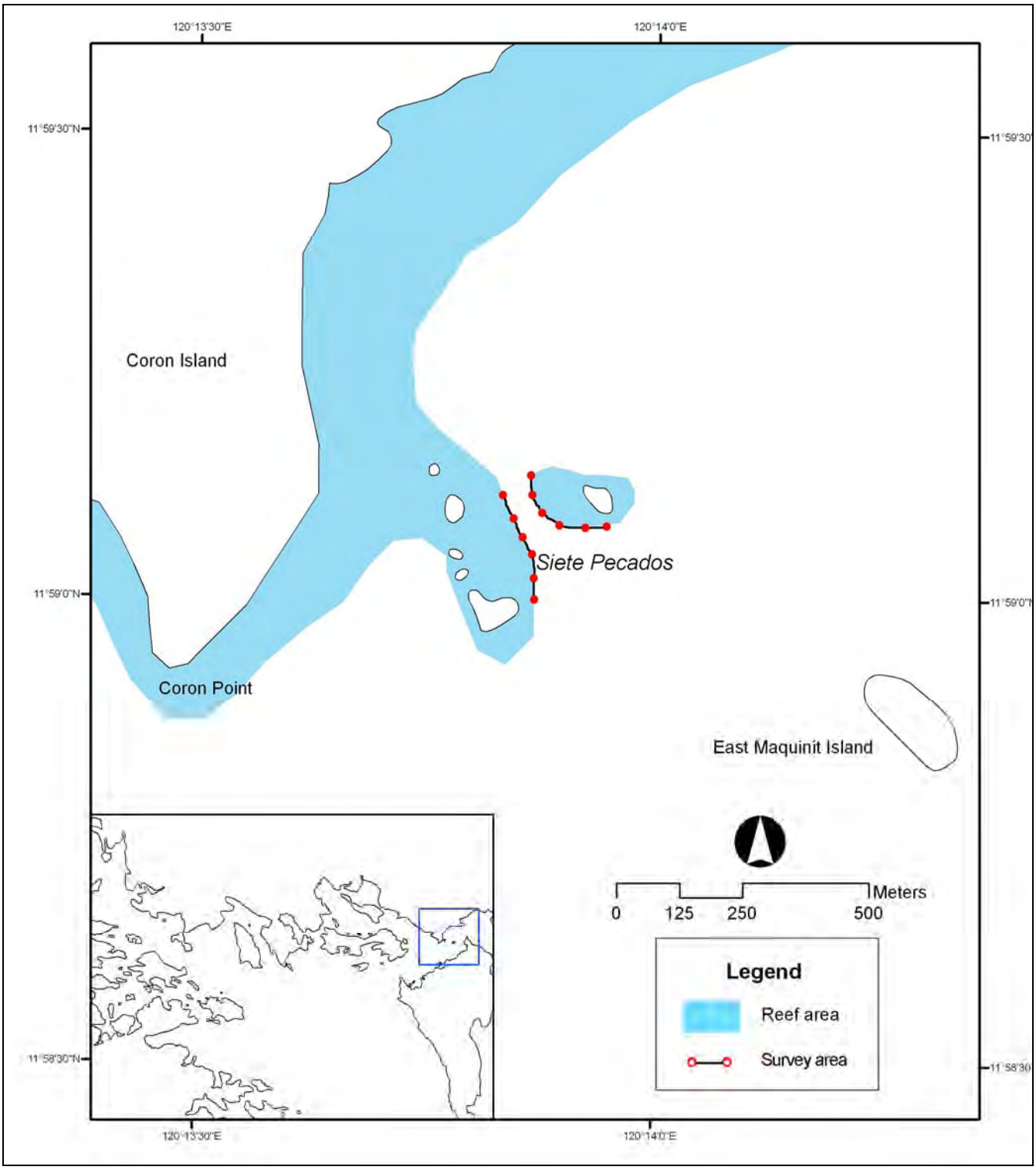


Figure 3. Survey areas of Siete Picados Marine Sanctuary, Coron, Palawan, 2006.

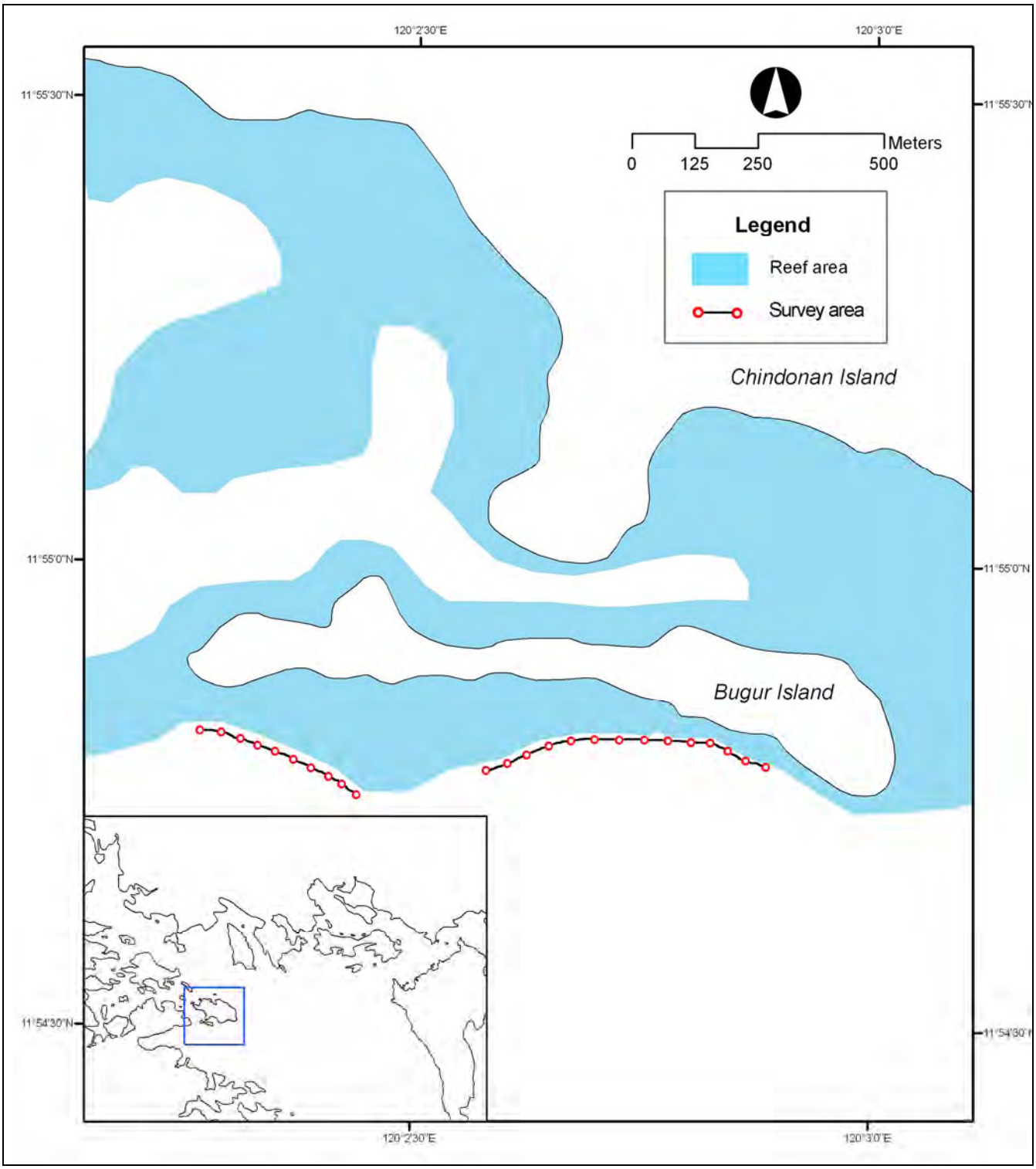


Figure 4. Survey areas at Bugor Marine Sanctuary, Culion, Palawan, 2006.

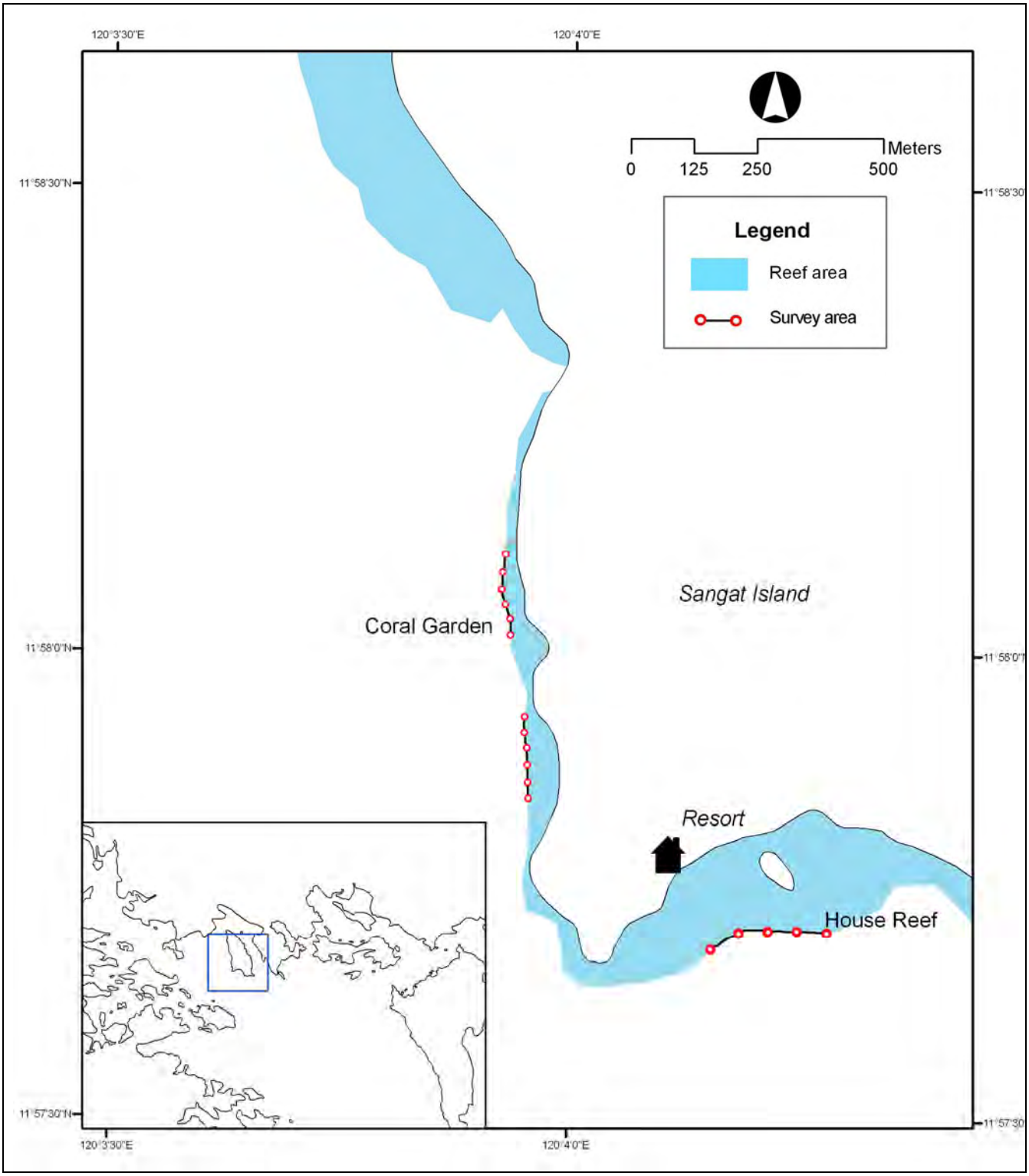


Figure 5. Survey areas at Sangat Resort House Reef and Sangat Reserve Coral Garden, Coron, Palawan, 2006.

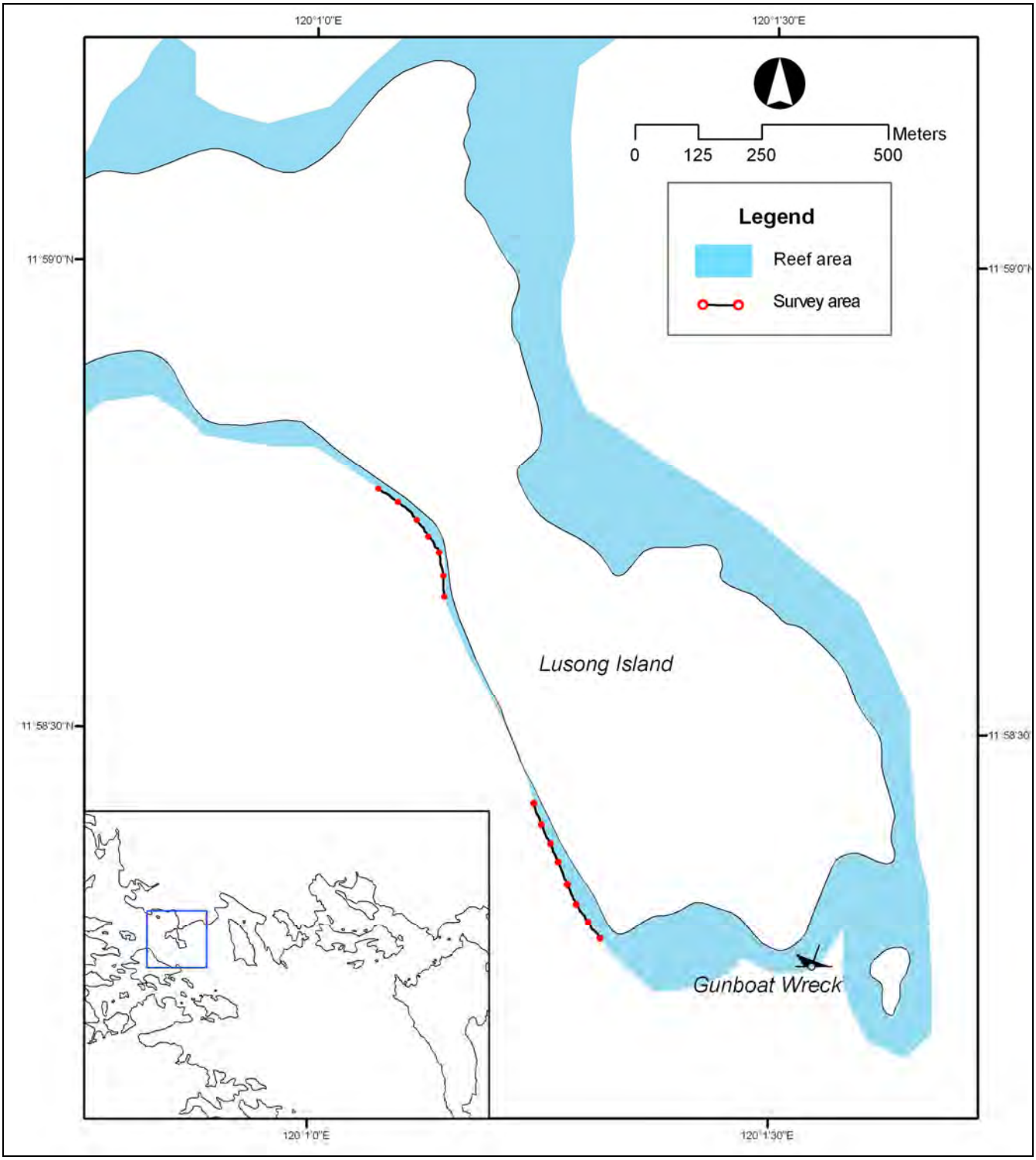


Figure 6. Survey areas at Lusong Island Coral Garden, Coron, Palawan, 2006.

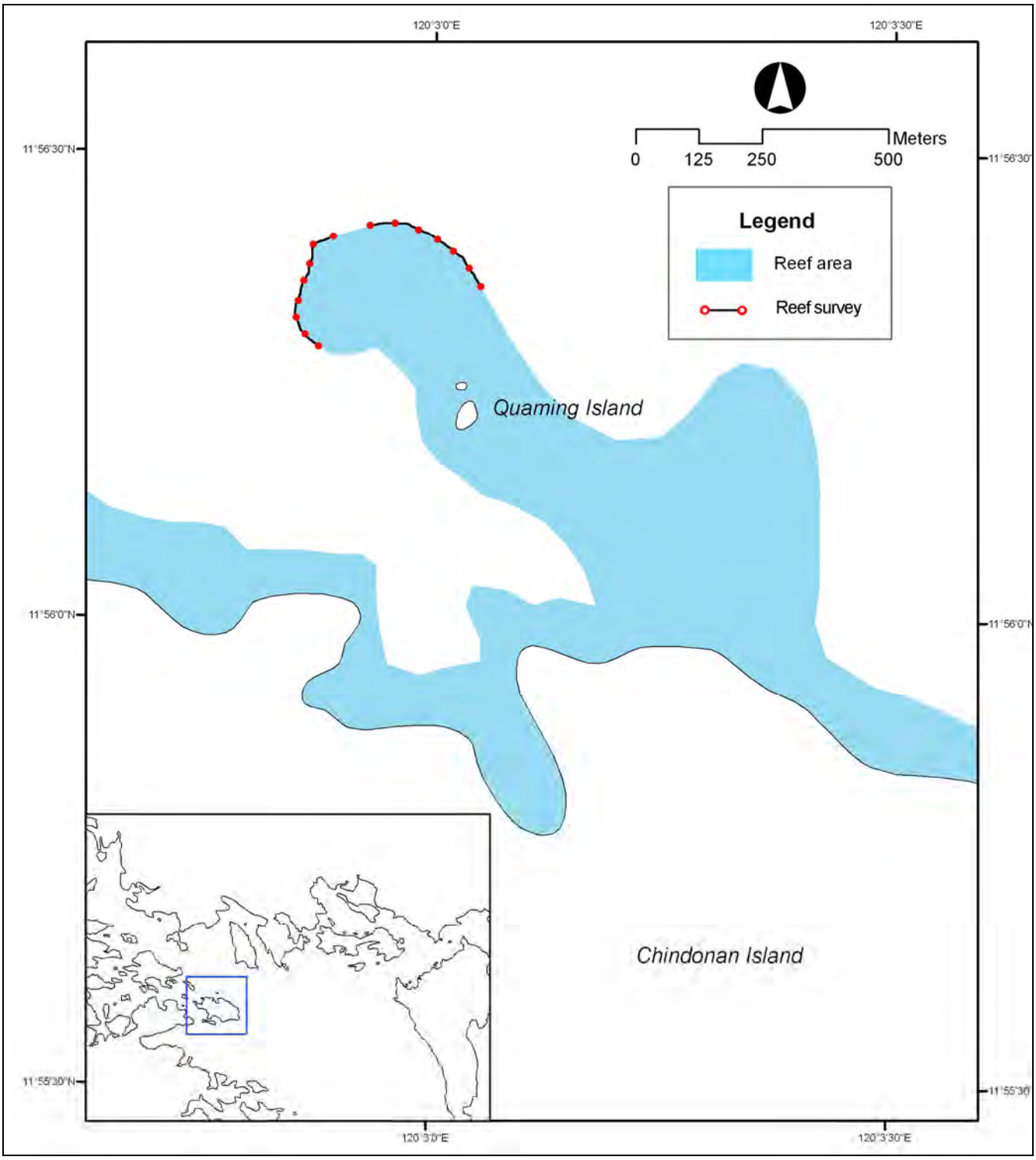


Figure 7. Survey areas at Cuaming Island reef, Culion, Palawan, 2006.

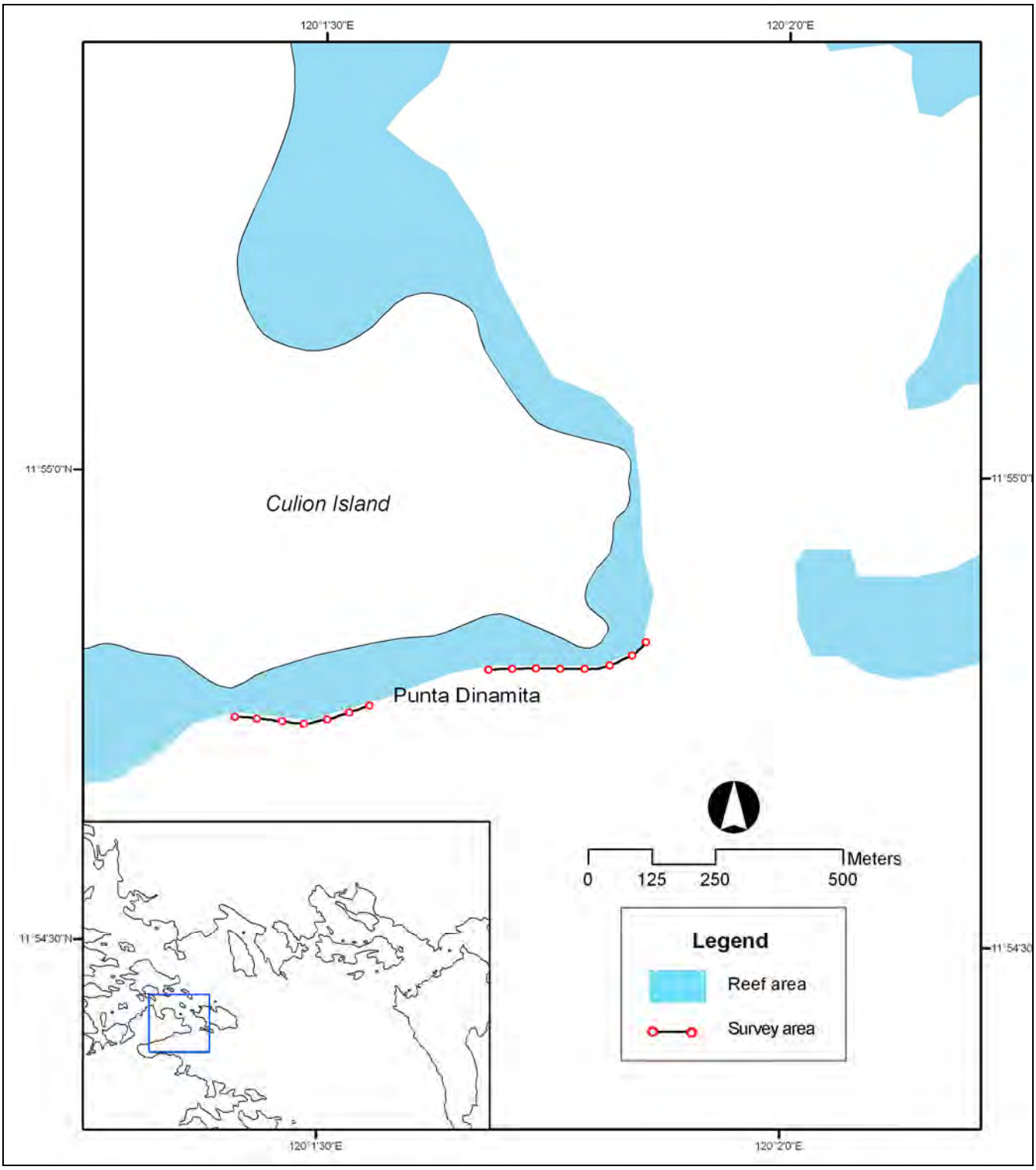


Figure 8. Survey areas at Punta Dinamita Reef, Culion, Palawan, 2006.

