

Napantao Fish Sanctuary

Report 2009



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1 - Introduction to Coral Cay Conservation

Coral Cay Conservation (CCC) has carried out marine conservation projects all over the world, including in the Philippines, Belize, Honduras, Malaysia and Fiji. CCC successfully set up Marine Protected Areas and provided scientific data that has been used to manage local marine resources. The project in Danjungan Island in the Philippines between the years 1996-1999 was particularly successful and the reefs around the island received the accolade of Best Managed Reef of the World. Since 1995, CCC has worked with the Philippine Reef and Rainforest Conservation Foundation Inc. (PRRCFI) and local communities to survey and safeguard reef and rainforest areas in the Philippines. To date these have included coastal regions of the Southern Negros Occidental, Anilao, Palawan, Danjungan Island and the forests of North Negros.

The Philippines is renowned for its rich marine environment but with as much as 97% of its reefs at risk, immediate conservation action is needed. Children living in coastal areas are recognized as the future stewards of their marine resources and CCC is working closely with this local stakeholder group to raise awareness and increase understanding of the need for greater conservation efforts in the Philippines.

At the invitation of the Provincial Government of Southern Leyte, CCC began its survey work in Sogod Bay in September 1999. CCC is conducting a collaborative program to survey the region's coral reefs and provide training and conservation education opportunities for project counterparts. The aim is to develop local capacity and ensure the long-term protection and sustainable use of marine resources throughout Southern Leyte. We are hoping that we can build on our previous successes, extending our stay here in Southern Leyte.

For further information regarding CCC's ethos and work, please visit our website at www.coralcay.org

2 – Napantao Fish Sanctuary MPA

In May of 2005, four Marine Protected Areas (MPA's) were installed in the municipality of Padre Burgos. The Barangay's of Buenavista, Santa Sofia, Lungsoda'an and Tangkaan have all set aside a small part of their coastal reef to allow fish stocks to recover and conserve the rich marine life that each of the areas support.

In April 2008, Coral Cay moved from their base in the municipality of Padre Burgos to take up residence in Napantao, San Francisco on the opposite end of Sogod bay (Figure 2.1). Since then CCC has worked with the Municipality of San Francisco and the Barangay of Napantao to install and assist with the management of the Napantao Fish Sanctuary (NFS). The NFS was established in 1996 under Municipal Ordinance number 90S, 1996 and is 5 hectares large. In 2008, the NFS Oversight Committee (NFSOC) was established to provide expert advice and guidance to the Barangay of Napantao and Municipality of San Francisco regarding the management of the NFS.



Figure 2.1. Satellite image of Panaon Island, Southern Leyte. The Barangay of Napantao is outlined in red with the NFS in yellow.

3 - Marine Protected Areas

MPA's are an important management and conservation tool in protecting existing fish stocks and helping them to recover. In addition to this, they allow coral reefs to grow and pristine reefs are protected from harmful human actions. Over a few years we can already begin to see the benefits that properly managed MPA's provide. A 'spill over' of fish from within the MPA to outside the MPA allows fishermen to catch fish, often more so than was the case before and ensures that a healthy fish community remains in the protected area (Figure 3.1). Community based MPA's have proven to be an effective way in sustainable fisheries and maintaining peoples livelihoods. A third benefit is that they can provide an income from eco-tourism when divers pay a fee to dive within the MPA. As long as the numbers of divers is restricted and diving is done without touching or directly interacting with the marine environment, the negative effects of eco-friendly diving have been proven to be minimal.