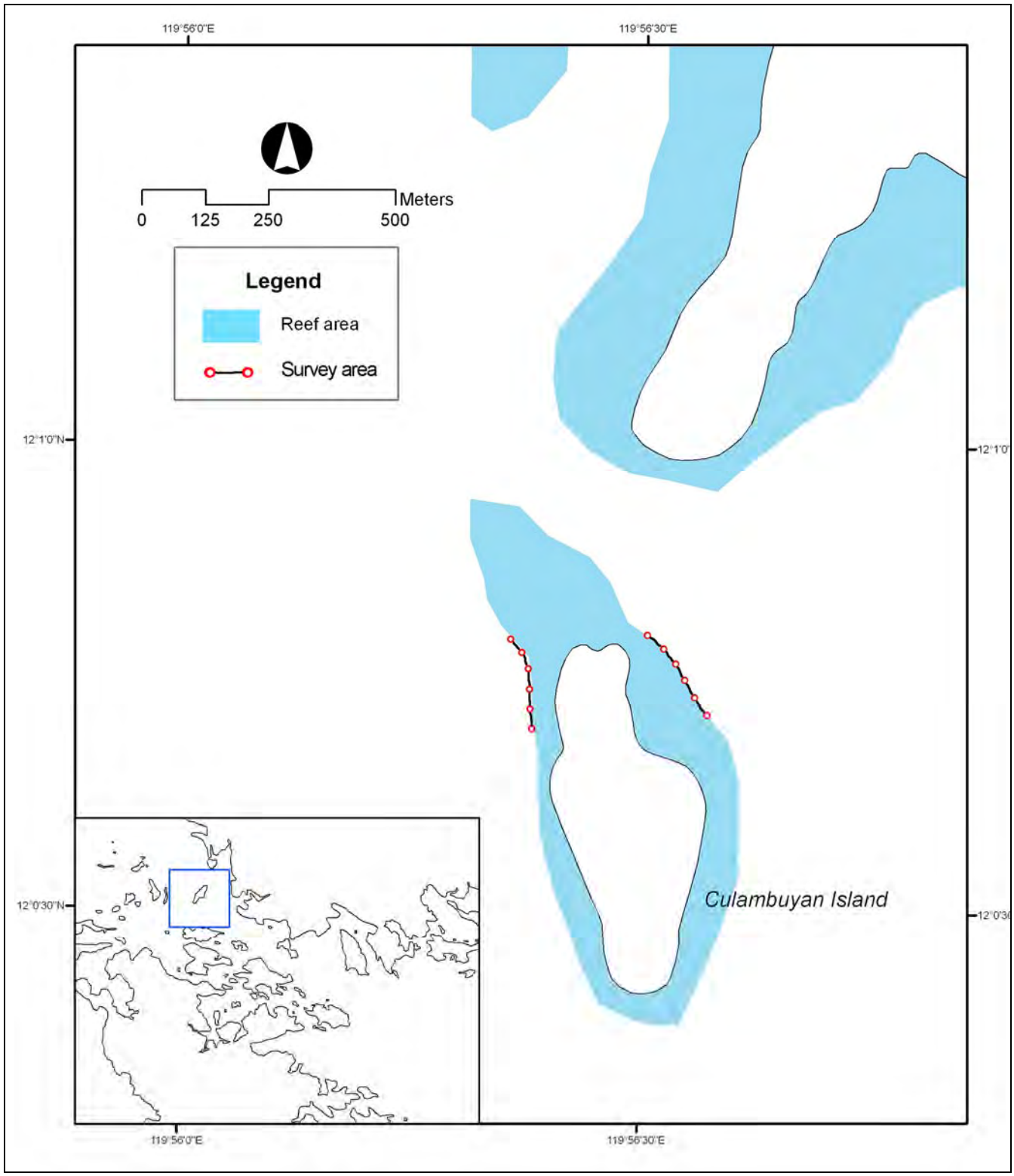


Figure 9. Survey sites at Culambuyan East and West, Busuanga, Palawan, 2006.

OVERVIEW AND RESULTS OF SITES SURVEYED

Sangat-Decalve Marine Sanctuary

This marine protected area (MPA) is located on an embayment near the northeastern tip of Sangat Island and was established in 2004 by a municipal ordinance of Coron. As one of the older MPAs in the area, the reef shows the benefits afforded by protection with an increasing fish density (Figure 13) and increasing coral growth (Figure 10) as compared to other areas. Under strict protection by municipal ordinance, the area is patrolled by Barangay Decalve, a small island opposite Sangat Island directly in front of the sanctuary area.

This MPA was one of the three sanctuaries identified by the FISH Project for technical assistance. The community that manages the MPA received some training in the form of MPA management and enforcement. The immediate area is within a larger management unit – the Sangat-Decalve Marine Park. Inside the Marine Park's proposed boundaries are 2 popular dive spots, the Sangat Island Coral Garden and the Sangat Gunboat Wreck. A user fee system for divers and other visitors of the park is currently in place.

The three major shallow water marine habitats are well represented in Sangat-Decalve MPA. Mangroves line the coastal fringes of Decalve Island as well as that of Busuanga. Situated in the reef flat is an extensive seagrass bed composed primarily of *Enhalus*. It is already well established that there is an exchange of materials and energy between ecosystems and is the basis why the coastal habitats are dynamic and very productive.

Figure 10. Changes in substrate composition (% mean ±SE) in Sangat-Decalve Marine Sanctuary, Coron, from 2004-2006 (8-10m depth)

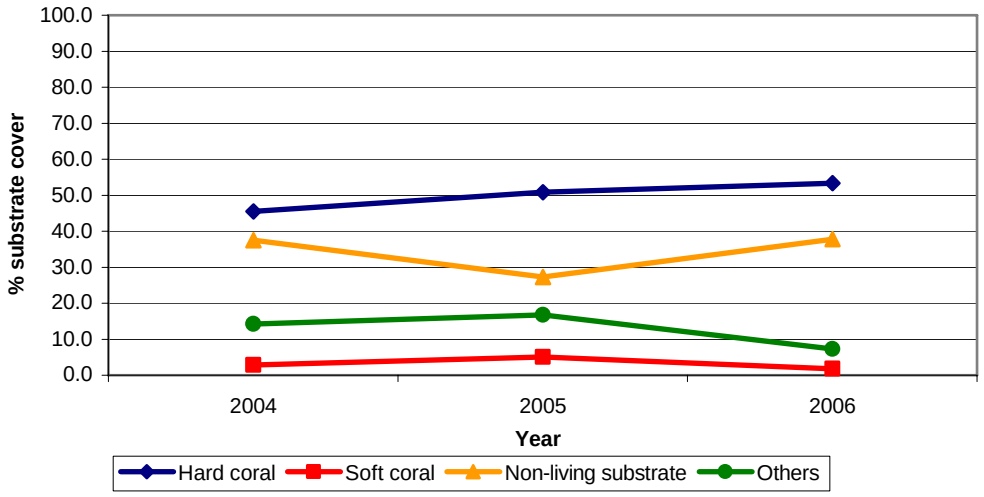
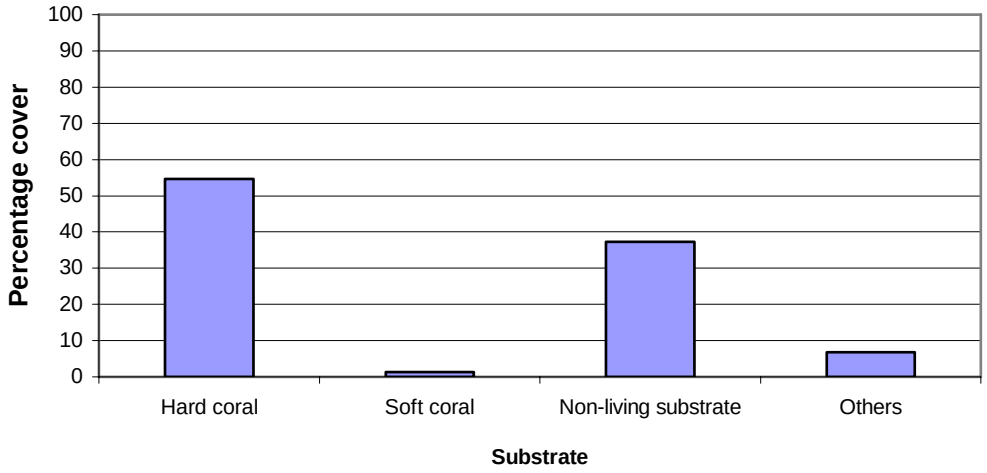


Figure 11. Substrate composition (%mean ±SE) in Sangat-Decalve Marine Sanctuary, Coron in 2006 (2-4m depth)



Fish density increased 147% from 2005 to 2006 for the target species, and 812% for all the reef species (Figure 13). However, in 2005, 208 reef species were recorded in the six transect samples taken. But in 2006, only 102 species were recorded. This is mainly due to the high numbers of wrasses (Labrids) and damselfish (Pomacentrids) recorded in 2005. Grouper species also declined from 13 species seen in 2005 to only one in 2006. Being a relatively new sanctuary, enforcement is still being developed. As seen in the MPA Rating System (Appendix 4), the Sangat-Decalve Marine Sanctuary has only accumulated 13 points which puts it at Level 1 in the 'Initiated' stage with a 'passing' mark in MPA management standards.

Figure 12. Mean (±SE) number of species/500m^2 at Sangat-Decalve Marine Sanctuary from 2004 to 2006.

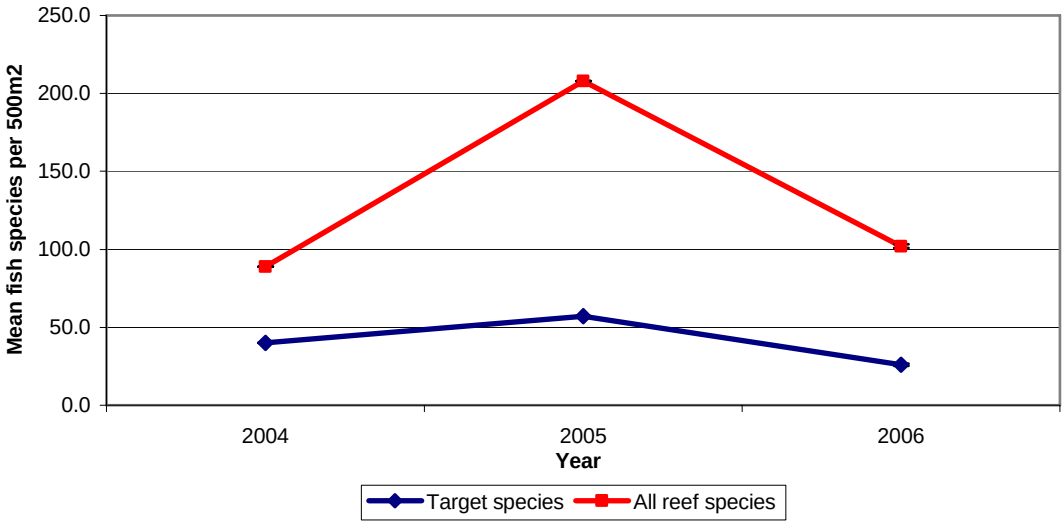
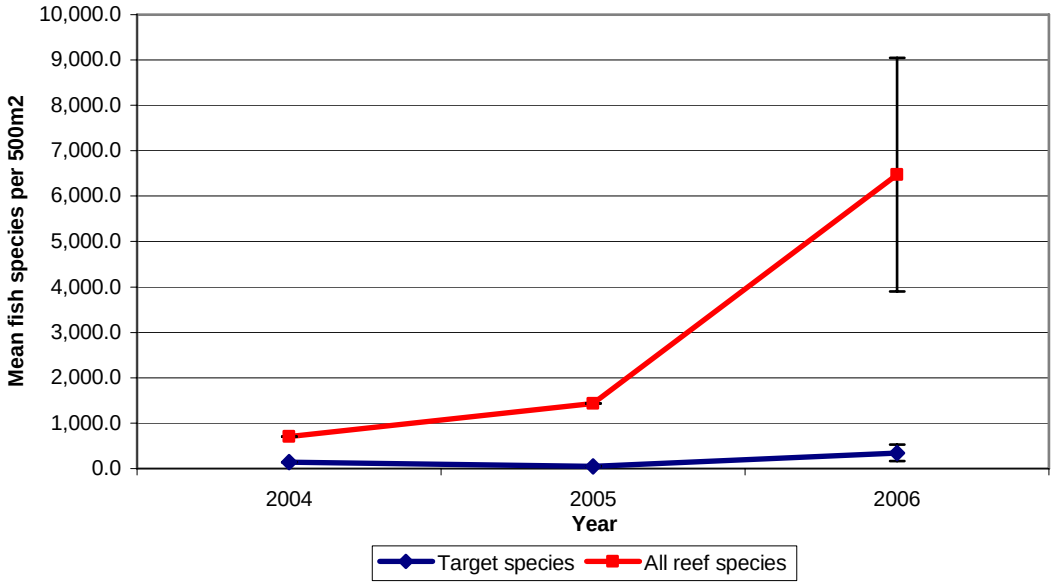


Figure 13. Mean (±SE) density (individuals/500m^2) at Sangat-Decalve Marine Sanctuary from 2004 to 2006.

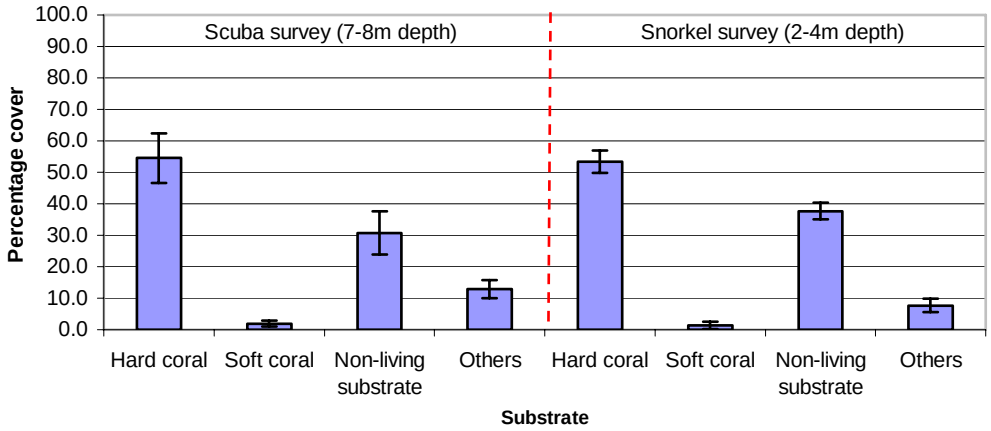


Siete Picados Marine Sanctuary

Siete Picados Marine Sanctuary was established in 2003. The sanctuary is comfortably located within in a small, slightly off-shore, group of seven islands near the Coron mainland. The seven islands are an ideal setting that bound the sanctuary area as well as protecting it from strong currents. Siete Picados has relatively good coral cover in both the deep and shallow areas. Hard coral cover is 54.5% from 7 to 10 meters depth, and 53.4% at 2 to 4 meters depth. Fish densities and species diversity were relatively good at 4932 fish/500m^2 for all reef species and 130.6 fish/500m^2 for target species. Species diversity was 10.8 species/500m^2 for target species and 33.4 for all species/500m^2.

One interesting note about Siete Picados is that the area has been a repository of confiscated fish from the live food fish trade. It remains to be seen whether this has or will contribute to the observed high species diversity in the area. Diving is allowed inside Siete Picados and the collection of user fees is enforced.

Figure 14. Substrate composition (% mean ±SE) in Siete Picados Marine Sanctuary in 2006.



Bugor Island Marine Sanctuary

Bugor Marine Sanctuary is a large sanctuary established in 2005. The MPA is composed of 22 hectares of fringing reef along the south side of Bugor Island, facing the northern coast of Culion Island (Figure 4). Bugor Island is protected by an ordinance of the Municipality of Culion which expressly states joint management and protection between the municipal government and the nearby pearl farm that uses the deeper portion of the area for pearl culture. This relationship has so far proven quite successful due to the 24-hour surveillance of the sanctuary area through the presence of the pearl farm.

Along with Sangat-Decalve MPA, Bugor Island Marine Sanctuary has received technical assistance from the FISH Project for management and materials required for markers and boundary delineation. Bugor Island and the adjacent reefs of Punta Dinamita are frequently visited by divers, and is one of the more popular dive spots in Coron.

Bugor Island survey results indicated an increase of 16.4% in live hard coral (LHC) cover in the deeper portion (7-8 meters depth) from 2005 (49.4% LHC) to 2006 (56.9% LHC). The shallow reef has a fair LHC cover of 36.9% at 2 to 4 meters depth. As a relatively new MPA, fish density for target species only increased 5.9%, but the effects of protection can be more clearly seen in the density of all the reef species which reflected an increase of 208% from 2004 (1113.3 fish/500m^2) to 2006 (3348.8 fish/500m^2).

Figure 15. Changes in substrate composition (%mean ±SE) in Bugor Island Marine Sanctuary, Culion from 2004 to 2006 (8-10m depth)

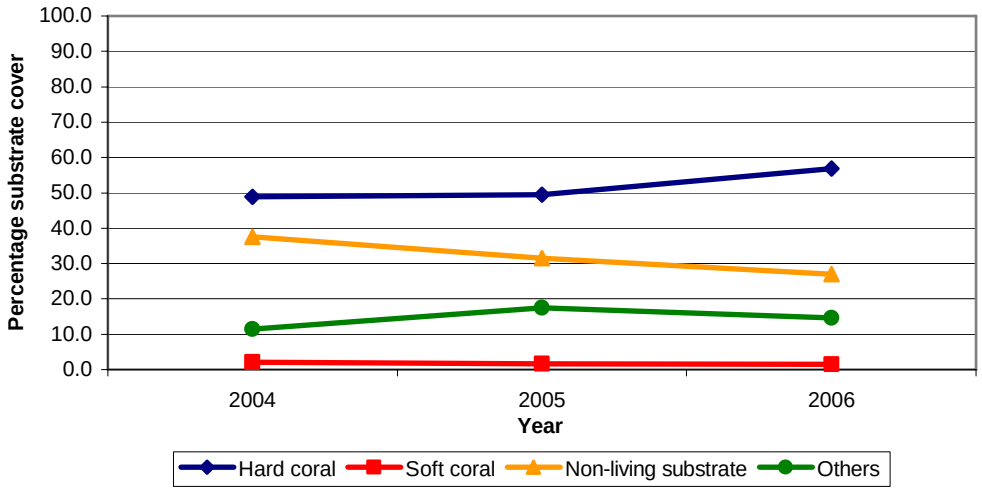


Figure 16. Substrate composition (%mean ±SE) in Bugor Island Marine Sanctuary, Culion in 2006 (2-4m depth)

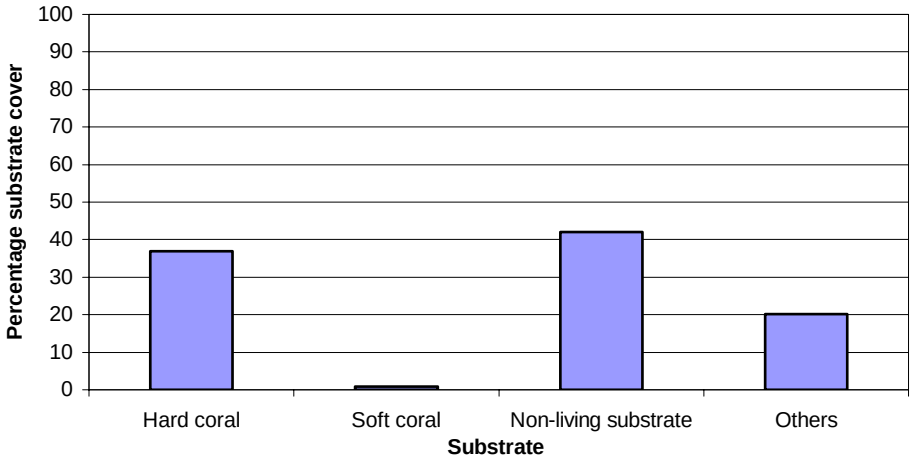


Figure 17. Mean (±SE) number of species/500m^2 at Bugor Island Marine Sanctuary from 2004 to 2006.

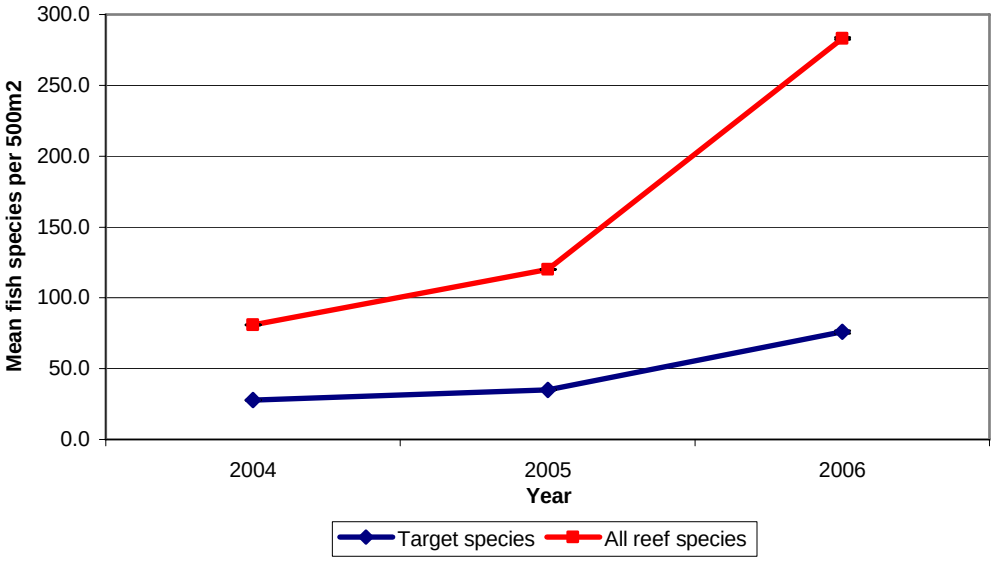
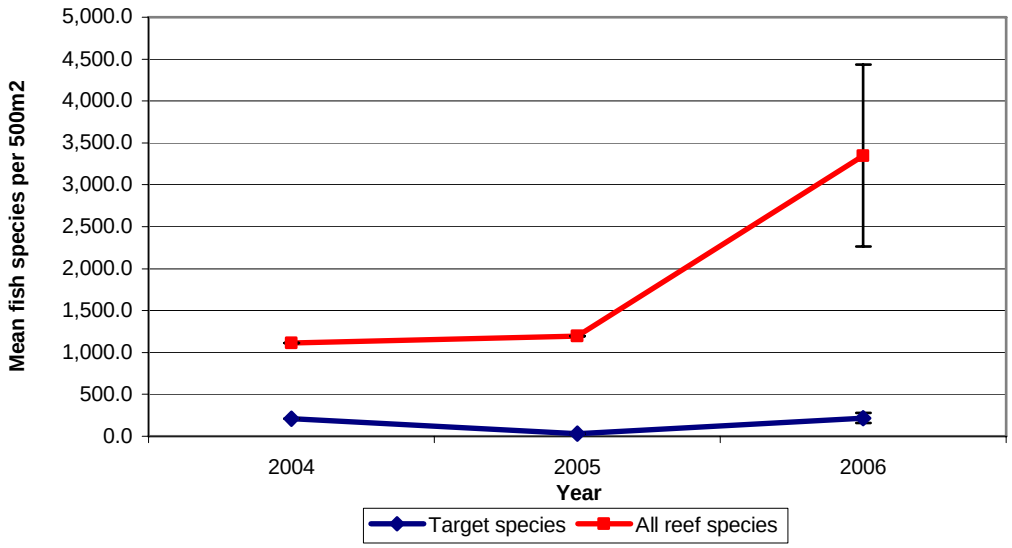


Figure 18. Mean (±SE) density (individuals/500m^2) at Bugor Island Marine Sanctuary from 2004 to 2006.

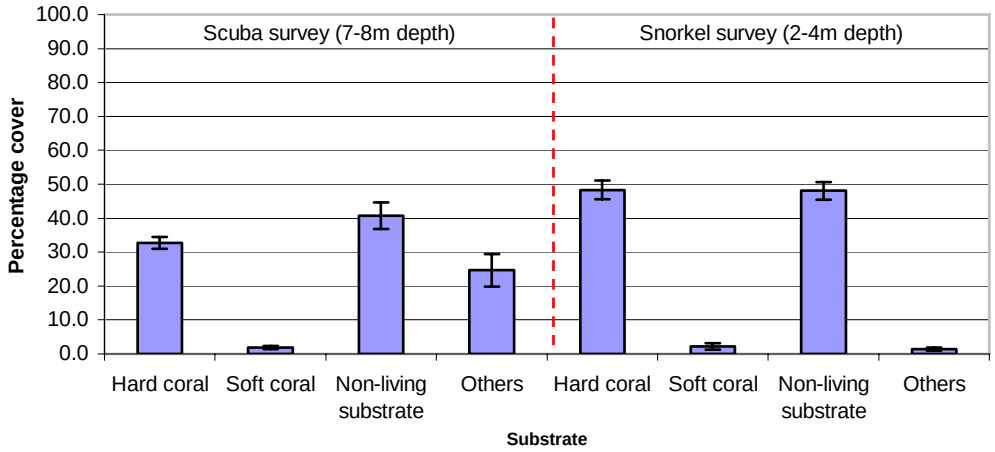


Sangat Resort House Reef

The Sangat Island Reserve Resort is located on the southern tip of Sangat Island in a protected alcove with a white beach, lush plant growth, and the resort that blends beautifully with the island vegetation. The adjacent reef enjoys the protection of the Sangat resort staff who implement strict rules on snorkeling and diving to avoid coral breakage in the shallow reef. The reef was damaged extensively during a typhoon in 1999 and still shows the scars of a damaged reef through the coral rubble mounds that are exposed during low tide in the shallower portions of the reef. However, over the years, the reef near and along the reef crest have recovered nicely. This is mainly due to the strict protection of the resort management and their efforts in avoiding reef damage by assigning specific docking and entry areas on the beach for boats.

Coral cover (at 7 to 8 meter depth) fronting the resort is fair with an average hard coral cover of 32.8%. Coral cover is much richer on the shallow reef with fast growing Acropora showing a 48.3% average live hard coral cover. Because of the typhoon that seriously diminished the reef in 1999, growth of fast growing branching corals is a dominant feature. The protection provided by the Sangat Resort Management has helped the reef to remain relatively undisturbed and speeds reef restoration. The house reef also attracts large schools of fish, particularly scads, with several thousand seen in one particular school.

Figure 19. Substrate composition (%mean ±SE) in Sangat Resort House Reef in 2006.

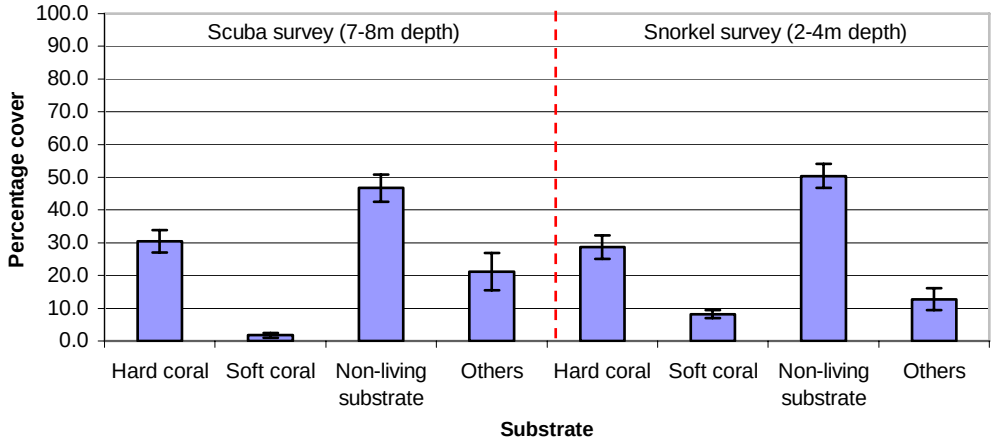


Sangat Island Coral Garden

Sangat Island Coral Garden is a narrow reef on the western side of Sangat Island that falls within the reserve area of the island. Although there is no strict enforcement in this area, there is some protection afforded by the pearl farm cultivators who position their pearl baskets in the deeper portion of the water adjacent to the reef. This reef is so narrow that the shallow portion runs from between two to four meters from the rock wall along the side of the island.

Coral growth on this reef is fair with 30.4% live hard coral cover at 7 to 8 meters depth, and 28.7% at 2 to 4 meters depth. Fish density had the lowest value as compared to the other sites surveyed in the Calamianes Islands at 2,221 fish/500m^2 for all reef fish species.

Figure 20. Substrate composition (%mean ±SE) in Sangat Island Coral Garden in 2006.



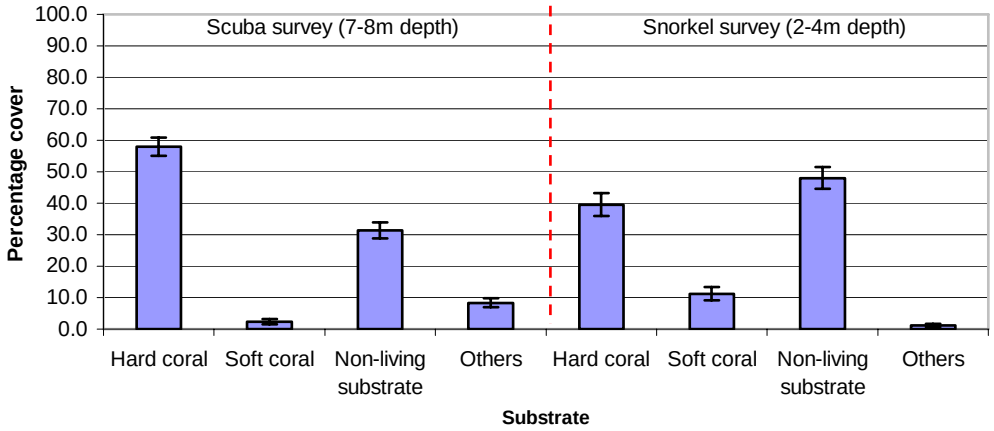
Lusong Island Coral Garden

Lusong Island Coral Garden is a popular dive site and a proposed MPA. The extensive, yet narrow reef stretches along the southwest side of Lusong Island. Still unprotected, the reef shows some damage by divers and fishers. There is a pearl farm off the deep portion adjacent

to the reef where the pearls are grown and cultivated. Near the southern tip of the island is a shallow World War II wreck.

Lusong reef has good live hard coral cover (57.9%) on the deep reef and fair live hard coral cover (39.6%) in the shallow reef. All reef fish density was fair at 7,900 fish/500m^2 and 121.4 fish/500m^2 for target species. Species diversity was 29 species/500m^2 for all reef species but only 8 target species/500m^2 (Table 15). Lusong Coral Garden is a popular dive site and is a proposed MPA. With a pearl farm close by, joint management and protection by the local government and the private pearl farm owners could contribute to the health and restoration of Lusong Coral Garden.

Figure 21. Substrate composition (%mean ±SE) in Lusong Island Coral Garden in 2006.



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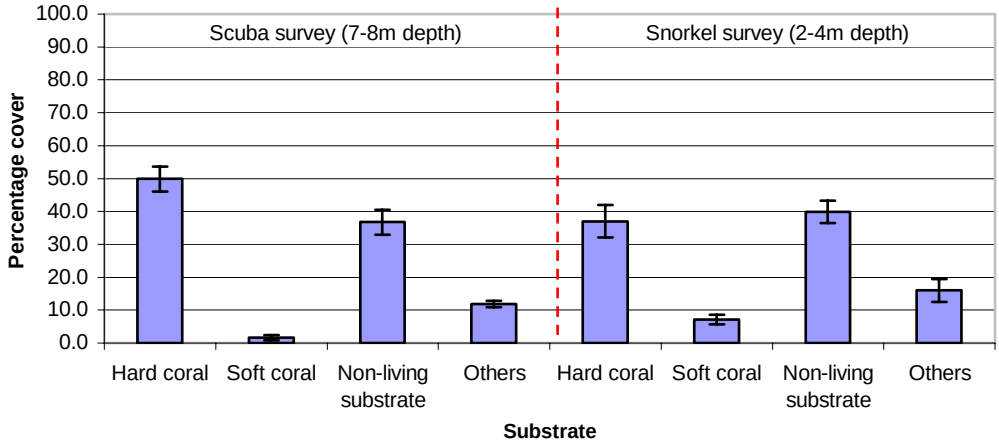
Cuaming Island

Cuaming Island is a small sandbar north of the island of Chindonan which is surrounded by shallow waters and a rich reef. On the island is a structure built by the Palawan Wildlife Association Foundation (PWAF). Once a year, two French scientists from the foundation (Philippe Dalmais and Pierre Douar) live on the island for a few weeks to monitor the surrounding reef. Unfortunately, this kind of management is not sufficient considering that when they leave the island, rampant fishing and aquarium collection is said to occur. In fact, on their recent arrival there was a large fish net installed in the outermost part of the reef used to catch aquarium fish that are herded into the net using compressor bubbles. This net was present during the survey. However, at the current stage of the PWAF project, the scientists are working closely with the municipality (especially the *Sangguniang Bayan* councilor for environment) and the community adjacent to the island on the larger island of Chindonan to make the area an official MPA.

Coral cover was good at 7 to 8 meters depth with 49.9% live hard coral. Shallow coral cover was fair at 37%. According to the PWAF scientists, *Sargassum* overgrowth in coral reefs has been observed recently in the area. *Sargassum* is apparently not a native seaweed in the islands of Culion. It is conjectured that *Sargussum* propagules came from the oyster scrapings from the pearl farms since these oysters are imported from other locations outside Calamianes, e.g. Masbate. This overgrowth occurred during the last 6 to 8 months and has been a focus of study and observation for the French volunteers. Fish density was average, as compared to the other sites, with counts of 209.6 fish/500m^2 for target species and 3,805 fish/500m^2 for all reef species. Species diversity was low at 7.2 target species/500m^2 and 28.4 species/500m^2 for all species. Butterflyfish counts were very low with only four species observed during the whole survey on scuba and on snorkel.

Figure 22. Substrate composition (%mean ±SE) in Cuaming Island in 2006.

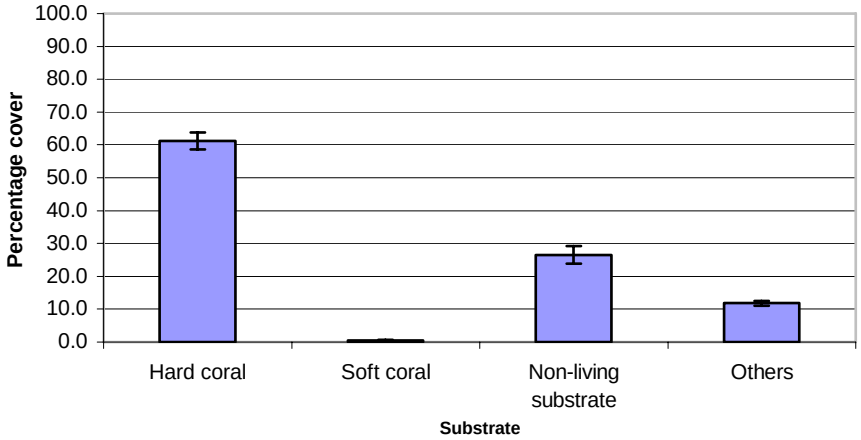


Punta Dinamita

Punta Dinamita is an extensive reef opposite, to the west side, of Bugor Island. Although it is an unprotected area, the reef shows a relatively good hard coral cover of 61.2 %. Punta Dinamita is also home to various rare and interesting sea life, such as a school of Bumphead parrotfish and turtles. This reef is a popular dive site with surrounding resorts as well as a popular fishing ground for local fishermen.

This reef has good hard coral cover (61.2%) at 7 to 8 meters depth. It showed a relatively high density of all reef species with 4231.8 fish/500m^2, and a low value for target fish145.8 fish/500m^2 which indicates the presence of fishing in the area, since it is unprotected (Table 19). The local government and community are currently considering this site as a future MPA. During the expedition team's reconnaissance survey, a one-meter long Napoleon Wrasse was sighted, as well as several large turtles.

Figure 23. Substrate composition (%mean ±SE) in Punta Dinamita in 2006. (7-8m depth)



Culambuyan Island – East and West

Culambuyan Island, southwest of the municipality of Busuanga, is a small island surrounded by strong, rushing currents. This site, especially along the eastern side, is popular with divers. A caretaker looks after the interests of the island's owner that includes a clean beach as well as a

protected reef. Unfortunately, the caretaker cannot exercise his authority unless dive boats dock at the island's beach where he charges them a fee for the use of the beach. Otherwise, dive boats come and go, as they please, to dive the rich reef. This area has been under private protection for over 10 years.

The eastern reef of the island has a rich substrate in the deep and shallow with equal averages of 61.3% live hard coral cover. Fish density was the highest, among all the surveyed areas, in Culambuyan-East with 17,674.5 fish/500m^2 for all reef fishes and 2,292.5 fish/500m^2 for target species (Table 21). This high number most likely reflects the management and enforcement of the private owner over his island and the surrounding ecosystems. The strong current in the area may also discourage fishers in this particular area as well as attract some fish. The caretaker also mentioned that this island protected area was selectively fished which explains the absence of very large-sized fish species (considering length of rotection) even though the general abundance and biomass of target species is high. Culambuyan-West has coral rubble covering 22.7% in the shallow area and 18.5% in the deeper portions. The live coral cover was fair (44.9%) at 7 to 8 meters depth and 24.2% at 2 to 4 meters depth. Fish density was fair at 3,566.3 fish/500m^2 for all reef species, and a low 46.7 target fish/500m^2 (Table 23).

Figure 24. Substrate composition (% mean ±SE) in Culambuyan Island (East) in 2006.

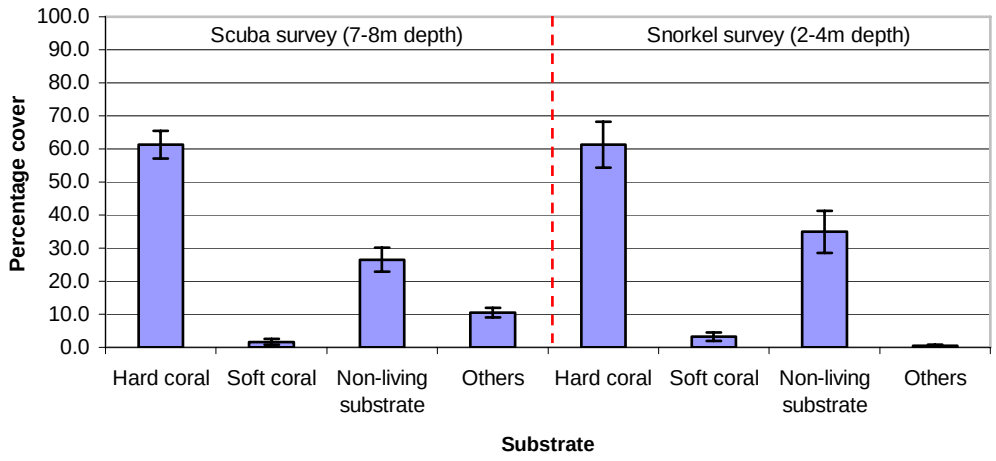


Figure 25. Substrate composition (%mean ±SE) in Culambuyan Island (West) in 2006.

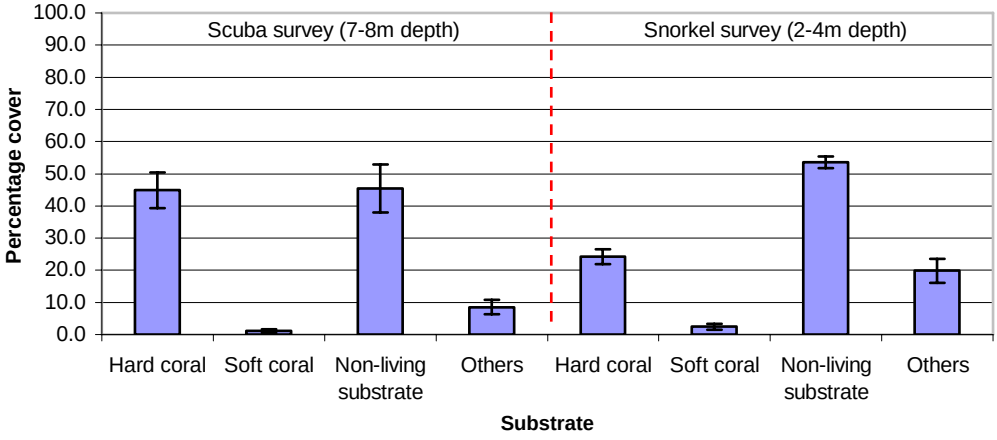


Table 1. Changes in substrate composition (% mean ±SE) in Sangat Decalve Marine Sanctuary, Coron from 2004 to 2006.

	SCUBA SURVEYS:				SNORKEL SURVEY
	2004	2005	2006	% change 2004-2006	2006
	% cover	% cover	% cover		% cover
SUBSTRATE COVER					
White dead standing coral (DC)	3.2	7.7	0.6	-82.1	2.2
Dead coral with algae (DCA)	34.3	14.0	14.0	-59.2	5.7
Coral rubble (R)	~	2.2	14.3	N/A	12.6
Rock and block (RCK)	~	0.3	4.0	N/A	8.1
Sand (S) & silt (SI)	~	3.0	4.9	N/A	8.5
Subtotal non-living substrate	**37.5**	**27.3**	**37.7**	0.6	**37.2**
Branching (CB)	~	26.6	30.8	N/A	37.9
Massive (CM)	~	11.5	4.0	N/A	8.3
Flat/Encrusting (CE)	~	4.6	4.1	N/A	2.6
Foliose/Cup (CF)	~	8.1	14.4	N/A	5.9
Total Hard Coral	**45.5**	**50.8**	**53.3**	17.1	**54.7**
Total Soft Coral	**2.8**	**5.1**	**1.8**	-36.2	**1.3**
Subtotal Coral	**48.3**	**55.9**	**55.1**	14.0	**56.0**
Sponges (SP)	~	6.9	3.5	N/A	1.5
Other animals (OT)	~	2.4	1.8	N/A	1.1
Algae					
Turf (TA)	~	0.1	0.0	N/A	0.0
Fleshy (MA)	~	1.2	1.2	N/A	1.7
Coralline (CA)	~	1.3	0.7	N/A	0.6
Seagrass (SG)	~	0.0	0.0	N/A	1.8
Subtotal Others	**14.2**	**11.9**	**7.2**	-49.2	**6.8**
Other (e.g. water)	~	4.896	~	~	~
TOTAL	**100**	**100**	**100**	**100**	**100**
Environmental Parameters					
Mean Slope (degrees)	2.5	~	59.0		40.0
Mean Topography (m)*	~	~	1.5		0.9
Mean Depth/Range (m)	8	8-10	5.7		2.3
Horizontal Visibility (m)	6.8	~	7.1		15.0
No. of 50 m Transects	10	10	7		11

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line
% change = $[(Yr_2/Yr_1)-1] \times 100$
(-) = decrease
(+) = increase

Table 2. Species list of butterflyfish in Calamianes group of Islands (Coron, Culion and Busuanga) from 2004 to 2006.