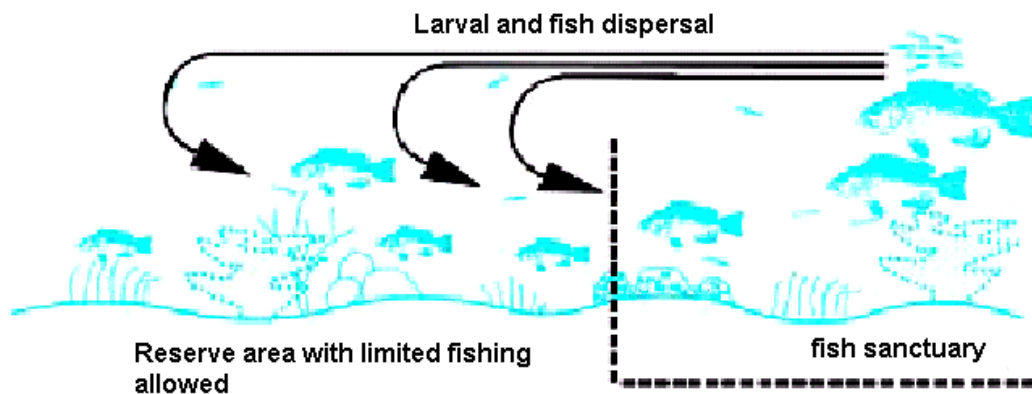


Fig. 3.1. Schematic diagram of MPA functioning. The large, protected fish within the MPA produce larvae which settle and grow outside the MPA where they can be caught by fishermen. In addition, the corals inside the MPA are not disturbed by direct human impacts. One square km of healthy reef can support over 20 tons of fish per year. One square km of damaged/destroyed reef can only produce 3 tons (Bohnsack, 1990).

4 - Methods

Data from inside and outside the Napantao Fish Sanctuary were collected from April to December 2008. The survey method closely follows the one outlined in the 'Coral Reef Monitoring for Management' book put together by the Marine Science Institute of the University of the Philippines, Diliman; the Guiuan

Development Foundation Inc. and the Volunteer Service Overseas. All surveys were carried out at a depth of 12m as this depth usually has high coral diversity as well as being subjected to significant artisanal fishing pressure. All survey transect lines were permanently set up and marked by iron standings set in place in a straight line every 10m for a total length of 50m along the 12m depth contour. In total, five permanent transect lines were set up, two placed inside the NFS and three outside of the NFS.

4.1 - Point-intercept transect

For estimating the relative abundance of living and non-living coral on the reef bottom, a benthic point-intercept transect was used by SCUBA divers (Figures 4.1 and 4.2) which followed the 50m permanent transect lines at a depth of 12m. “Benthic” refers to the animal and plant life growing on the seabed. A note was made of the benthic cover every 25cm along the line. The total number of points along the transect line was 200. Five replicates for each of the five permanent transect lines were conducted. Benthic categories were chosen as presented in Table 4.1.

Table 4.1. Categories chosen to represent benthos. Note: Non-Acropora represented by NA and Acropora represented by A under the hard coral category.

Category	Description	Category	Description
Hard coral (NA)	branching	Soft coral	Soft coral
	massive	Dead coral	white dead coral
	sub-massive		dead coral w/ algae
	encrusting	Other	Sponges
	foliose		Other animals
	mushroom		Turf Algae
Hard coral (A)	branching		fleshy macroalgae
	sub-massive	Non-living	Coralline algae
	tabulate		Seagrass
	digitate		Rubble
	bottlebrush		Rock
	encrusting		Sand
			Silt



Fig. 4.1. A Coral Cay observer estimating benthic cover every 25 cm along the transect line.

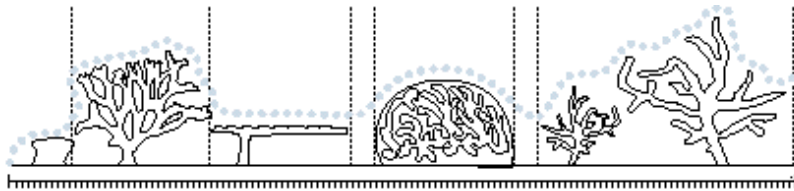


Fig. 4.2. Schematic diagram of a point intercept line laid over different coral life forms

From these results, the percentage cover of the various substrate types could be calculated. The results for the benthic surveys can be found in chapter 5.

4.2 - Fish Visual Census

Fish families were counted and a note was made of their size within a defined area, along the same permanent transect line as used to estimate benthic cover. Five replicates of each permanent transect line were conducted. Two diver's swim side-by-side and count numbers of target fish 5m to either side of the 50m transect line (Figure 4.3). Swimming speed is controlled and there is a 15-minute waiting period after the line has been laid so as not to disturb the fish and let them come out of hiding. Fish families that were observed were chosen on the basis that they are (a) good indicator species for reef health or (b) important fish for consumption. Fish families counted in the survey are listed in table 4.2.