Butterfly species	Common name	Sangat Resort House Reef	Sangat Decalve Marine Sanctuary	Siete Picados Marine Sanctuary	Lusong Island Coral Garden	Sangat Island Coral Garden	Cuaming Island	Bugur Island Marine Sanctuary	Punta Dinamita	Culambuyan East	Culambuyan West
Chaetodon adiergastos	Philippine butterflyfish	Z	Z	Z		Z			Z		
Chaetodon auriga	Threadfin butterflyfish			Z							
Chaetodon baronessa	Eastern triangular butterflyfish			Z				Z			
Chaetodon bennetti	Bluelashed butterflyfish			Z							
Chaetodon citrinellus	Speckled butterflyfish										
Chaetodon ephippium	Saddle butterflyfish										
Chaetodon kleinii	Klein's butterflyfish			Z	Z						Z
Chaetodon lineolatus	Lined butterflyfish	Z		Z		Z			Z		
Chaetodon lunula	Raccoon butterflyfish			Z		Z					
Chaetodon lunulatus	Pacific redfin butterflyfish			Z							Z
Chaetodon melannotus	Blackback butterflyfish			Z			Z				Z
Chaetodon mertensii	Merten's butterflyfish										
Chaetodon meyeri	Meyer's butterflyfish										
Chaetodon ocellicaudus	Spottail butterflyfish										
Chaetodon octofasciatus	Eightband butterflyfish	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Chaetodon ornatissimus	Ornate butterflyfish										
Chaetodon oxycephalus	Spot-nape butterflyfish			Z							
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	Z									
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	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Forcipiger flavisimmus	Forcepsfish										
Forcipiger longirostris	Longnose butterflyfish										
Hemitaurichthys polylepis	Pyramid butterflyfish	Z									
Heniochus acuminatus	Pennant coralfish			Z		Z					
Heniochus chrysostomus	Threeband pennantfish										
Heniochus diphreutes	Schooling bannerfish										
Heniochus monoceros	Masked bannerfish										
Heniochus singularius	Singular bannerfish			Z		Z		Z	Z		
Heniochus varius	Horned bannerfish			Z		Z			Z		
Parachaetodon ocellatus	Sixspine butterflyfish		Z								
Coradion chrysozonus	Goldengirdled coralfish	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Coradion melanopus	Twospot coralfish			Z	Z	Z					
Total number of species/site		**7**	**5**	**17**	**5**	**10**	**4**	**5**	**7**	**3**	**6**

Total number of species observed in all sites surveyed in 2004:
Total number of species observed in all sites surveyed in 2005:
Total number of species observed in all sites surveyed in 2006:

Table 3. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Sangat Decalve Marine Sanctuary, Coron in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbitfish (Siganids)	0.6	0.4	0.0	3.6	0.0	0.0	3.6	3.1
Groupers (Serranids)*	0.2	0.2	0.0	0.4	0.0	0.0	0.4	0.4
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.0	0.3	0.4	2.4	8.0	0.0	10.8	7.9
Sweetlips (Haemulids)*	0.4	0.2	0.0	0.8	0.0	0.0	0.8	0.5
Emperors (Lethrinids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jacks (Carangids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (Caesionids)*	1.0	0.3	301.6	0.0	0.0	2.8	304.4	171.3
Spinecheeks (Nemipterids)*	0.6	0.4	0.8	7.2	0.0	0.0	8.0	5.8
Goatfish (Mullids)*	0.2	0.2	0.0	0.4	0.0	0.0	0.4	0.4
Parrotfish (Scarids)*	1.2	0.4	12.8	4.0	0.0	0.0	16.8	12.3
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.4
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Butterflyfish (Chaetodontids)	1.8	0.4	17.6	1.2	0.0	0.0	18.8	4.3
Angelfish (Pomacanthids)	1.0	0.3	1.8	0.4	0.4	0.0	2.6	0.7
Wrasses (Labrids)	4.4	0.5	17.4	8.8	0.0	0.0	26.2	4.7
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	8.0	0.7	6,081.2	0.4	0.0	0.0	6,081.6	2,621.7
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**5.2**	**0.7**	**315.6**	**18.8**	**8.4**	**2.8**	**345.6**	**178.7**
Total (all reef species)	**20.4**	**1.1**	**6,433.6**	**29.6**	**8.8**	**2.8**	**6,474.8**	**2,577.2**

* Target species/families

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

Table 4. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) and their percentage change per family in Sangat Decalve Marine Sanctuary, Coron from 2004 to 2006.

Family	(N = 10) 2004	(N = 6) 2005	(N = 5) 2006	% Change 2004-2006	(N = 6) 2005	(N = 5) 2006	% Change 2004-2006	(N = 10) 2004	(N = 6) 2005	(N = 5) 2006	% Change 2004-2006
	Total # species recorded				species/500m^2			density/500m^2			
Surgeonfish (Acanthurids)*	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Rabbitfish (Siganids)	2	7	3	50.0	1.2	0.6	-48.6	1.2	4.2	3.6	200.0
Groupers (Serranids)*	4	13	1	-75.0	2.2	0.2	-90.8	2.8	2.5	0.4	-85.7
Barramundi cod; senorita	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Snapper (Lutjanids)*	3	7	5	66.7	1.2	1.0	-14.3	10.6	2.8	10.8	1.9
Sweetlips (Haemulids)*	1	1	2	100.0	0.2	0.4	140.0	0.4	1.7	0.8	100.0
Emperors (Lethrinids)*	2	2	0	-100.0	0.3	0.0	-100.0	1.6	0.7	0.0	-100.0
Jacks (Carangids)*	1	0	0	-100.0	0.0	0.0	N/A	1.2	0.0	0.0	-100.0
Fusiliers (Caesionids)*	3	6	5	66.7	1.0	1.0	0.0	92.6	23.5	304.4	228.7
Spinecheeks (Nemipterids)*	6	8	3	-50.0	1.3	0.6	-55.0	8.6	3.0	8.0	-7.0
Goatfish (Mullids)*	2	2	1	-50.0	0.3	0.2	-40.0	0.6	0.2	0.4	-33.3
Parrotfish (Scarids)*	16	11	6	-62.5	1.8	1.2	-34.5	20.4	3.7	16.8	-17.6
Bumphead parrotfish; taungan	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.4	N/A
Rudderfish (Kyphosids)*	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Triggerfish (Balistids)	~	1	0	N/A	0.2	0.0	-100.0	~	0.2	0.0	N/A
Butterflyfish (Chaetodontids)	5	12	9	80.0	2.0	1.8	-10.0	9.2	10.0	18.8	104.3
Angelfish (Pomacanthids)	2	6	5	150.0	1.0	1.0	0.0	3	4.0	2.6	-13.3
Wrasses (Labrids)	19	58	22	15.8	9.7	4.4	-54.5	57	41.2	26.2	-54.0
Humphead wrasse; ameng	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Damselfish (Pomacentrids)	23	74	40	73.9	12.3	8.0	-35.1	500.6	1,337.2	6,081.6	1114.9
Fairy Basslets (Anthids)	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Moorish Idols (Zanclids)	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Total (target reef species)*	**40.0**	**57.0**	**26.0**	-35.0	**9.5**	**5.2**	-45.3	**140.0**	**42.2**	**345.6**	146.9
Total (all reef species)	**89.0**	**208.0**	**102.0**	14.6	**34.7**	**20.4**	-41.2	**709.8**	**1,434.7**	**6,474.8**	812.2

* Target species/families

% change = $[(Yr_2/Yr_1)-1] \times 100$

(-) = decrease

(+) = increase

~ = no available data

Table 5. Changes in substrate composition (% mean ±SE) in Bugor Island Marine Sanctuary, Culion from 2004 to 2006.

	SCUBA SURVEYS:				SNORKEL SURVEY
	2004	2005	2006	% change 2004-2006	2006
	% cover	% cover	% cover		% cover
SUBSTRATE COVER					
White dead standing coral (DC)	3.7	2.3	0.0	-98.9	1.2
Dead coral with algae (DCA)	33.8	18.6	12.4	-63.4	5.3
Coral rubble (R)	~	8.2	5.9	N/A	5.2
Rock and block (RCK)	~	1.2	7.1	N/A	15.0
Sand (S) & silt (SI)	~	1.2	1.6	N/A	15.3
Subtotal non-living substrate	**37.5**	**31.4**	**27.0**	-28.0	**42.0**
Branching (CB)	~	23.5	23.9	N/A	14.5
Massive (CM)	~	12.2	12.1	N/A	18.7
Flat/Encrusting (CE)	~	6.5	9.2	N/A	2.6
Foliose/Cup (CF)	~	7.3	11.7	N/A	1.1
Total Hard Coral	**48.9**	**49.4**	**56.9**	16.4	**36.9**
Total Soft Coral	**2.1**	**1.6**	**1.5**	-30.6	**0.9**
Subtotal Coral	**51.0**	**51.0**	**58.4**	14.5	**37.8**
Sponges (SP)	~	3.7	2.2	N/A	1.0
Other animals (OT)	~	1.1	0.4	N/A	0.2
Algae					
Turf (TA)	~	0.6	0.5	N/A	0.4
Fleshy (MA)	~	4.7	8.6	N/A	16.7
Coralline (CA)	~	0.5	3.0	N/A	0.4
Seagrass (SG)	~	0.0	0.0	N/A	1.5
Subtotal Others	**11.5**	**10.6**	**14.6**	27.2	**20.1**
Other (e.g. water)	~	6.9	~		~
TOTAL	**100**	**100.0**	**100**		**100**
Environmental Parameters					
Mean Slope (degrees)	3	~	63.5		2.9
Mean Topography (m)*	~	~	1.8		0.8
Mean Depth/Range (m)	8-10	8-10	6.6		2.3
Horizontal Visibility (m)	7.4	~	19.3		14.0
No. of 50 m Transects	10	10	12		13

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 6. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Bugor Island Marine Sanctuary, Culion in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.2	0.1	0.9	0.0	0.2	0.0	1.1	0.9
Rabbitfish (Siganids)	0.7	0.3	0.4	0.8	0.2	0.0	1.4	0.5
Groupers (Serranids)*	0.9	0.2	0.1	0.8	0.2	0.0	1.1	0.3
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.2	0.2	0.0	3.7	0.4	0.2	4.3	1.8
Sweetlips (Haemulids)*	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1
Emperors (Lethrinids)*	0.1	0.1	0.0	0.3	0.0	0.0	0.3	0.3
Jacks (Carangids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (Caesionids)*	1.4	0.3	15.0	165.3	0.0	0.0	180.3	57.5
Spinecheeks (Nemipterids)*	0.5	0.3	0.1	15.4	0.0	0.0	15.5	15.2
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	2.5	0.5	6.1	5.4	0.5	0.6	12.6	4.5
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	2.7	0.4	3.1	2.5
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1
Butterflyfish (Chaetodontids)	1.3	0.2	5.7	0.7	0.0	0.0	6.4	1.0
Angelfish (Pomacanthids)	0.9	0.2	2.1	0.9	0.0	0.0	3.0	0.8
Wrasses (Labrids)	6.9	0.4	37.6	6.2	0.0	0.0	43.8	15.6
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	11.5	0.6	3,075.5	0.2	0.0	0.0	3,075.7	1,061.5
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**7.6**	**0.9**	**21.7**	**191.7**	**4.3**	**1.2**	**218.9**	**61.9**
Total (all reef species)	**28.3**	**0.7**	**3,143.5**	**199.8**	**4.3**	**1.2**	**3,348.8**	**1,085.9**

* Target species/families

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

Table 7. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) and their percentage change per family in Bugor Island Marine Sanctuary, Culion from 2004 to 2006.

Family	(N = 10) 2004	(N = 3) 2005	(N = 10) 2006	% Change 2004-2006	(N = 3) 2005	(N = 10) 2006	% Change 2005-2006	(N = 10) 2004	(N = 3) 2005	(N = 10) 2006	% Change 2004-2006
	Tot. # species recorded				species/500m^2			density/500m^2			
Surgeonfish (Acanthurids)*	1	0	2	100.0	0.0	0.2	+	0.3	0.0	1.1	319.8
Rabbitfish (Siganids)	2	2	7	250.0	0.7	0.7	5.0	1.5	1.3	1.4	-6.7
Groupers (Serranids)*	~	10	9	N/A	3.3	0.9	-73.0	~	5.7	1.1	N/A
Barramundi cod; senorita	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Snapper (Lutjanids)*	3	4	12	300.0	1.3	1.2	-10.0	8.0	2.3	4.3	-46.3
Sweetlips (Haemulids)*	1	1	1	0.0	0.3	0.1	-70.0	0.0	0.3	0.1	+
Emperors (Lethrinids)*	~	1	1	N/A	0.3	0.1	-70.0	~	0.3	0.3	N/A
Jacks (Carangids)*	1	0	0	-100.0	0.0	0.0	N/A	1.0	0.0	0.0	-100.0
Fusiliers (Caesionids)*	4	2	14	250.0	0.7	1.4	110.0	173.0	10.0	180.3	4.2
Spinecheeks (Nemipterids)*	5	3	5	0.0	1.0	0.5	-50.0	4.0	1.7	15.5	287.5
Goatfish (Mullids)*	2	0	0	-100.0	0.0	0.0	N/A	1.0	0.0	0.0	-100.0
Parrotfish (Scarids)*	9	12	25	177.8	4.0	2.5	-37.5	18.0	7.3	12.6	-30.0
Bumphead parrotfish; taungan	~	0	0	N/A	0.0	0.0	N/A	~	0.0	3.1	N/A
Rudderfish (Kyphosids)*	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Triggerfish (Balistids)	1	0	1	0.0	0.0	0.1	+	0.3	0.0	0.1	-61.8
Butterflyfish (Chaetodontids)	3	5	13	333.3	1.7	1.3	-22.0	12.5	4.3	6.4	-48.8
Angelfish (Pomacanthids)	1	3	9	800.0	1.0	0.9	-10.0	6.0	3.7	3.0	-50.0
Wrasses (Labrids)	22	38	69	213.6	12.7	6.9	-45.5	80.0	35.3	43.8	-45.3
Humphead wrasse; ameng	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Damselfish (Pomacentrids)	25	39	115	360.0	13.0	11.5	-11.5	807.5	1,125.3	3,075.7	280.9
Fairy Basslets (Anthids)	~	0	0	N/A	0.0	0.0	N/A	~	0.0	0.0	N/A
Moorish Idols (Zanclids)	1	0	0	-100.0	0.0	0.0	N/A	0.3	0.0	0.0	-100.0
Total (target reef species)*	**28.0**	**35.0**	**76.0**	171.4	**11.7**	**7.6**	-34.9	**206.8**	**29.0**	**218.9**	5.9
Total (all reef species)	**81.0**	**120.0**	**283.0**	249.4	**40.0**	**28.3**	-29.3	**1,113.3**	**1,197.7**	**3,348.8**	200.8

* Target species/families

% change = [(Yr_2/Yr_1)-1] x 100

(-) = decrease

(+) = increase

~ = no available data

Table 8. Changes in substrate composition (% mean ±SE) in Siete Picados Marine Sanctuary, Coron from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.4	2.9
Dead coral with algae (DCA)	7.6	3.3
Coral rubble (R)	11.1	19.9
Rock and block (RCK)	8.2	8.6
Sand (S) & silt (SI)	3.4	3.0
Subtotal non-living substrate	**30.7**	**37.6**
Branching (CB)	31.7	38.3
Massive (CM)	7.6	8.4
Flat/Encrusting (CE)	7.9	3.8
Foliose/Cup (CF)	7.4	2.9
Total Hard Coral	**54.5**	**53.4**
Total Soft Coral	**1.9**	**1.3**
Subtotal Coral	**56.4**	**54.7**
Sponges (SP)	7.1	4.8
Other animals (OT)	1.4	1.0
Algae		
Turf (TA)	0.1	0.0
Fleshy (MA)	2.9	0.2
Coralline (CA)	1.4	1.7
Seagrass (SG)	0.0	0.0
Subtotal Others	**12.9**	**7.7**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	54.0	15.0
Mean Topography (m)*	1.9	1.3
Mean Depth/Range (m)	6.8	2.3
Horizontal Visibility (m)	15.0	15.0
No. of 50 m Transects	7	8

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 9. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Siete Picados Marine Sanctuary, Coron in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Rabbitfish (Siganids)	1.8	0.5	7.6	13.6	1.4	0.2	22.8	10.8
Groupers (Serranids)*	1.6	0.2	0.4	1.6	0.0	0.2	2.2	0.6
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.2	0.4	3.6	0.6	0.8	0.2	5.2	3.5
Sweetlips (Haemulids)*	0.2	0.2	0.0	0.0	0.2	0.0	0.2	0.2
Emperors (Lethrinids)*	1.0	0.3	0.0	3.2	0.2	0.0	3.4	2.0
Jacks (Carangids)*	0.4	0.2	0.0	0.6	0.0	0.0	0.6	0.4
Fusiliers (Caesionids)*	0.8	0.4	18.0	58.6	0.0	0.0	76.6	54.5
Spinecheeks (Nemipterids)*	0.6	0.4	0.0	0.6	0.0	0.0	0.6	0.4
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	3.0	0.8	0.2	15.8	2.6	0.0	18.6	10.0
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.8	0.4	3.0	0.8	0.0	0.0	3.8	2.9
Butterflyfish (Chaetodontids)	3.4	0.7	11.2	5.0	0.0	0.0	16.2	4.4
Angelfish (Pomacanthids)	0.6	0.2	2.0	0.2	0.0	0.0	2.2	1.5
Wrasses (Labrids)	5.4	0.8	20.0	3.6	0.2	0.0	23.8	9.1
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	12.0	1.4	4,754.6	0.2	0.0	0.0	4,754.8	1,390.4
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.4	0.2	0.2	0.4	0.0	0.0	0.6	0.4
Total (target reef species)*	**10.8**	**1.4**	**29.8**	**94.8**	**5.2**	**0.8**	**130.6**	**52.5**
Total (all reef species)	**33.4**	**3.8**	**4,820.8**	**105.0**	**5.4**	**0.8**	**4,932.0**	**1,417.7**

* Target species/families

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

Table 10. Changes in substrate composition (% mean ±SE) in Sangat Resort House Reef, Coron from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.0	0.9
Dead coral with algae (DCA)	8.5	10.7
Coral rubble (R)	3.6	12.9
Rock and block (RCK)	23.1	13.0
Sand (S) & silt (SI)	5.5	10.6
Subtotal non-living substrate	**40.8**	**48.0**
Branching (CB)	6.8	33.5
Massive (CM)	16.4	10.8
Flat/Encrusting (CE)	9.0	3.5
Foliose/Cup (CF)	0.6	0.5
Total Hard Coral	**32.8**	**48.3**
Total Soft Coral	**1.9**	**2.2**
Subtotal Coral	**34.6**	**50.6**
Sponges (SP)	7.3	0.3
Other animals (OT)	1.4	0.2
Algae		
Turf (TA)	1.0	0.0
Fleshy (MA)	11.4	0.7
Coralline (CA)	3.6	0.2
Seagrass (SG)	0.0	0.0
Subtotal Others	**24.6**	**1.4**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	62.5	3.0
Mean Topography (m)*	2.3	1.1
Mean Depth/Range (m)	6.9	2.4
Horizontal Visibility (m)	12.8	19.2
No. of 50 m Transects	4	12

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 11. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Sangat Resort House Reef, Coron in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.3	0.3	0.0	1.0	0.0	0.0	1.0	1.0
Rabbitfish (Siganids)	1.0	0.6	0.0	20.0	0.0	0.0	20.0	19.0
Groupers (Serranids)*	2.0	0.6	0.0	2.3	0.0	0.0	2.3	0.3
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.3	0.7	0.0	1.7	0.3	0.0	2.0	1.2
Sweetlips (Haemulids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (Lethrinids)*	1.0	0.0	0.0	3.7	0.0	0.0	3.7	2.2
Jacks (Carangids)*	0.3	0.3	0.0	2.3	0.0	0.0	2.3	2.3
Fusiliers (Caesionids)*	0.7	0.3	0.0	266.7	0.0	0.0	266.7	133.3
Spinecheeks (Nemipterids)*	1.0	0.0	0.0	2.0	0.0	0.0	2.0	0.6
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	4.7	0.9	3.7	25.3	5.3	0.0	34.3	24.8
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.3	0.3	0.0	0.3	0.0	0.0	0.3	0.3
Butterflyfish (Chaetodontids)	2.0	0.6	4.0	1.0	0.0	0.0	5.0	1.2
Angelfish (Pomacanthids)	1.0	0.0	2.0	0.0	0.0	0.0	2.0	0.6
Wrasses (Labrids)	6.0	1.2	20.7	2.3	0.0	0.0	23.0	7.1
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	13.3	1.7	9,781.0	2.0	0.0	0.0	9,783.0	3,168.2
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**12.3**	**2.9**	**3.7**	**325.3**	**5.7**	**0.0**	**334.7**	**81.8**
Total (all reef species)	**35.0**	**5.9**	**9,811.3**	**331.0**	**5.7**	**0.0**	**10,148.0**	**3,232.2**

* Target species/families

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

Table 12. Changes in substrate composition (% mean ±SE) in Sangat Island Coral Garden, Coron from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.0	1.6
Dead coral with algae (DCA)	9.6	8.4
Coral rubble (R)	16.9	10.7
Rock and block (RCK)	13.6	26.1
Sand (S) & silt (SI)	6.6	3.7
Subtotal non-living substrate	**46.7**	**50.4**
Branching (CB)	9.9	7.3
Massive (CM)	7.1	15.5
Flat/Encrusting (CE)	9.1	3.2
Foliose/Cup (CF)	4.4	2.6
Total Hard Coral	**30.4**	**28.7**
Total Soft Coral	**1.7**	**8.2**
Subtotal Coral	**32.1**	**36.9**
Sponges (SP)	3.9	1.3
Other animals (OT)	1.8	0.2
Algae		
Turf (TA)	2.9	0.6
Fleshy (MA)	4.0	7.5
Coralline (CA)	8.5	3.1
Seagrass (SG)	0.0	0.0
Subtotal Others	**21.1**	**12.7**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	71.7	16.7
Mean Topography (m)*	1.8	0.2
Mean Depth/Range (m)	6.3	1.8
Horizontal Visibility (m)	16.7	24.9
No. of 50 m Transects	7	10

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 13. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Sangat Island Coral Garden, Coron in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.2	0.2	1.0	0.0	0.0	0.0	1.0	1.0
Rabbitfish (Siganids)	1.0	0.3	0.0	1.2	0.0	0.2	1.4	0.4
Groupers (Serranids)*	1.4	0.2	1.2	1.0	0.2	0.0	2.4	0.7
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.6	0.2	0.0	3.2	1.0	0.0	4.2	2.2
Sweetlips (Haemulids)*	0.2	0.2	0.0	0.0	0.0	0.2	0.2	0.2
Emperors (Lethrinids)*	0.8	0.4	0.0	0.6	0.0	0.2	0.8	0.4
Jacks (Carangids)*	0.4	0.2	0.0	0.4	0.0	0.0	0.4	0.2
Fusiliers (Caesionids)*	1.0	0.0	86.4	333.0	0.0	0.0	419.4	88.9
Spinecheeks (Nemipterids)*	1.0	0.0	1.8	1.4	0.0	0.0	3.2	0.7
Goatfish (Mullids)*	0.6	0.4	0.2	0.4	0.0	0.0	0.6	0.4
Parrotfish (Scarids)*	2.4	0.7	0.4	8.4	1.2	0.4	10.4	3.4
Bumphead parrotfish; taungan	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)	0.4	0.2	0.0	1.2	0.0	0.0	1.2	1.0
Butterflyfish (Chaetodontids)	3.0	0.8	6.4	2.8	0.0	0.0	9.2	5.0
Angelfish (Pomacanthids)	1.2	0.2	3.6	2.4	0.0	0.0	6.0	1.4
Wrasses (Labrids)	6.0	0.9	9.0	4.8	0.0	0.0	13.8	3.1
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	10.0	0.7	1,747.0	0.0	0.0	0.0	1,747.0	327.5
Fairy Basslets (Anthids)	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**10.6**	**1.9**	**90.0**	**349.6**	**2.4**	**1.0**	**443.0**	**86.0**
Total (all reef species)	**31.4**	**3.3**	**1,857.0**	**361.0**	**2.4**	**1.0**	**2,221.4**	**318.2**

* Target species/families

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

Table 14. Changes in substrate composition (% mean ±SE) in Lusong Island Coral Garden, Coron from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.1	2.4
Dead coral with algae (DCA)	14.4	8.9
Coral rubble (R)	7.6	12.3
Rock and block (RCK)	8.4	19.9
Sand (S) & silt (SI)	0.9	4.5
Subtotal non-living substrate	**31.4**	**48.0**
Branching (CB)	19.5	16.5
Massive (CM)	9.0	13.5
Flat/Encrusting (CE)	11.5	4.5
Foliose/Cup (CF)	17.9	5.0
Total Hard Coral	**57.9**	**39.6**
Total Soft Coral	**2.4**	**11.2**
Subtotal Coral	**60.3**	**50.8**
Sponges (SP)	5.2	0.1
Other animals (OT)	2.6	0.1
Algae		
Turf (TA)	0.1	0.0
Fleshy (MA)	0.1	0.7
Coralline (CA)	0.4	0.3
Seagrass (SG)	0.0	0.1
Subtotal Others	**8.4**	**1.2**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	57.5	2.5
Mean Topography (m)*	1.5	0.5
Mean Depth/Range (m)	6.6	2.2
Horizontal Visibility (m)	16.7	17.7
No. of 50 m Transects	7	11

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 15. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Siete Picados Marine Sanctuary, Coron in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbitfish (Siganids)	0.6	0.2	0.0	0.8	0.4	0.0	1.2	0.5
Groupers (Serranids)*	0.8	0.2	0.2	2.0	0.0	0.2	2.4	0.9
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	2.8	0.2	0.0	17.4	0.6	1.4	19.4	6.8
Sweetlips (Haemulids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (Lethrinids)*	0.2	0.2	0.0	0.4	0.0	0.0	0.4	0.4
Jacks (Carangids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (Caesionids)*	0.4	0.2	80.0	6.6	0.0	0.0	86.6	78.6
Spinecheeks (Nemipterids)*	1.0	0.0	0.0	4.2	0.6	0.0	4.8	1.9
Goatfish (Mullids)*	0.6	0.4	0.0	1.0	0.0	0.0	1.0	0.6
Parrotfish (Scarids)*	1.6	0.6	0.0	2.0	1.4	1.6	5.0	2.0
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.4	0.2	0.0	0.2	0.2	0.0	0.4	0.2
Butterflyfish (Chaetodontids)	2.6	0.5	14.2	1.8	0.0	0.0	16.0	4.1
Angelfish (Pomacanthids)	1.0	0.0	1.6	2.8	0.0	0.0	4.4	1.2
Wrasses (Labrids)	6.2	1.1	26.4	1.0	0.4	0.0	27.8	17.0
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6
Damselfish (Pomacentrids)	10.8	2.9	7,727.4	2.2	0.0	0.0	7,729.6	2,672.7
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**8.0**	**0.4**	**80.2**	**34.4**	**3.0**	**3.8**	**121.4**	**81.5**
Total (all reef species)	**29.0**	**3.7**	**7,849.8**	**42.4**	**3.6**	**4.4**	**7,900.2**	**2,696.0**

* Target species/families

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

Table 16. Changes in substrate composition (% mean ±SE) in Cuaming Island, Culion from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.5	0.2
Dead coral with algae (DCA)	9.6	5.7
Coral rubble (R)	13.2	4.2
Rock and block (RCK)	7.7	11.4
Sand (S) & silt (SI)	5.7	18.4
Subtotal non-living substrate	**36.7**	**39.9**
Branching (CB)	21.7	19.9
Massive (CM)	12.6	12.3
Flat/Encrusting (CE)	9.7	3.3
Foliose/Cup (CF)	5.8	1.5
Total Hard Coral	**49.9**	**37.0**
Total Soft Coral	**1.6**	**7.1**
Subtotal Coral	**51.5**	**44.1**
Sponges (SP)	5.5	1.3
Other animals (OT)	1.5	0.6
Algae		
Turf (TA)	0.4	0.0
Fleshy (MA)	3.4	9.5
Coralline (CA)	0.9	0.2
Seagrass (SG)	0.0	4.4
Subtotal Others	**11.8**	**16.0**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	52.9	2.5
Mean Topography (m)*	1.4	0.8
Mean Depth/Range (m)	6.9	2.4
Horizontal Visibility (m)	16.7	17.3
No. of 50 m Transects	7	13

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 17. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Cuaming Island, Culion in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.2	0.2	0.0	1.8	0.0	0.0	1.8	1.8
Rabbitfish (Siganids)	0.2	0.2	0.2	0.0	0.0	0.0	0.2	0.2
Groupers (Serranids)*	1.0	0.3	0.2	1.2	0.0	0.0	1.4	0.5
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.6	0.2	0.0	46.6	0.2	0.0	46.8	26.6
Sweetlips (Haemulids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (Lethrinids)*	0.2	0.2	0.0	0.8	0.0	0.0	0.8	0.8
Jacks (Carangids)*	0.4	0.2	0.0	6.8	0.0	0.0	6.8	6.6
Fusiliers (Caesionids)*	0.8	0.5	0.0	135.4	0.0	0.0	135.4	127.1
Spinecheeks (Nemipterids)*	0.4	0.2	0.0	2.0	0.0	0.0	2.0	1.4
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	2.4	1.3	0.0	14.0	0.4	0.0	14.4	7.5
Bumphead parrotfish; taungan	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)	0.4	0.2	0.0	0.4	0.0	0.0	0.4	0.2
Butterflyfish (Chaetodontids)	2.0	0.4	6.6	8.8	0.0	0.0	15.4	6.9
Angelfish (Pomacanthids)	0.8	0.2	0.8	2.8	0.0	0.0	3.6	0.9
Wrasses (Labrids)	5.8	0.6	15.2	10.8	0.0	0.0	26.0	9.7
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	12.2	1.3	3,547.4	2.8	0.0	0.0	3,550.2	419.2
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**7.2**	**1.7**	**0.4**	**208.6**	**0.6**	**0.0**	**209.6**	**127.3**
Total (all reef species)	**28.4**	**2.9**	**3,570.4**	**234.2**	**0.6**	**0.0**	**3,805.2**	**501.3**

* Target species/families

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

Table 18. Substrate composition (% mean ±SE) in Punta Dinamita, Culion from 1998 to 2006.

	SCUBA SURVEYS:
	2006
	% cover
SUBSTRATE COVER	
White dead standing coral (DC)	0.0
Dead coral with algae (DCA)	13.2
Coral rubble (R)	5.3
Rock and block (RCK)	7.0
Sand (S) & silt (SI)	1.0
Subtotal non-living substrate	**26.5**
Branching (CB)	28.0
Massive (CM)	13.6
Flat/Encrusting (CE)	10.5
Foliose/Cup (CF)	9.1
Total Hard Coral	**61.2**
Total Soft Coral	**0.5**
Subtotal Coral	**61.7**
Sponges (SP)	1.8
Other animals (OT)	0.4
Algae	
Turf (TA)	0.1
Fleshy (MA)	7.2
Coralline (CA)	2.2
Seagrass (SG)	0.0
Subtotal Others	**11.8**
TOTAL	**100**
Environmental Parameters	
Mean Slope (degrees)	57.5
Mean Topography (m)*	1.3
Mean Depth/Range (m)	7.1
Horizontal Visibility (m)	19.1
No. of 50 m Transects	7

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 19. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Punta Dinamita, Culion in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.4	0.4	0.0	0.0	0.2	0.4	0.6	0.6
Rabbitfish (Siganids)	1.0	0.3	0.0	0.6	0.4	2.8	3.8	2.1
Groupers (Serranids)*	0.4	0.2	0.0	0.4	0.2	0.0	0.6	0.4
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.4	0.5	0.0	2.4	0.6	0.6	3.6	1.7
Sweetlips (Haemulids)*	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Emperors (Lethrinids)*	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Jacks (Carangids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusiliers (Caesionids)*	0.6	0.2	111.0	0.0	0.0	0.0	111.0	97.5
Spinecheeks (Nemipterids)*	0.4	0.2	4.8	0.8	0.0	0.0	5.6	4.7
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	2.0	1.0	6.6	12.8	0.4	0.2	20.0	9.0
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.2
Butterflyfish (Chaetodontids)	2.4	0.7	7.6	1.2	0.0	0.0	8.8	1.4
Angelfish (Pomacanthids)	0.8	0.2	2.0	0.4	0.0	0.0	2.4	1.1
Wrasses (Labrids)	4.2	0.7	22.6	7.8	0.0	0.0	30.4	15.3
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	10.2	0.4	4,044.0	0.2	0.0	0.0	4,044.2	1,915.4
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**6.6**	**2.1**	**122.4**	**17.4**	**1.8**	**4.2**	**145.8**	**102.6**
Total (all reef species)	**24.4**	**2.7**	**4,198.6**	**27.2**	**1.8**	**4.2**	**4,231.8**	**2,004.5**

* Target species/families

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

Table 20. Changes in substrate composition (% mean ±SE) in Culambuyan East, Busuanga from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.3	0.2
Dead coral with algae (DCA)	13.0	14.7
Coral rubble (R)	4.7	4.1
Rock and block (RCK)	5.7	12.3
Sand (S) & silt (SI)	2.8	3.7
Subtotal non-living substrate	**26.5**	**34.9**
Branching (CB)	23.2	41.3
Massive (CM)	16.0	14.4
Flat/Encrusting (CE)	10.7	2.6
Foliose/Cup (CF)	11.5	3.1
Total Hard Coral	**61.3**	**61.3**
Total Soft Coral	**1.7**	**3.2**
Subtotal Coral	**63.0**	**64.6**
Sponges (SP)	7.5	0.0
Other animals (OT)	1.7	0.1
Algae		
Turf (TA)	0.0	0.1
Fleshy (MA)	0.5	0.3
Coralline (CA)	0.8	0.0
Seagrass (SG)	0.0	0.1
Subtotal Others	**10.5**	**0.5**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	60.0	8.0
Mean Topography (m)*	1.3	1.0
Mean Depth/Range (m)	6.5	3.2
Horizontal Visibility (m)	18.7	22.6
No. of 50 m Transects	3	6

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 21. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Culambuyan East, Busuanga in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbitfish (Siganids)	0.5	0.5	0.0	0.5	0.0	0.0	0.5	0.5
Groupers (Serranids)*	2.5	0.5	3.0	8.5	0.0	0.0	11.5	1.5
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.5	0.5	0.0	90.5	0.0	0.0	90.5	78.5
Sweetlips (Haemulids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (Lethrinids)*	1.0	0.0	0.0	1.5	0.0	0.0	1.5	0.5
Jacks (Carangids)*	0.5	0.5	0.0	0.5	0.0	0.0	0.5	0.5
Fusiliers (Caesionids)*	2.5	0.5	0.0	2,181.0	0.0	0.0	2,181.0	821.0
Spinecheeks (Nemipterids)*	1.5	0.5	1.0	0.5	0.0	0.0	1.5	0.5
Goatfish (Mullids)*	0.5	0.5	0.0	1.0	0.0	0.0	1.0	1.0
Parrotfish (Scarids)*	3.0	3.0	0.0	2.5	1.0	0.0	3.5	3.5
Bumphead parrotfish; taungan	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
Rudderfish (Kyphosids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triggerfish (Balistids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Butterflyfish (Chaetodontids)	2.5	0.5	7.5	3.0	0.0	0.0	10.5	5.5
Angelfish (Pomacanthids)	1.0	0.0	6.5	0.0	0.0	0.0	6.5	2.5
Wrasses (Labrids)	7.5	1.5	25.0	0.5	0.0	0.0	25.5	0.5
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	16.0	0.0	15,238.0	0.0	0.0	0.0	15,238.0	5,230.0
Fairy Basslets (Anthids)	0.5	0.5	100.0	0.0	0.0	0.0	100.0	100.0
Moorish Idols (Zanclids)	0.5	0.5	1.5	0.0	0.0	0.0	1.5	1.5
Total (target reef species)*	**13.5**	**1.5**	**4.0**	**2,286.5**	**1.0**	**1.0**	**2,292.5**	**739.5**
Total (all reef species)	**41.5**	**2.5**	**15,382.5**	**2,290.0**	**1.0**	**1.0**	**17,674.5**	**6,062.5**

* Target species/families

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

Table 22. Changes in substrate composition (% mean ±SE) in Culambuyan West, Busuanga from 1998 to 2006.

	SCUBA SURVEYS:	SNORKEL SURVEYS:
	2006	2006
	% cover	% cover
SUBSTRATE COVER		
White dead standing coral (DC)	0.0	0.6
Dead coral with algae (DCA)	18.9	8.8
Coral rubble (R)	18.5	22.7
Rock and block (RCK)	6.5	18.4
Sand (S) & silt (SI)	1.6	3.1
Subtotal non-living substrate	**45.5**	**53.6**
Branching (CB)	22.9	12.6
Massive (CM)	4.9	6.0
Flat/Encrusting (CE)	9.6	1.7
Foliose/Cup (CF)	7.5	3.8
Total Hard Coral	**44.9**	**24.2**
Total Soft Coral	**1.1**	**2.4**
Subtotal Coral	**46.0**	**26.6**
Sponges (SP)	4.1	0.5
Other animals (OT)	0.5	0.2
Algae		
Turf (TA)	0.0	0.2
Fleshy (MA)	2.3	18.7
Coralline (CA)	1.6	0.2
Seagrass (SG)	0.0	0.0
Subtotal Others	**8.5**	**19.9**
TOTAL	**100**	**100**
Environmental Parameters		
Mean Slope (degrees)	51.7	20.0
Mean Topography (m)*	1.9	0.5
Mean Depth/Range (m)	6.4	3.8
Horizontal Visibility (m)	14.0	14.3
No. of 50 m Transects	4	8

a = total no. of stops made by snorkelers
~ no data available
* mean distance between lowest and highest points on the horizontal transect line

Table 23. Mean (±SE) fish species richness (species/500m^2) and density (individuals/500m^2) per family in Culambuyan West, Busuanga in 2006.

Family	Species		Size Class				Density	
	Mean	SE	1-10cm**	11-20 cm	21-30 cm	>30 cm	Mean	SE
Surgeonfish (Acanthurids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbitfish (Siganids)	0.3	0.3	0.0	0.3	0.0	0.0	0.3	0.3
Groupers (Serranids)*	1.3	0.3	0.0	1.3	0.7	0.0	2.0	0.6
Barramundi cod; senorita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snapper (Lutjanids)*	1.0	0.6	0.0	14.7	0.0	0.0	14.7	13.7
Sweetlips (Haemulids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emperors (Lethrinids)*	0.3	0.3	0.0	0.0	0.3	0.0	0.3	0.3
Jacks (Carangids)*	0.7	0.3	0.0	1.0	0.0	0.0	1.0	0.6
Fusiliers (Caesionids)*	1.0	0.0	0.0	15.3	0.0	0.0	15.3	8.4
Spinecheeks (Nemipterids)*	1.0	0.0	0.0	2.0	0.3	0.0	2.3	0.7
Goatfish (Mullids)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parrotfish (Scarids)*	1.7	0.7	0.0	8.3	2.0	0.3	10.7	7.2
Bumphead parrotfish; taungan	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)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Butterflyfish (Chaetodontids)	2.3	0.9	8.7	1.0	0.0	0.0	9.7	6.8
Angelfish (Pomacanthids)	1.0	0.0	3.0	2.0	0.0	0.0	5.0	2.0
Wrasses (Labrids)	4.7	0.3	29.7	6.0	0.0	0.0	35.7	27.2
Humphead wrasse; ameng	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damselfish (Pomacentrids)	12.0	2.1	3,468.3	1.0	0.0	0.0	3,469.3	304.7
Fairy Basslets (Anthids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moorish Idols (Zanclids)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (target reef species)*	**7.3**	**0.7**	**0.0**	**43.0**	**3.3**	**0.3**	**46.7**	**23.1**
Total (all reef species)	**27.3**	**0.9**	**3,509.7**	**53.0**	**3.3**	**0.3**	**3,566.3**	**253.2**

* Target species/families

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

Table yyy. Mean biomass (kg per 500 m^2) of selected targetfish for both commercial food fishery and aquarium trade recorded from Calamianes sites during the April 2006 SPR survey.

	Sangat I. Resort		Sangat I. Coral Garden		Sangat I.-Decalve MPA		Siete Picados MPA		Lusong I. Coral garden		Cuaming I.		Bugor I.		Punta Dinamita		Calumbuyan-West		Calumbuyan-East	
FAMILY/SUBFAMILY	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE	**mean**	SE
EPINEPHILINAE*	0.19	0.04	0.03	0.02	0.00	0.00	0.14	0.11	0.78	0.63	0.03	0.01	0.07	0.06	0.26	0.24	0.04	0.02	0.26	0.12
LUTJANIDAE*	0.22	0.13	0.38	0.15	1.03	1.08	0.47	0.28	2.57	0.72	6.70	3.40	0.45	0.33	0.87	0.61	0.08	0.06	14.49	10.52
LETHRINIDAE*	0.55	0.33	0.17	0.13	0.00	0.00	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.26	0.21	0.11	0.05
CARANGIDAE*	0.21	0.21	0.05	0.05	0.00	0.00	0.05	0.04	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02
CAESIONIDAE^	8.34	4.55	11.81	4.58	2.38	1.83	2.37	1.94	1.27	1.14	0.48	0.48	9.59	4.71	1.52	1.39	0.53	0.39	111.68	51.39
ACANTHURIDAE^#$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAEMULIDAE!	0.00	0.00	0.00	0.00	0.02	0.02	0.36	0.26	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
NEMIPTERIDAE!	0.14	0.03	0.16	0.10	0.03	0.04	0.01	0.01	0.54	0.19	0.05	0.05	2.34	2.79	0.06	0.06	0.56	0.38	0.05	0.03
MULLIDAE!	0.00	0.00	0.02	0.02	0.01	0.01	0.00	0.00	0.09	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.10
BALISTIDAE!^#$	0.03	0.03	0.02	0.02	0.00	0.00	0.04	0.02	0.02	0.02	0.04	0.03	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00
CHAETODONTIDAE$	0.13	0.04	0.09	0.05	0.09	0.03	0.49	0.24	0.23	0.05	0.20	0.10	0.05	0.03	0.23	0.10	0.18	0.09	0.21	0.13
POMACANTHIDAE$	0.02	0.00	0.09	0.03	0.07	0.07	0.02	0.02	0.12	0.06	0.09	0.04	0.03	0.02	0.04	0.02	0.08	0.04	0.08	0.04
SCARIDAE#	6.05	5.01	1.55	0.69	0.21	0.14	2.31	2.05	11.35	8.30	1.19	0.69	10.67	12.48	2.49	1.47	2.30	0.97	2.15	1.74
SIGANIDAE#	3.67	3.59	0.34	0.17	0.12	0.14	3.33	2.10	0.16	0.14	0.00	0.00	0.29	0.14	5.26	4.25	0.08	0.04	0.16	0.13
TOTAL	**19.55**	**5.48**	**14.70**	**5.29**	**3.97**	**2.15**	**9.82**	**5.11**	**17.13**	**8.61**	**8.80**	**4.26**	**23.53**	**11.11**	**10.76**	**4.11**	**4.12**	**1.87**	**129.34**	**54.14**

*Piscivores

^ Planktivores

#Herbivores

!Invertebrate feeder

$sSome species in the family are collected as aquarium fish

SUMMARY OF FINDINGS AND TRENDS

Coral reef substrate and invertebrates

Comparison of our 2006 fish data from Calamianes with previous SPR survey regions (Batangas 2005, Tubbataha 2004), with known management histories served as a gauge in determining the status of Calamianes reefs. Live hard coral cover (LHC) in 10 surveyed sites ranges from fair to good (deep areas: 7-10, m: 32.8 ± 1.76 to 61.2 ± 2.54%; Fig. 26). Site names per region and management status are found in Table 25.

Figure 26. Live Hard Coral (% mean ±SE), Calamianes-2006, Batangas-2005, Tubbataha-2004

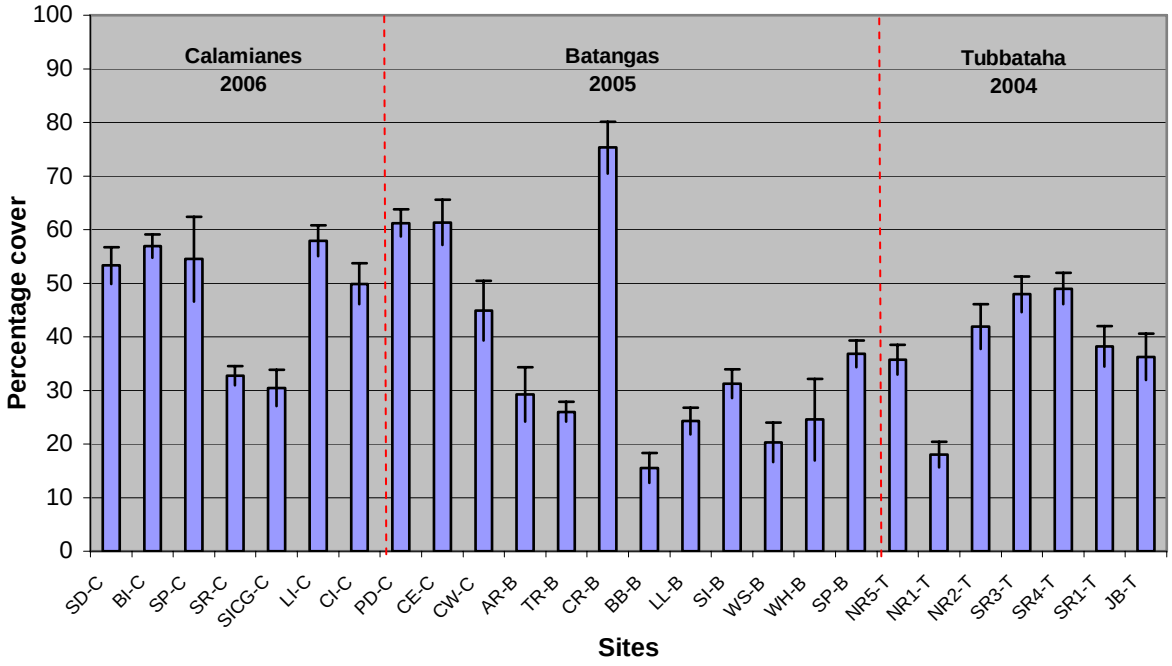


Figure 27. Fish species richness (species/500m^2), Calamianes-2006, Batangas-2005, Tubbataha-2005

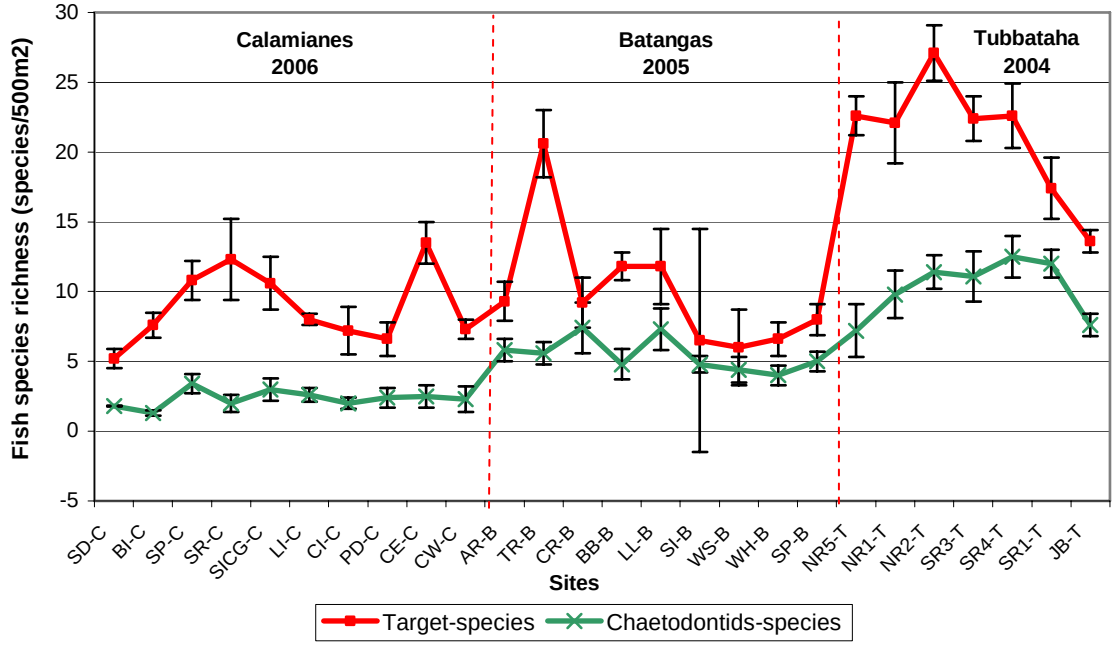


Figure 28. Fish density (individuals/500m^2), Calamianes-2006, Batangas-2005, Tubbataha-2004

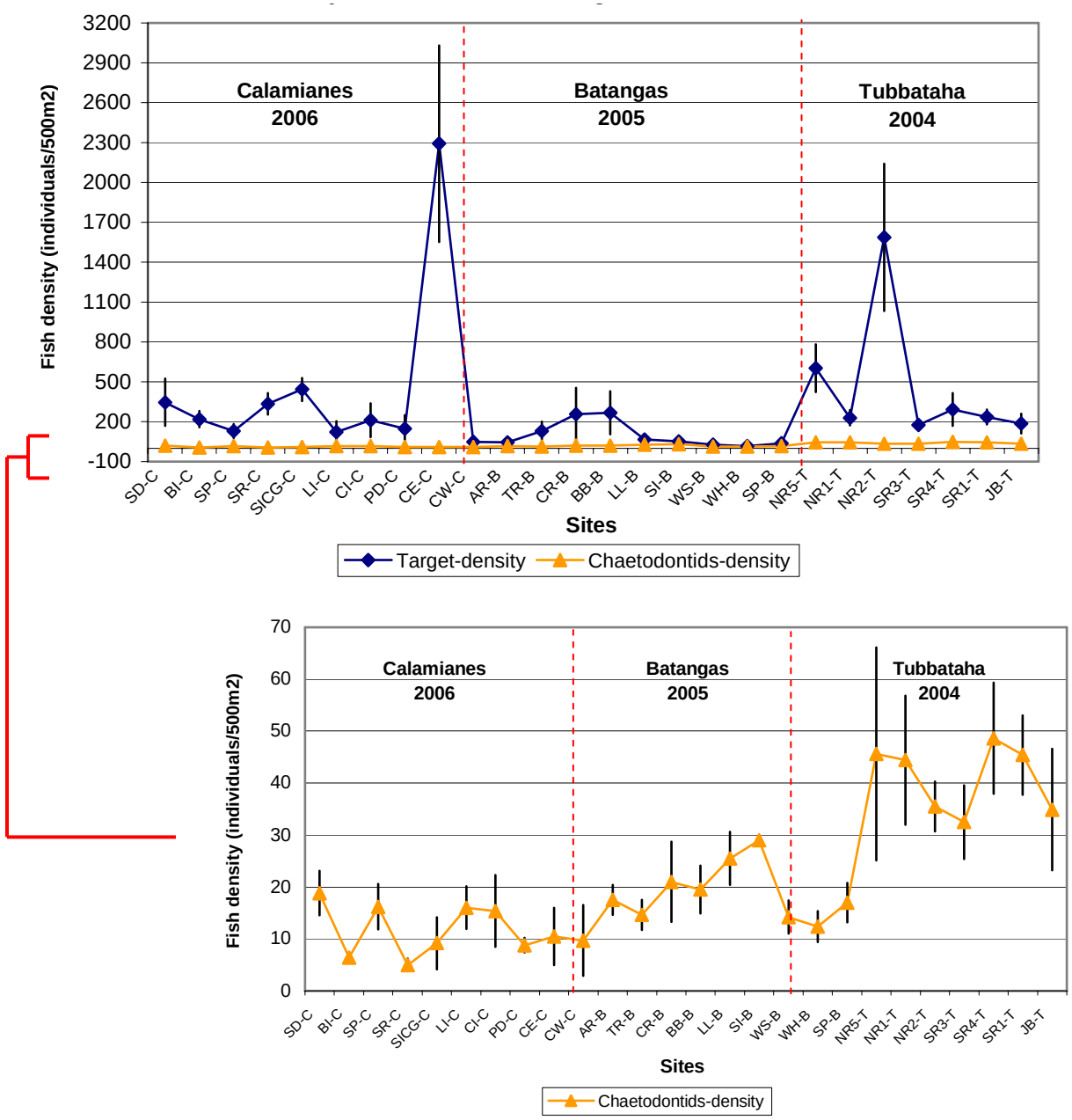


Table 25. Survey sites of three regions surveyed by SPR from 2004-2006 and their management status.

Site Code	Site Name	Management status at the time of survey
CALAMIANES 2006		
SD-C	Sangat-Declave MPA, Coron	MPA, 1 year of protection
BI-C	Bugor I., Culion	MPA, 1 year of protection
SP-C	Siete Picados, Coron	MPA, 3 years of protection
SR-C	Sangat Resort, Sanagat I.	Protected for over ten years through Sangat Resort
SI-CG-C	Coral Garden, Sangat I., Coron	A reserve but open to fishing to Tagbanua Tribe

Site Code	Site Name	Management status at the time of survey
LI-CG-C	Coral Garden, Lusong I., Coron	Fishing ground
CI-C	Cuaming Island, Culion	A reserve but poaching is going on
PD-C	Punta Dinamita, Culion	Fishing Ground
CE-C	Calumbuyan I., Busuanga-East	Fishing Ground
CW-C	Calumbuyan I., Busuanga-West	Protected for 11 years but fished selectively
BATANGAS 2005		
(Mabini-Tingloy)		
AR-B	Arthur's Rock, Mabini	MPA, 13 years of protection
TR-B	Twin Rocks, Mabini	MPA, 13 years of protection
CR-B	Cathedral Reef, Mabini	MPA, 13 years of protection
BB-B	Batalang Bato, Tingloy	MPA, 4 years of protection, Closed to recreational diving
LL-B	Layag-layag, Tingloy	Fishing Ground
SI-B	Sombrero Island, Tingloy	Fishing Ground
WS-B	White Sand Reef, Mabini	Fishing Ground
WH-B	White House Reef, Mabini	Fishing Ground
SP-B	Sepoc Point, Tingloy	Fishing Ground
TUBBATAHA 2004		
NR-5-T	North Reef 5 (Bird Islet)	MPA, protected by a Presidential Decree since 1988
NR-1-T	North Reef 1(Amos Rock or Malayan Wreck)	MPA, protected by a Presidential Decree since 1988
NR-2-T	North Reef 2 (Ranger Station)	MPA, protected by a Presidential Decree since 1988
SR-3-T	South Reef 3 (Black Rock)	MPA, protected by a Presidential Decree since 1988
SR-4-T	South Reef 4 (Northwest corner of the south atoll)	MPA, protected by a Presidential Decree since 1988
SR-1-T	South Reef 1(Lighthouse Islet)	MPA, protected by a Presidential Decree since 1988
JB-T	Jessie Beazley Reef	Fishing ground

Fish diversity, abundance, biomass and large marine life

Target fish (commercially important food fish) and butterflyfish (aquarium fish) abundance and species richness appear to vary between regions and within regions between sites despite similarities in LHC. This is partly explained by management. In most cases, target fish abundance is higher inside marine protected areas (MPAs) compared to fishing grounds (White et al. 2004, 2005). This is especially seen in those MPAs with strict enforcement and protected longer (e.g., sites in Tubbataha Reefs National Marine Park, Balatang Bato in Tingloy, Batangas, Twin Rocks in Mabini, Batangas)(White et al. 2004, 2005).

Hierarchical agglomerative cluster analysis and multi-dimensional scaling identified four site groups based on densities and species richness of target species, butterflyfishes and angelfishes, and total counts of butterfly species per site (Fig. 29). The groupings were confirmed by the ordination stress level (0.05) that indicated a useful representation of the overall relationship in sites (Fig. 30).

Figure 29. A dendogram of hierarchical clustering (group-average linking) of sites in three regions in the Philippines comparing coral reef fish abundance and species richness. Sites are MPAs and non-MPAs with known management histories.

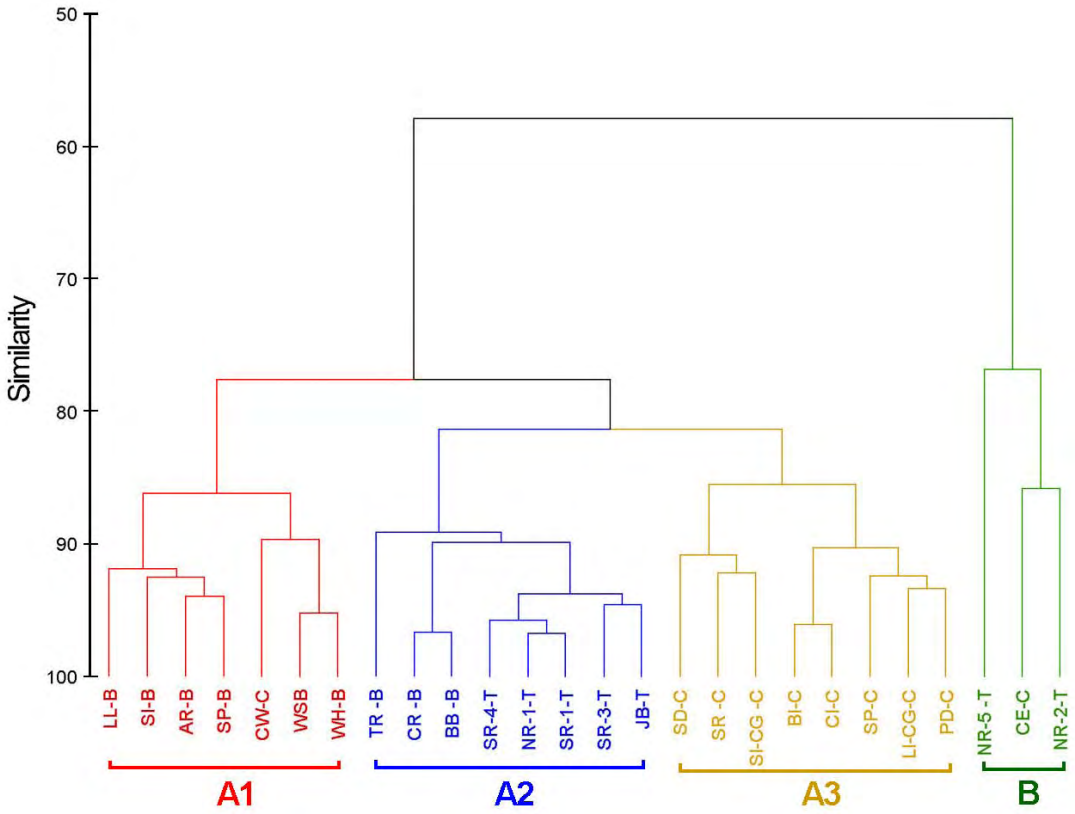
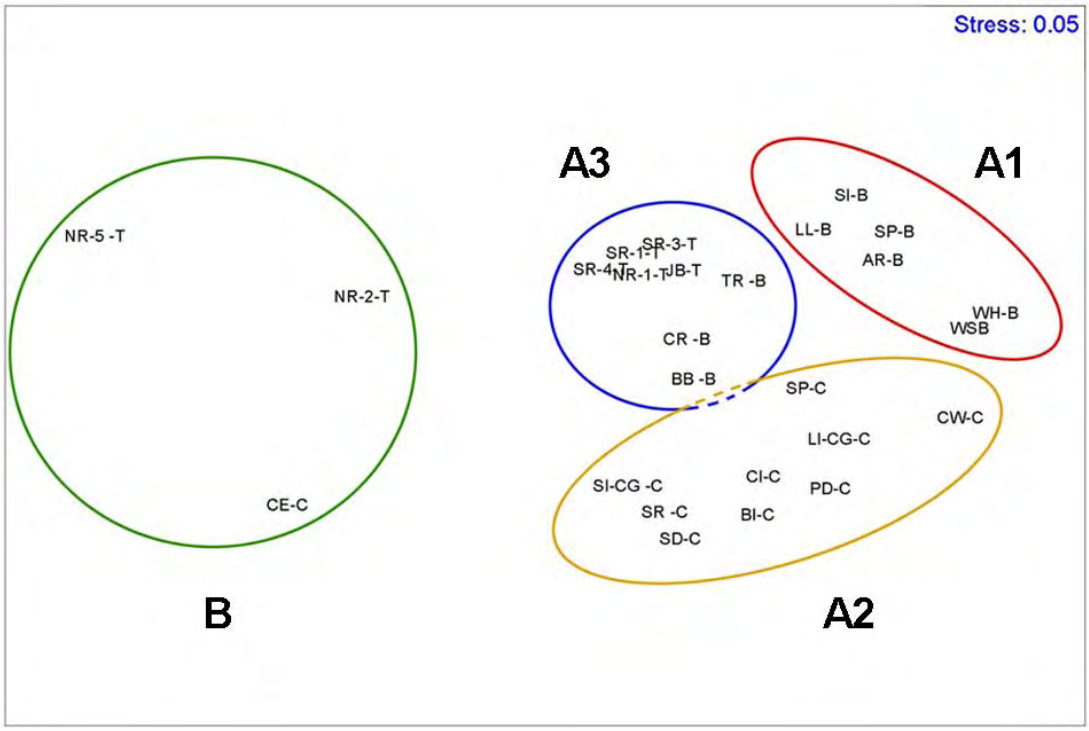


Figure 30. Ordination of site attributes (reef fish abundance and species richness) in three regions in the Philippines. Sites are MPAs and non-MPAs with known management histories. Kruskal stress = 0.05.



The groups were described as: A1, A2, A3 and B. Community type B separated at a lower level as compared to the majority of the sites (Fig. 30). The other site groups, i.e., A1, A2 and A3, although distinct clusters, are grouped together at a higher distance value. This supports the known similarity overlap in fish parameters used, between these different groups.

Three communities were composed of low-mid densities of target species and densities, low-high species richness for all species recorded, low-high densities and species richness of indicator fish families belonging to Chaetodontidae and Pomacanthidae (groups A1, A2 and A3) (Table 26). Group A1 consistently had low-mid ranges compared to A2 and A3. Group A1 included all of the fishing grounds and one MPA in the Batangas region and one site from Calamianes, Calumbuyan I., West (CW-C)(Table 25).

Table 26. Results of the SIMPER analysis (in order of relative contribution) showing coral reef fish parameters that contribute most to (A) similarities within site groups and (B) percentage dissimilarities between groups.

(A) Factors contributing to site groupings, average densities (fish/500m^2)/species richness/counts of each factor and an arbitrary classification of values per factor (low-high) limited to sites used.

Factors	Site Groups			
	A1	A2	A3	B
Density (target)	41.87 (low)	221.61 (mid)	243.70 (mid)	3300.17 (high)
Species richness (all species)	40.03 (mid)	54.39 (high)	28.79 (low)	53.03 (high)
Species richness (targets)	7.93 (low)	17.46 (mid)	8.54 (low)	21.07 (high)
Total species counts (Chaetodontidae)	15.71 (mid)	25.88 (high)	7.50 (low)	19.33 (mid)
Density (Chaetodontidae)	17.90 (mid)	32.61 (high)	11.98 (low)	30.53 (high)
Species richness (Chaetodontidae)	4.80 (mid)	8.85 (high)	2.31 (low)	7.03 (high)
Density (Pomacanthidae)	7.02 (mid)	10.70 (high)	3.28 (low)	9.00 (high)
Species richness(Pomacanthidae)	1.89 (mid)	2.43 (high)	0.91 (low)	1.77 (mid)

(B) Percentage dissimilarity between site groups

	A1			
A2	48.23	**A2**		
A3	54.54	13.85	**A3**	
B	91.74	79.61	77.49	**B**

Group B was composed of high target fish and indicator fish densities and species richness. This group included only three sites: NR5 and NR2 of Tubbataha and Calumbuyan I.-East in Calamianes. The rest of the Calamianes sites grouped as A3, whose distinct characteristics are low densities, species richness and total counts of butterfly and angelfishes compared to the rest of the groups. This indicates high fishing pressure for aquarium fish in the area as confirmed by local interviews and data from ReefCheck/Marine Aquarium Council (MAC).

Table 27. Aquarium fish demand from Coron (data from Stuart Green of ReefCheck/MAC).

FAMILY/SPECIES	COMMON NAME
ACANTHURIDAE	**Surgeonfish/Unicornfish**
Naso litturatus	Orangespine unicornfish
Zebrasoma veliferum	Pacific sailfin tang
BALISTIDAE	**Triggerfish**
Balistoides conspicillum	Clown trigger
CHAETODONTIDAE	**Butterflyfish**
Chelmon rostratus	Long-beaked coralfish
Forcipeger flavissimus	Longnose butterflyfish
Forcipiger longirostris	Big longnose butterflyfish
EPHIPPIDAE	**Batfish**
Platax pinnatus	Pinnate spadefish
LUTJANIDAE	**Snapper**
Symphorichthys spilurus	Sailfin snapper
POMACANTHIDAE	**Angelfish**
Apomelichthys trimaculatus	Three-spot angelfish
Genicanthus lamarck	Blackstriped angelfish
Pomacanthus imperator	Emperor angelfish
Pomacanthus semicircularis	Semicircle angelfsih
Pomacanthus sextriatus	Six-banded angelfish
Pmacanthus xanthometopon	Yellow-masked angelfish
POMACENTRIDAE	**Damsels/Anemonefish**
Amphiprion frenatus	Tomato anemone
Amphiprion ocellaris	False clown anemonefish
Premnas biaculeatus	Spinecheech anemonefish
PSUEDOCHROMIIDAE	**Dottyback**
Calloplesiops altivelis	Comet dottyback
Pseudochromis diadema	Purpletop dottyback
PTERELEOTRIDAE	**Dartfish**
Nemateleotris magnifica	fire dartfish

Calamianes reefs, although remote from the greater majority of the Philippine population, appears to be frequented by aquarium and commercial fishers. It is important to note that a couple of the families/subfamilies were consistently absent or represented only by one or two species or individuals are: Acanthuridae, Carangidae, Balistidae and Haemulidae, Anthiinae, *Amphiprion* spp. The absence of these families/subfamilies/species may be a reflection of overfishing but needs further verification due to our survey method limitations. Management initiatives have been started in the area (e.g., establishment of marine protected areas), however, needs a stronger support and enhancement from the residents, local government, non-government organizations, commercial fishers and aquarium traders.

Further, our list of fish species (Appendix 3) and other surveys (Allen, 1998) listed many species that are not found/not commonly found in other locations in the Philippines (e.g., *Altricthys* spp. of the family Pomacentridae, *Parachaetodon ocellatus* of the family Chaetodontidae, many other pomacentrids and *Bolbometopon muricatum* or bumphead parrotfish). Geological evidence indicates that Palawan has a separate evolutionary history to the rest of the Philippines (Inger 1954) and geological history and isolation may play a role in the observed species differences and distributions. However, our results also suggest that anthropogenic impacts played a greater role in the current observed species composition and abundance in Calamianes since some species and genus were not observed.

Human activities

As seen in the results, anthropogenic impacts play a great role in the status of the reefs, especially the fishes. There is still evidence of rampant aquarium fishing in the unprotected reefs that were surveyed. As seen in Table 27, there is a large market for at least 20 different species of fish being targeted for the aquarium trade. This helps explain the extremely low butterflyfish counts in almost all the areas surveyed, as seen on Table 2. Calamianes Islands is a group of islands endowed in rich and diverse reefs and a heritage that still supports the “relatively” pristine quality of the area as a tourist destination to endure. However, presently the area has been fully discovered as an area rich in fisheries resources. This is shown by the decreasing densities of fish and the absence of some species that are expected to be present in the area. There is a need for the establishment of more and better-managed marine protected areas to address the problem of rampant aquarium fishing and over-fishing. There is also an urgent need to improve fisheries management outside of marine protected areas. This can be done through more rigorous gear regulation and control and through better enforcement of illegal fishing methods still common in the area.

RECOMMENDATIONS FOR IMPROVED MANAGEMENT

Calamianes has a unique geologic history. The terrestrial area is characterized by rocky mountainous and coastal karst formations that serve as a habitat to a diverse collection of animals and birds in a thickly forested area. These islands have long been home to a number of indigenous people away from modern Manila. Calamianes likewise offers a unique set of aquatic ecosystems. It has several inland lakes known for their beauty and natural condition. Most importantly the islands are surrounded by a highly diverse coral reefs that are home to some species of fish seldom found in other parts of the country. They equally support a rich assortment of fisheries that provide the main source of livelihood for residents in the area.

Various human uses are impacting the condition of the marine ecosystems of the Calamianes Islands. There is a high frequency of aquarium fishing, illegal fishing and poaching activities as attested by the interviews with local persons and as observed from the results generated by this research expedition.

Since the 1960s, the mariculture of pearls within the calm water-environment of Calamianes has become a main industry of the area. More recently, dive-tourism as a marine resource use activity is increasing rapidly. In addition, the area is popular for its numerous wreck-dives located in relatively shallow waters.

The abuse of the coastal and marine resources of Calamianes suggest an urgent need for a long-term conservation program to preserve their biodiversity and beauty and to restore these resources in some areas for the benefit of all. The area, although still relatively intact, shows many signs of impact from threats as indicated by the past degradation of reef health and fisheries. The Calamianes group of islands requires an integrated approach to management with participation of collaborators and stakeholders. An integrated plan of action is needed that includes the following recommendations:

1. **Enhance management efforts of Siete Picados, Sangat-Decalve, and Bugor Marine Sanctuaries.** As new sanctuaries, these sites display recovering fish densities and species diversity. Although there are indications that aquarium fishing is still occurring in these areas, despite their legal protection, management is improving and starting to make a positive impact on these MPAs. To continue this progress and considering the distance of these areas from the main towns, the local government needs to further build the capacity and to empower local communities to be vigilant in guarding and managing the areas.

2. **More sanctuaries are needed to protect additional reef habitats in this large and heavily fished area.** All the islands have potentially healthy reefs and fisheries that are heavily fished by commercial and artisanal fishers and aquarium fishers alike. Additional no-take sanctuaries will protect and restore reefs and their fisheries from overfishing that can lead to improved productivity.

3. **An integrated sustainable use management plan for Coron, Busuanga and Culion and networking in management and law enforcement.** Key stakeholders of the area include fishing communities, groups of indigenous people, pearl farmers, tourism operators, several NGOs and the FISH Project. The opportunity to network marine protected areas through an organized group of collaborators can reap returns in improved protection. The area has an advantage of having many sites concentrated between islands and in close proximity to one another which can be an ideal venue for collaborative management, patrolling and monitoring. A partnership involving key stakeholders of the Calamianes area is being established to create and implement a sustainable management plan that needs continuing support.

4. **Education and information campaigns for local residents and dive tourists on the proper utilization and protection of marine protected areas.** As a culturally, historically and ecologically rich site of national importance, Calamianes has a tremendous potential as a prime tourist spot and educational area. It is recommended that an organized educational and recreational tour package be created as part of the long-term sustainable development plan being proposed. Local communities can be trained to share their experience and assist in tourism activities. This could provide additional livelihoods for locals and can facilitate management of tourists and their impacts.

5. **Monitoring and evaluation results should be shared with all stakeholders.** Presenting such data can give local residents and other stakeholders of the common resources they benefit from and how they can assist in improving conservation and management efforts. As part of the integrated management plan, they can all have a role in future monitoring activities so they can gauge their efforts together.

6. **Continued monitoring for sustained management.** Through this expedition, it was observed how management efforts are concentrated only on certain sites of interest. With results from the expedition, coupled with results from local implementers such as the FISH Project, continued monitoring with the participation of stakeholders is a key to having them understand the problems that are apparent in the area and how they can address them.

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APPENDIX 1. Expedition Itinerary

Saving Philippine Reefs 2006 Itinerary
April 8-16, 2006
Sangat Island, Coron, Palawan

Day	Date and Site	Time	Activities
1	April 8 House Reef Sangat Is., Coron	AM 12 1 pm 7pm	Arrival of volunteers Lunch Briefing on the FISH Project sites (Benjie) Briefing on SPR expeditions (Alan) Practice snorkel Kick calibration Dinner Presentation: Coral and Fish Monitoring Guide (Brian)
2	April 9 Sangat Resort House Reef Sangat Is., Coron Sangat-Decalve Marine Sanctuary (MPA-SEMP) Sangat Is., Coron	7 am 8 9 12 1:30 7 pm	Breakfast Briefing on monitoring methods Scuba practice and actual surveys Lunch Scuba surveys Dinner Presentation: CCE Foundation Research (Aileen)
3	April 10 Siete Picados Brgy. Tagumpay, Coron (MPA-SEMP and FISH) Sangat Decalve Marine Sanctuary (MPA-SEMP) Sangat Is., Coron	7 am 8 9 12 1:30 7 pm	Breakfast Briefing Scuba and snorkel surveys Lunch Snorkel surveys Dinner
4	April 11 Quaming Island Reefs, Culion (MPA-FISH) Bugur Island Reefs, Culion (MPA-FISH)	7 am 8 9 12 1:30 7 pm	Breakfast Briefing Scuba and snorkel surveys Lunch Scuba surveys Dinner Presentation: CCE Foundation (Anna) Presentation: Alan T. White Library and Learning Center (Sheryll) Presentation: CCE Foundation Financial Report (Vangie)
5	April 12 Bugur Island Reefs, Culion (MPA-FISH) Punta Dinamita, Culion (Non-MPA)	7 am 8 9 12 1:30 7 pm	Breakfast Briefing Scuba and snorkel surveys Lunch Scuba and snorkel surveys Dinner Presentation: Basking Shark Watch Survey (Vittoria)

Day	Date and Site	Time	Activities
6	April 13 Culambuyan Island (East and West) Busuanga Tantangen Reef, Busuanga	7 am 8 9 12 1:30 7 pm	Breakfast Briefing Scuba and snorkel surveys Lunch Fun dive/snorkel Dinner Presentation: the Indian Ocean Tsunami Warning System Program (Alan)
7	April 14 Lusong Island, Coron (proposed MPA-FISH and SEMP) Olympia Maru Wreck	7 am 8 9 12 1:30 7 pm	Breakfast Briefing Scuba and snorkel surveys Lunch Fun dive Dinner Free night
8	April 15 Sangat-Decalve, Coron (MPA-FISH) Barracuda Lake, Coron Sangat Resort House Reef Coron	7 am 8 9 12 1:30 4:00 7 pm	Breakfast Briefing scuba and snorkel surveys Lunch Fun snorkel Snorkel survey Dinner Presentation: Mimicry (Brian)
9	April 16 Travel home	AM	Breakfast Travel back to Coron and Manila

APPENDIX 2. Expedition staff and volunteers

Saving Philippine Reefs Expedition Volunteers
April 8-16, 2006

	Name/Address	Contact numbers/fax/email	Profession/Affiliations/Interests
1	**Denise Illing** 34 Oakland Drive Warrandyte 3113 Australia	Home: +613 9844 1583 Mobile: +61 429 146 147 denise@illing.com.au	Technical Librarian, UNICO Computer Systems. BA in Geography and Sociology. DAN First Aid and Oxygen Provider with CPR. Interested in marine life, reefs, and diving. 4th Saving Philippine Reefs expedition.
2	**Geoff Illing** 34 Oakland Drive Warrandyte, VIC 3113 Australia	Phone: 03 9865 9140 Office Phone: +613 9865 9118 Home Phone: +613 9844 1583 Mobile: +61 419307047 geoff@illing.com.au or geoff@unico.com.au	Originally a mathematician, now director/owner of software development company. Amateur musician, playing clarinet, bass clarinet, sax and bassoon in concert bands, orchestra and small ensembles.
3	**Julia Cichowski** 41 Gray Street Boston, MA 02116 U.S.A.	Home Phone: (617) 451-6976 Office Phone: (617) 563-0881 Julia.cichowski@fmr.com	V.P, Development, Fidelity Investments; Computer Science graduate; interest in underwater photography; 7th Saving Philippine Reefs Expedition; Divemaster.
4	**Thomas J. Mueller** 29905 Rainbow Crest Drive Agoura Hills, CA 91301 U.S.A.	Mobile Phone: 917-592-7074 (prefered) Home Phone: 818-865-2133 tj@tjmueller.com	Self employed educational consultant to Higher Education; PhD in Biology; small boat experience, especially sail; underwater photographer; SCUBA instructor; 8th "Saving Philippine Reefs" expedition; CCE Foundation, board member
5	**Sandra Breil** 608 First Ave Farmville, Virginia 23901 U.S.A.	Phone: 434 392 4568 sbreil@kinex.net	PhD. in Biology; retired Biology teacher; experienced in reef survey; experienced scuba diver; has interest in photography.
6	**Vittoria Annoscia-Thornley** Kemble Mill Somerford Keynes Cirencester, Glos. GL7 6ED U.K.	Phone: +44 1285 861303 Fax: +44 1285 860888 Mobile: +44 7866 458125 vittoria@annoscia-thornley.freeserve.co.uk	Human Sciences graduate (Oxford); MSc in Ecology (Bristol); volunteer with the Marine Conservation Society (UK); Advanced open water scuba diver. 6th Saving Philippine Reef expedition.
7	**Mary Pickett** 116 Vista Lane, Taos, New Mexico 87571-5311 U.S.A.	Home: (808) 395-3325 Work: (808) 440-9011 marypickett@aol.com	Waikiki Aquarium School Program Coordinator. Interests include scuba and snorkeling, hiking, kayaking, reading
8	**Ed Cooper** P O Box 99 Embudo, New Mexico 87531 USA	Phone: 505-579 4190 Cell: 505-927-2970 eecoop@la-tierra.com	Retired Dentist Affiliated with several local environmental groups, the local library board etc Interests include exploring, discovery, hiking, kayaking

	Name/Address	Contact numbers/fax/email	Profession/Affiliations/Interests
9	**Gaywynn Cooper** P O Box 99 Embudo, NM 87531 U.S.A.	Phone: 505 579 4190 Cell: 505 927 2971 Fax: 505 579 4191 gwcoop@la-tierra.com	Part time Dental Hygienist Affiliated with Environmental Org, Peace and Justice Org. Interests include organic Farming, permaculture, anything to do with the out of doors, sustainability and preserving biodiversity, reading, history, sailing, hiking, kayaking, yoga.
10	**Alexander Douglas Robb** 4 Nevada Rtt., Bulleen, Victoria 3105 Australia Tel 61-3-92438460 Wk 61-3-9850- 5497 Hm	Tel 61-3-92438460 Wk 61-3-9850- 5497 Hm sandy.robb@griffithhack.com.au	IP Researcher/Civil Engineer

Saving Philippine Reefs Expedition Staff
April 8-16, 2006

	Name/Address	Contact numbers/fax/email	Profession/Affiliations/Interests
1	**Dr. Alan T. White** Principal Investigator 322 Aoloa St. #412 Kailua, HI 96734 U.S.A.	Phone: Hawaii 808-262-1091 Phone: Thailand 662-651-4400 Rm 511 alan.white@ttemi.com	Chief of Party Program Integrator for the Indian Ocean Tsunami Warning System Program President Coastal Conservation and Education Foundation, Inc.
2	**Aileen Maypa, MSc.** Co-Principal Investigator CCE Foundation c/o Silliman University Marine Lab Dumaguete City 6200 Philippines	Phone: 035 225-2500 apmaypa@mozcom.com	Coordinator Research Division CCE Foundation, Inc.
3	**Evangeline White** Overall Project and Logistics Coordinator 322 Aoloa St. #412 Kailua HI 96734 USA	Home Tel. (808) 2621091 Cellphone (808) 4892460 vangiewhite@hawaiiantel.net	Finance Manager/Advisor CCE Foundation, Inc.
4	**Sheryll Tesch** Data and Research Coordinator #7 Aquamarine Street St. Michael Village, Banilad Cebu City, 6000 Philippines	Phone: (6332) 416-2040 233-6947 Fax: (6332) 233-6891 sheryll.tesch@gmail.com	Information, Education and Communications/Data Coordinator CCE Foundation, Inc.
5	**Anna Blesilda Meneses** Data and Community Surveys Coordinator #7 Aquamarine Street St. Michael Village, Banilad Cebu City, 6000 Philippines	Phone: (6332) 416-2040 233-6947 Fax: (6332) 233-6891 abtmeneses@yahoo.com	MPA Project Coordinator CCE Foundation, Inc.
6	**Brian Stockwell** Data and Research Coordinator Silliman University Marine Lab Dumaguete City 6200 Philippines	Phone: 035 225-2500 brianstockwell@gmail.com	Fisheries Research Consultant CCE Foundation, Inc.
7	**Rafael Martinez** GIS Specialist FISH Project, 5th Floor CIFC Towers, North Reclamation Area Cebu City, 6000 Philippines	Phone: (6332) 232-1821 to 22 Fax: (6332) 232-1825 raffy.martinez@gmail.com	GIS Specialist and Database Programmer Fisheries Improved for Sustainable Harvest (FISH) Project

	Name/Address	Contact numbers/fax/email	Profession/Affiliations/Interests
8	**Ethan Lucas** Divemaster #7 Aquamarine Street St. Michael Village, Banilad Cebu City, 6000 Philippines	Phone: (6332) 416-2040 233-6947 Fax: (6332) 233-6891 ethanylucas@yahoo.com	Peace Corps Volunteer/Dive Instructor (NAUI) CCE Foundation, Inc.
9	**Ian White** Volunteer 322 Aoloa St. #412 Kailua HI 96734 USA	Home Tel. (808) 2621091 Cellphone (808) 4892460	Student, soccer, competitive swimmer, kayaker, wall climber, diver, and likes to play!

APPENDIX 3. Fish Species List

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
I	**Acanthuridae - surgeonfishes**										
	Naso brevirostris				1						
	Naso lituratus			1	1				1		
	Naso vlamingi								1		
	Zebrasoma veliferum		1								
II	**Apogonidae - cardinalfishes**										
	Apogon bandanensis	1	1	1		1	1	1	1		
	Apogon compressus	1	1	1	1	1	1	1	1	1	1
	Apogon chysopomus		1					1			
	Apogon fragilis				1			1			1
	Apogon griffini	1	1	1				1			
	Apogon leptacanthus							1			
	Apogon parvulus	1							1		1
	Apogon rhodopterus			1	1	1		1			
	Apogon sealei	1	1	1	1		1	1	1		
	Archamia fucata			1	1	1		1	1		
	Archamia zosterophora	1		1			1	1	1		
	Cheliodipterus artus							1			
	Cheilodipterus macrodon	1		1					1	1	1
	Cheilodipterus quinquilineatus	1	1	1	1	1	1	1	1	1	
	Cheilodipterus zonatus				1		1	1			
	Sphaeramia nematoptera	1	1	1	1	1	1	1	1		
	Sphaeramia orbicularis					1					
III	**Aulostomidae - trumpetfishes**										
	Aulostomus chinensis		1							1	1
IV	**Balistidae - triggerfishes**										
	Balistapus undulatus		1								

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Balistoides viridescens		1		1	1	1	1	1		1
	Melichthys vidua			1							
	Pseudobalistes flavimarginatus		1		1						
	Sufflamen bursa						1				
V	**Blenniidae - blennies**										
	Cirrepectes sp.			1	1						
	Meiacanthus atrodorsalis	1		1				1	1		
	Salarias fasciatus							1			
VI	**Caesionidae - fusiliers**										
	Caesio caerulaurea	1	1	1	1		1	1	1	1	
	Caesio teres	1	1	1	1	1	1	1	1	1	1
	Pterocaesio lativittata			1							
	Pterocaesio marri									1	
	Pterocaesio pisang		1								
	Pterocaesio tesselata			1			1				
VII	**Carangidae - jacks**										
	Carangoides bajad		1		1	1		1		1	1
	Caranx sexfasciatus		1								
	Elagatis bipinnulatus		1								
VIII	**Centriscidae - shrimpfishes**										
	Aeoliscus strigatus						1				
	Centriscus scutatus					1					
IX	**Chaetodontidae - butterflyfishes**										
	Chaetodon adiergastos		1		1				1		
	Chaetodon auriga		1								
	Chaetodon baronessa		1	1							
	Chaetodon bennetti		1								
	Chaetodon kleinii		1								1
	Chaetodon lineolatus		1		1				1		
	Chaetodon lunula		1								

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Chaetodon lunulatus		1								
	Chaetodon melannotus		1					1			1
	Chaetodon octofasciatus	1	1	1	1	1	1	1	1	1	1
	Chaetodon oxycephalus		1								
	Chaetodon speculum				1						
	Chelmon rostratus	1	1	1	1	1	1	1	1	1	1
	Coradion chrysozonus	1	1	1	1	1	1	1	1	1	1
	Hemitaurichthys polylepis				1						
	Heniochus acuminatus		1			1					
	Heniochus singularis		1	1		1			1		
	Heniochus varius		1			1			1		
	Parachaetodon ocellatus	1									
X	**Dasyatidae- sting rays**										
	Dasyatis kuhli										1
XI	**Ephippidae - batfishes**										
	Platax boersii		1		1				1		
	Platax pinnatus				1				1		1
	Platax teira		1	1							
XII	**Gobiidae - gobies**										
	Amblyeleotris sp. "red fin"										1
	Amblyeleotris steinitzi		1								1
	Amblygobius decussatus				1						
	Amblygobius hectori			1	1						1
	Bryaninops natans						1				
	Coryphopterus signipinnis				1						
	Ecsenius bicolor			1				1			
	Exyrias bellisimus				1	1		1			
	Signigobius biocellatus		1								
XIII	**Gobiesocidae - clingfishes**										
	Diademichthys lineatus	1		1							

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
XIV	**Haemulidae - sweetlips**										
	Diagramma pictum										1
	Diagramma sp.										1
	Plectorynchus chaetodonoides	1	1	1					1		
	Plectorynchus lessonii		1								
	Plectorynchus lineatus		1								
	Plectorynchus polytaenia				1						
XV	**Holocentridae - squirrelfishes**										
	Myripristis kuntee					1					1
	Myripristis murdjan			1				1			
	Myripristis violacea		1				1				
	Sargocentron rubrum										1
XVI	**Labridae - wrasses**										
	Bodianus mesothorax			1	1	1	1	1		1	
	Cheilinus chlorourus			1							1
	Cheilinus fasciatus	1	1	1	1	1	1	1	1	1	1
	Cheilinus undulatus		1								
	Choerodon anchorago	1		1	1	1	1	1		1	1
	Choerodon oligacanthus						1				
	Cirrhilabrus cyanopleura			1		1		1	1		
	Coris batuensis				1						
	Coris pictoides										1
	Diproctacanthus xanthurus	1	1	1	1	1	1		1	1	1
	Epibulus insidiator	1	1	1	1	1	1	1	1	1	1
	Halichoeres argus	1	1	1			1				1
	Halichoeres chloropterus	1	1	1	1	1	1	1	1	1	1
	Halichoeres leurcurus	1	1	1	1	1	1	1	1		
	Halichoeres melanurus	1		1	1	1	1	1	1		
	Halichoeres nigrescens			1			1				
	Halichoeres prosopeion					1	1				

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Halichoeres purpurascens	1	1	1	1	1	1	1	1	1	
	Halichoeres richmondi					1	1				
	Halichoeres scapularis	1			1			1			
	Hemigymnus fasciatus			1			1				1
	Hemigymnus melapterus		1	1	1		1		1	1	
	Labrichthys unilineatus			1							
	Labroides dimidiatus	1	1	1	1	1	1	1	1	1	
	Oxycheilinus celebicus	1	1	1	1	1	1	1	1	1	
	Oxycheilinus diagrammus			1							
	Oxycheilinus unifasciatus				1			1			
	Pseudocheilinus ataenia			1			1				
	Pseudocheilinus evanidus			1							
	Pseudocheilinus octotaenia				1						
	Pteragogus cryptus			1	1						1
	Thalassoma hardwicke		1								
	Thalassoma lunare		1	1	1			1		1	1
XVII	**Lethrinidae - emperors**										
	Lethrinus erythropterus		1	1	1	1		1	1	1	1
	Monotaxis grandoculus		1								
XVIII	**Lutjanidae - snappers**										
	Lutjanus argentimaculatus		1								
	Lutjanus biguttatus	1	1	1	1	1	1	1	1	1	1
	Lutjanus bohar		1								
	Lutjanus carponotatus	1	1	1	1	1	1	1	1	1	1
	Lutjanus decussatus			1	1	1	1		1		1
	Lutjanus fulviflamma		1				1	1			1
	Lutjanus monostigma		1			1			1		
	Lutjanus russelli					1	1	1			
XIX	**Monacanthidae - leatherjackets**										
	Amanses scopas		1								

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Pervagor melanocephalus		1	1	1	1	1	1		1	1
	Pseudomonocanthus macrurus		1	1			1				
XX	**Monodactylidae - diamondfishes**										
	Monodactyus argenteus				1	1					
XXI	**Mullidae - goatfishes**										
	Mulloidichthys flavolineatus				1		1			1	
	Parupeneus barbarinoides				1						
	Parupeneus barberinus	1		1	1	1	1		1		1
	Parupeneus cyclostomus				1						
	Parupeneus indicus						1				1
	Parupeneus multifasciatus				1	1					1
	Upeneus tragula				1						1
XXII	**Nemipteridae - breams**										
	Pentapodus aureofasciatus			1							
	Pentapodus trivittatus		1	1	1			1			
	Scolopsis affinis										1
	Scolopsis bilineatus									1	
	Scolopsis ciliata	1			1	1	1				
	Scolopsis lineatus		1						1		
	Scolopsis margaritifer	1	1	1	1	1	1	1	1	1	1
XXIII	**Plotosidae - catfishes**										
	Plotosus lineatus			1							
XXIV	**Pomacanthidae - angelfishes**										
	Chaetodontoplus mesoleucus	1	1	1	1	1	1	1	1	1	1
	Pomacanthus semicirculatus		1								
	Pomacanthus sextriatus	1	1	1			1				
XXV	**Pomacentridae - damselfishes**										
	Abudefduf bengalensis	1			1	1	1				
	Abudefduf lorenzi				1		1				
	Abudefduf sexfasciatus		1				1			1	1

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Abudefduf vaigiensis		1		1						
	Acanthochromis polyacanthus	1	1	1	1	1	1	1	1	1	1
	Altrichthys azurelineatus	1	1	1	1	1	1	1	1	1	1
	Altrichthys curatus	1	1	1	1	1	1	1		1	1
	Amblyglyphidodon aureus				1	1		1			
	Amblyglyphidodon batunai	1	1	1	1	1	1	1	1	1	1
	Amblyglyphidodon curacao			1	1	1	1	1		1	
	Amblyglyphidodon leucogaster		1	1	1	1	1	1		1	1
	Amblyglyphidodon ternatensis	1	1	1			1	1	1		1
	Amblypomacentrus breviceps				1						
	Amblypomacentrus clarus						1				
	Amphiprion clarkii	1	1	1	1	1	1	1			
	Amphiprion frenatus				1						
	Amphiprion ocellaris		1		1		1	1			
	Amphiprion sandaricinos		1								
	Chromis amboinensis			1							
	Chromis atripectoralis		1							1	
	Chromis cinerascens						1				1
	Chromis ternatensis				1						
	Chromis viridis		1		1		1				
	Chrysiptera oxycephala		1								
	Chrysiptera parasema	1	1	1	1	1	1	1	1	1	1
	Chrysiptera rollandi		1	1	1	1		1			1
	Chrysiptera springeri	1	1	1	1	1	1	1	1	1	
	Chrysiptera talboti				1						
	Dascyllus reticulatus		1								1
	Dascyllus trimaculatus		1	1							1
	Dischistodus chrysopoecilus							1			
	Dischistodus fasciatus				1		1				
	Dischistodus melanotus				1						1

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Dischistodus perspicillatus	1	1		1		1		1		
	Dischistodus prosopotaenia	1		1	1		1	1	1		1
	Dischistodus pseudochrysopoecilus	1			1		1				
	Hemiglyphidodon plagiometopon	1	1	1	1	1	1	1	1	1	1
	Neoglyphidodon melas	1	1		1		1	1		1	1
	Neoglyphidodon nigroris		1	1	1	1	1	1	1	1	1
	Neoglyphidodon oxyodon		1		1		1	1			1
	Neopomacentrus anabatoides	1	1	1	1	1	1	1	1	1	1
	Plectroglyphidodon lachrymatus				1						
	Pomacentrus adelus				1		1				
	Pomacentrus alexanderae	1	1	1	1	1	1	1	1	1	1
	Pomacentrus amboinensis				1						1
	Pomacentrus armillatus		1	1	1	1	1				
	Pomacentrus bankanensis	1	1	1				1			
	Pomacentrus brachialis			1							
	Pomacentrus burroughi	1	1	1	1	1	1	1	1	1	1
	Pomacentrus coelestis				1						
	Pomacentrus cuneatus		1								
	Pomacentrus chrysurus				1	1					
	Pomacentrus geminospilus		1		1	1					
	Pomacentrus grammorhynchus	1	1	1	1		1	1		1	1
	Pomacentrus lepidogenys				1						
	Pomacentrus littoralis						1				
	Pomacentrus moluccensis			1					1		1
	Pomacentrus nagasakiensis		1		1	1	1	1			1
	Pomacentrus ophisthostigma			1		1		1	1		
	Pomacentrus philippinus			1	1			1			
	Pomacenrus smithi		1	1	1	1	1	1	1		1
	Pomacentrus stigma			1	1	1	1	1	1	1	1
	Pomacentrus vaiuli			1							

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Premnas biaculeatus	1		1	1	1	1	1			
	Stegastus fasciolatus	1	1	1							1
	Stegastus obreptus										1
XXVI	**Pseudochromidae - dottybacks**										
	Labracinus cyclophthalmus	1		1	1				1	1	
	Labracinus sp.			1							
	Pseudochromis colei										1
XXVII	**Ptereleotridae - dartfishes**										
	Aioliops megastigma	1	1	1		1	1	1	1		
	Ptereleotris microlepis						1				
XXVIII	**Pinguipedidae - sandperches**										
	Parapercis lineopunctata								1		
XXIX	**Scaridae - parrotfishes**										
	Bolbometopon muricatum	1	1	1	1	1	1	1	1	1	
	Cetoscarus bicolor				1		1				
	Chlorurus bleekeri	1	1	1	1	1	1	1	1	1	1
	Chlorurus bowersi		1	1	1						
	Scarus dimidiatus		1	1	1			1	1		1
	Scarus ghobban		1	1		1	1	1	1	1	1
	Scarus hypselopterus	1	1	1	1	1	1	1			1
	Scarus niger		1		1			1		1	
	Scarus oviceps				1					1	
	Scarus quoyi		1	1	1		1	1	1		1
	Scarus rivulatus	1	1	1	1	1		1			
	Scarus rivulatus (yellow tail)	1	1	1	1	1		1	1	1	
	Scarus sordidus				1						
	Scarus sp.			1							
XXX	**Scorpaenidae - scorpionfishes**										
	Dendrochirus zebra							1			1
	Pterois antennata				1						

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
	Pterois volitans							1			1
	Scorpaenopsis papuensis				1						
XXXI	**Serranidae - groupers/ basslets**										
	Anyperodon leucogrammicus	1		1			1				
	Cephalopolis argus		1	1	1	1	1	1	1	1	
	Cephalopolis boenak			1	1	1	1			1	
	Cephalopolis cyanostigma		1		1	1	1	1	1	1	
	Cephalopholis leopardus			1							
	Cephalopolis microprion	1	1	1	1			1			1
	Cromiliptes altivelis		1								
	Diploprion bifasciatum			1			1	1	1		1
	Epinephelus ongus					1					
	Ephinephelus merra				1						
	Plectropomus leopardus		1	1	1			1			
	Pseudoanthias huchtii					1				1	
XXXII	**Siganidae - rabbitfishes**										
	Siganus corallinus					1			1		1
	Siganus doliatus	1									
	Siganus guttatus		1						1		1
	Siganus puellus		1	1		1					
	Siganus punctatissimus		1	1	1	1	1		1	1	
	Siganus unimaculatus			1					1		
	Siganus virgatus	1	1	1	1	1		1	1		
	Siganus vulpinus	1	1	1	1			1	1		1
XXXIII	**Sphyraenidae - barracudas**										
	Sphyraena barracuda		1								
	Sphyraena flavicauda		1	1				1			
	Sphyraena qenie		1								
XXXIV	**Synodontidae - lizardfishes**										
	Synodos variegatus	1			1						

CALAMIANES ISLANDS, CORON, CULION AND BUSUANGA Fish Species List as of April 2006		Sangat-Decalve Marine Sanctuary, Coron	Siete Picados Marine Sanctuary, Coron	Bugor Island Marine Sanctuary, Culion	Sangat Resort House Reef, Coron	Sangat Island Coral Garden, Coron	Lusong Island Coral Garden, Coron	Cuaming Island, Culion	Punta Dinamita, Culion	Culambuyan Island (East), Busuanga	Culambuyan Island (West), Busuanga
		2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
XXXV	**Tetraodontidae - puffers**										
	Arothron caeruleopunctatus						1			1	
	Arothron mappa		1				1		1		
	Arothron nigropunctatus		1	1	1	1	1	1	1		
	Canthigaster papua						1	1			
	Canthigaster valentini		1				1	1			
	Sufflamen bursa						1				
XXXVI	**Zanclidae - moorish idol**										
	Zanclus cornutus		1					1	1		
TOTAL		71	135	123	136	88	107	104	83	61	88

271 species and 36 families in 2006

Appendix 4. MPA Management Rating

	Coron MPAs				Culion MPAs		
	Bintuan Marine Park				Libis Marine Protected Areas		
SITE NAME / CRITERIA OR ACTIVITY SATISFIED	Decalve Strict Protection Zone	Coral Gardens MPA	Lusong MPA	Siete Pecados Marine Sanctuary	Bugor MPA	Punta-dinamita	Quaming MPA
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	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
Management plan adopted by community and LGU or PAMB	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
Collaborative patrolling and surveillance conducted by mandated enforcement group and local community volunteers	0	0	0	0	0	0	0
MPA billboard signs, boundary markers and anchor buoys maintained	0	0	0	0	0	0	0

SITE NAME / CRITERIA OR ACTIVITY SATISFIED	Decalve Strict Protection Zone	Coral Gardens MPA	Lusong MPA	Siete Pecados Marine Sanctuary	Bugor MPA	Punta-dinamita	Quaming MPA
Management body active	0	0	0	0	0	0	0
Budget from local gov't or from other sources allocated and is accessible for MPA mgmt	0	0	0	0	0	0	0
Fishing effectively stopped inside of sanctuary zone	0	0	0	0	0	0	0
Illegal and destructive fishing reduced outside of MPA	0	0	0	0	0	0	0

SITE NAME / CRITERIA OR ACTIVITY SATISFIED	Decalve Strict Protection Zone	Coral Gardens MPA	Lusong MPA	Siete Pecados Marine Sanctuary	Bugor MPA	Punta-dinamita	Quaming MPA
Level IV: MPA Sustained: Very Good (Year 3 or older) (30 points required)							
MPA management plan updated in a participatory process	0	0	0	0	0	0	0
Annual biophysical monitoring and feedback of results supervised by the managing body and implemented for 2 years or more	0	0	0	0	0	0	0
Budget from government or from other sources allocated and was accessed for 2 or more consecutive years	0	0	0	0	0	0	0
Management body trained and capacitated to run the MPA independently	0	0	0	0	0	0	0
Enforcement system fully operational	0	0	0	0	0	0	0
Illegal and destructive activities stopped inside and within the vicinity of MPA	0	0	0	0	0	0	0
Environment friendly enterprise and/or user fees collected as a sustainable financing strategy	0	0	0	0	0	0	0
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	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	0	0	0	0	0	0	0
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
Points accumulated	**13**	**13**	**13**	**13**	**13**	**13**	**13**
Rating level achieved	**I**	**I**	**I**	**I**	**I**	**I**	**I**
Implementation phase	Initiated	Initiated	Initiated	Initiated	Initiated	Initiated	Initiated
Performance in management	Passing	Passing	Passing	Passing	Passing	Passing	Passing

* 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

APPENDIX 5. Community perception surveys

SIETE PICADOS & CALAMBUYAN MARINE SANCTUARIES
Calamianes Islands, Palawan

Number of respondents: 7

- Respondents are PO officers, fishers and housewives
- Respondents include 3 men and 4 women

Results	
Knowledge ▪ Yes - 7 ▪ No - 0	▪ According to respondents, MPAs are: breeding place for fish; serves as protection from fishing; for preservation of habitats and; eco-tourism site ▪ They learned about the MPA from assembly meetings, seminars and trainings. Other housewives heard it from their husbands and children who attended the meetings. While others learned it through word of mouth
Attitude ▪ + About sanctuary - 7 ▪ - About sanctuary - 0	▪ All are in favor of MPAs. They believe it will help in achieving conservation for the benefit of their children's future.
Benefits derived from marine sanctuary establishment	▪ Some think that MPAs can help increase fish catch. Some are not sure of the benefits from MPAs. There is one from Barangay Makinit who is hopeful that maybe if they show their willing support to their MPA, it might help them win claim over their small piece of land.
Perception on fish catch ▪ Increase - 5 ▪ Decrease - 2	▪ The majority observed spill-over. While a few thinks that fish catch is decreasing.
Change is related to MPA? ▪ Yes - 5 ▪ No - 1 ▪ Undecided – 1	▪ The majority believes that MPAs help increase fish catch. One said there is a decrease in fish catch due to too many fishers
Assessment on MPA mgmt ▪ Non- existing - 0 ▪ Poor - 0 ▪ Average – 2 ▪ Good - 4 ▪ Excellent - 0 ▪ Undecided – 1	▪ Most thinks that MPA management is good. They mentioned that enforcement support and funds are lacking.
Suggestions to improve management	▪ Among the suggestions are: additional information and education campaigns to improve community knowledge; additional funds for operations; intensify LGU support (e.g. ordinances), and; allocate barangay share from tourism revenues
Tourism activities ▪ Beneficial - 2 ▪ Not beneficial - 4 ▪ Undecided – 1	▪ Some said they have not yet benefited from the tourism activities but they are hopeful that in the future they will be able to get a share from tourism revenues. Currently, there are deputized- wardens who get salary from the Barangay.
Aside from fishing, what other income activities exist?	▪ Public utility vehicle driving ▪ Small *sari-sari* store business ▪ Construction labor ▪ Livestock farming ▪ Tourism-based activities
Linkages established	▪ Local government units ▪ Bureau of Fisheries and Aquatic Resources of the Department of Agriculture ▪ Environmental Legal Assistance Center ▪ Fisheries Improved for Sustainable Harvest (FISH) Project ▪ SEMP
Coastal resource management problems/issues	▪ Waste management ▪ Illegal fishing ▪ Lack of funds ▪ Politics ▪ Lack of institution support
Threats to fishery resources	▪ Illegal fishing ▪ Commercial fishing ▪ Exploitation of resources ▪ Increasing population ▪ Coral mining

Awareness

Level of awareness of the respondents is very high. All respondents indicated their awareness on the existence of the MPA in their area. According to respondents, the MPA serves as a breeding place for fish, a no-fishing area and an eco-tourism site which allows preservation of habitats. The respondents learned about the MPA from assembly meetings, seminars and trainings. Other housewives heard it from their husbands and their children who attended the meetings. While others learned it through word of mouth

Attitude

Results showed that all respondents are in-favor of MPAs. They believe that MPAs could help in achieving resource conservation to ensure availability of benefits in the future for the next generation. When asked about the benefits derived from MPAs, some respondents think that MPAs can help increase fish catch. While, some are not sure of the benefits from MPAs. There is one from Barangay Makinit who is hopeful that maybe if they show their willing support to their MPA, the LGU will reward them the small piece of land where they now live.

Perception on change in fish catch

The majority of the respondents think that fish catch is improving as a result of the MPA. While a few thinks that fish catch is decreasing. Part of the reason for this decline is due to the increasing fishing pressure from the growing number of fishers.

Benefits from MPA tourism activities

At this point, only a few gets direct benefits from MPA tourism activities. They are the deputized wardens who earn monthly income from the Barangay Government. Although many are yet to experience the benefits of MPA tourism, they are hopeful that eventually, they will get a share from tourism revenues.

MPA Management

The assessment of most of the respondents on existing management effort is something within the range of good to average. The PO officers expressed that there is a lack in available budget for operations and maintenance activities. This is verified by the response of representatives from the community. According to them, enforcement is weak. They are aware that enforcement activities and support are still lacking.

When asked about their opinion on how to improve management, their suggestions are: additional information and education campaigns to improve community knowledge; additional funds for operations; intensify LGU support (e.g. ordinances), and; allocate barangay share from tourism revenues.

Problems in coastal resource management and threats to fishery resources

Among the sites surveyed, common issues on coastal resource management were noted. The common problems are the absence of a waste management program, persistence of illegal fishing, lack of funds, politics and lack of institution support.

On the other hand, the common threats to fishery resources were identified by respondents, and the common threats are the persistence of illegal fishing activities (including commercial fishing), exploitation of resources, increasing population, and coral mining.

Appendix 6. General prohibitions of MPAs surveyed during the SPR Expedition.

MPA name	Date established	General prohibitions
Municipality of Coron		
Bintuan Marine Park Decalve Strict Protection Zone	2005	▪ Fishing, gleaning and collection of dead/live marine organisms ▪ No boat or persons can enter this zone; Human access is allowed only with prior written agreement by the Management Committee (ManCom) → Research diving is allowed with proper approval from ManCom. Only 11 divers at a time are allowed
Coral Gardens and East Sangat Gun Boat		▪ Any type of extractive activity ▪ Anchoring of boats ▪ Stepping and touching of corals and marine life ▪ Fish feeding ▪ Use of gloves or spear gun by divers ▪ Night diving in East Sangat and Coral Gardens ▪ Jet skis ▪ Entry of boats except in cases of storms or emergencies ▪ Disposal of wastes ▪ Collection of other wild plants or animals such as birds, orchids, etc. ▪ Camping or sleeping in the core zone ▪ Building of structures within the zone without permission from ManCom → Upon payment of a user-fee, snorkeling, swimming, diving, kayaking, underwater photography/videography and picnicking are allowed ▪ Diver, snorkelers and swimmers - PhP50/head/day ▪ Calamianes residents – PhP10/head/day ▪ 50% discount on fees for Filipinos ▪ Students and senior citizens gets additional 25% discount ▪ Residents of Barangay Bintuan are exempted from the fees

Cont.

MPA name	Date established	General prohibitions
Municipality of Culion		
Libis Marine Sanctuaries (Cuaming, Bugor and Punta Dinamita)	2005	No-take zones ▪ No extraction or any human activity for at least 5 years Buffer zones ▪ No navigational use except for law enforcement patrolling ▪ No fishing ▪ No seaweed farming ▪ Recreational and research activities allowed in a permitted basis Fisheries management zone ▪ Only fishing with corresponding permit endorsed by BFARMC are allowed ▪ No use of scaring devices and other destructive methods ▪ Exclusive use of identified zone for sustainable fishing and aqua-culture of local fishers ▪ Recreational and research diving allowed in a permit basis. Rehabilitation zone/Mangrove ecosystem ▪ Stop mangrove deforestation

APPENDIX 7. Expedition photos

Unloading the dive gear from the plane at Busuanga airport.

On the first day, Benjie Francisco gives the group a short orientation on the Calamianes Islands and the conservation efforts being done by the Fisheries Improved for Sustainable Harvest (FISH) Project.

A view from the beach of the entry point into Sangat Island and the island resort.

The group travels to the Siete Picados Marine Sanctuary for reef monitoring.

Bumphead parrotfish in Sangat-Decalve Marine Sanctuary.

A forest of intact purple branching coral (*Acropora*) in the Siete Picados Marine Sanctuary, Coron.

Jojo Mazo, an active marine sanctuary warden and manager comes onto the dive boat to welcome the volunteers and orient them on the management of the sanctuary.

Tiers of *Acropora* flourishing in the sanctuary of Siete Picados, Coron.

Vittoria gives an interesting presentation on the Basking Shark Watch Survey where she is actively involved in the United Kingdom.

Another survey trip, on the smaller boat, to one of the many islands with rich coral reefs to monitor.

Mary Pickett records data on substrate cover to determine reef health.

Pterois antennata (lionfish) in the Sangat-Decalve Marine Sanctuary.

The group relaxing after lunch on Cuaming Island at the invitation of Pierre and Philippe of Palawan Wildlife Association (PWA).

Aileen, Anna, Philippe and Pierre relaxing in the shade on Cuaming Island.

A beautiful harp coral (c*tenocella pectinata)* at a Culion dive site.

Sangat Island Resort proved to be a simple, but relaxing venue for the 2006 dive expedition.

Vangie and Mary busy transcribing their substrate data after a long day of diving.

Sandra, Geoff, Denise and Sandy spend a late afternoon, after a fulfilling day of diving, to check the substrate data they collected.

A school of barracuda (*sphyraena qenie*) swims around the Siete Picados Marine Sanctuary.

TJ and Gaywynn enjoy their lunch on the boat before visiting Barracuda Lake.

Barracuda Lake, an unusual and interesting tourist spot and dive site in Coron, is named after its large, resident barracudas.

Children, from the small community residing on Sangat Island, show off the large groupers they caught while fishing around the island.

The resort staff receives a token of thanks from the expedition volunteers for their hospitality and great service.

The expedition volunteers are treated to a surprise awarding ceremony by the CCE Foundation staff. Through the awards presented the staff showed their appreciation for the volunteers' energy, generosity, and team spirit in helping the foundation with its conservation efforts.

A school of rabbitfish (*siganus guttatus*) making their rounds in the rich reef crests of Siete Picados Marine Sanctuary.

Encountering a squid during the wreck dive at the Olympia Maru. The Japanese freighter is about 120 meters long and is lying on its starboard side in Coron Bay.

A large grouper (*plectropomus leopardus*) spotted swimming in and out of the Olympia Maru wreck.

Ed and Sandy model headgear, an original design by Denise Illing (material originating from her now sleeveless shirt!)

SPR team (L-R back) Julia Cichowski, Mary Pickett, Sandra Breil, Denise Illing, Geoff Illing, TJ Mueller, Sandy Robb, Raffy Martinez, Ian White, Alan White, Aileen Maypa. (L-R front) Gaywynn Cooper, Ed Cooper, Brian Stockwell, Vangie White, Ethan Lucas, Sheryll Tesch, Anna Meneses, Vittoria Thornley.

APPENDIX 8. EXPEDITION "FUN" AWARDS

Presented by:
Coastal Conservation and Education Foundation, Inc.
Given at
Sangat Island Reserve, Bintuan, Coron, Palawan, Philippines,
this
16th day of April, in the Year of Our Lord, Two Thousand and Six.

AWARD	CATEGORY DESCRIPTION	AWARDED TO
The Jack and Rose Award	For exemplary tender expressions of sweet affection and appreciation for the team and for each other.	Ed and Gaywynn Cooper
Aquaman and Firewoman Award	For outstanding diving skills, data management assistance and commendable wetsuit color coordination.	Geoff and Denise Illing
McDiver Award	For exceptional foresight, meticulous data sheet editorship, and readiness for on-the-spot dive gear requirements.	T.J. Mueller
"Parrot Poisson" Award	For brilliant linguistic skills and superb interpersonal charms for creating rapport for the SPR invasion of Quaming Island.	Vittoria Annoscia-Thornley
The Lady Drifter Award	For excellent implementation of SPR survey methods while gracefully drifting in a ripping current with team monkey boys on Calumbuyan Island.	Mary Pickett
Ms. Earthwatch Expedition Award	For displaying excellent voluntary strength and endurance whilst participating in several, if not all, Earthwatch activities worldwide.	Sandra Breil
The "Other Faberge Egg" Award	For modeling the most colorful and innovative "Denise couture" headgear during snorkel data collection.	Sandy Robb
The Shutterbug Award	For displaying exceptional patience and skill in the field of underwater photography for six weeks, and still find energy for an additional week of substrate data collection, and all with a smile.	Julia Cichowski
The Skype Award	For extraordinary management in the preparations of a successful SPR 2006 Expedition through the wonders of globalized communications through the internet and Skype software.	Vangie White