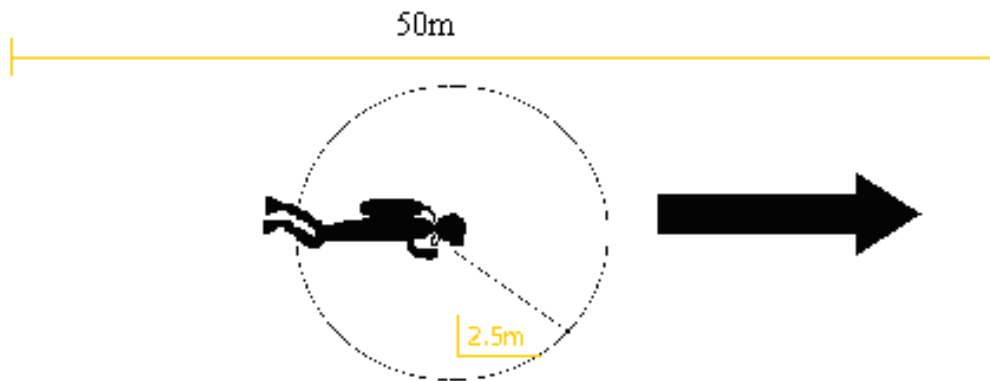


Figure 4.3. Fish visual survey method used to estimate fish abundance along the 50m line. The diver notes down any target fish seen 2.5m to either side and 5m above him/her. The observer on the other side of the line does the same.

Table 4.2. A list of the families (in bold) and species (where relevant) of fish assessed during this survey. See appendix for local Visayan names (Table 7.1).

Common name	Latin name
Grouper	<i>Epinephelinae</i>
Barramundi Cod	<i>Cromileptes altivelis</i>
Blacktip	<i>Epinephelus fasciatus</i>
Peacock	<i>Cephalopholis argus</i>
Coral Grouper	<i>Cephalopholis spp</i>
Lyretail	<i>Variola spp</i>
Snapper	<i>Lutjanidae</i>
Two-spot	<i>Lutjanus biguttatus</i>
Black-and-white	<i>Macolor niger</i>
Chequered	<i>Lutjanus decussatus</i>
Sweetlips	<i>Haemulidae</i>
Emperors	<i>Lethrinidae</i>
Jacks	<i>Carangidae</i>
Fusiliers	<i>Caesionidae</i>
Spinecheeks	<i>Nemipteridae</i>
Goatfish	<i>Mullidae</i>
Triggerfish	<i>Balistidae</i>
Butterflyfish	<i>Cheatoodontidae</i>
Angelfish	<i>Pomacanthidae</i>
Humphead wrasse	<i>Cheilinus undulatus</i>
Parrotfish	<i>Scaridae</i>
Bumphead	<i>Bulbometopon muricatum</i>
Surgeonfish	<i>Acanthuridae</i>
Unicorn spp.	<i>Naso spp</i>
Rabbitfish	<i>Siganidae</i>
Filefish	<i>Kyphosidae</i>
Moorish Idol	<i>Zanclus cornutus</i>

Surveys were also conducted that looked specifically at butterflyfish diversity and abundance. The methods were the same as outlined above and 40 species of butterflyfish were targeted. The species names of these butterflyfish (common and latin names) are listed in Table 4.3. This survey was conducted because butterflyfish may be good representatives of coral reef health and diversity. High diversity and abundance of butterfly fish usually corresponds with a healthy, diverse and functional reef.

Table 4.3. Species names (Common and Latin) of target butterflyfish recorded in the surveys.

Common name	Latin name	Common name	Latin name
Philippine butterfly	<i>Chaetodon adiergastos</i>	Yellowdotted butterfly	<i>C. selene</i>
Threadfin butterfly	<i>C. auriga</i>	Dotted butterfly	<i>C. semeion</i>
Eastern triangle butterfly	<i>C. baronessa</i>	Mirror butterfly	<i>C. speculum</i>
Bluelashed butterfly	<i>C. bennetti</i>	Chevron butterfly	<i>C. trifascialis</i>
Speckled butterfly	<i>C. citrinellus</i>	Melon butterfly	<i>C. trifasciatus</i>
Saddle butterfly	<i>C. ephippium</i>	Pacific doublesadle butterfly	<i>C. ulietensis</i>
Klein's butterfly	<i>C. kleinii</i>	Teardrop butterfly	<i>C. unimaculatus</i>
Lined butterfly	<i>C. lineolatus</i>	Vagabond butterfly	<i>C. vagabundus</i>
Racoon butterfly	<i>C. lunula</i>	Pearscale butterfly	<i>C. xanthurus</i>
Blackback butterfly	<i>C. melannotus</i>	Copperbanded butterfly	<i>Chelmon rostratus</i>
Merton's butterfly	<i>C. mertensii</i>	Longnose butterfly	<i>Forcipiger flavissimus</i>
Meyer's butterfly	<i>C. meyeri</i>	Longnose butterfly	<i>F. longirostris</i>
Spottail butterfly	<i>C. ocellicaudus</i>	Pyramid butterfly	<i>Hemitaurichthys polyepis</i>
Eightband butterfly	<i>C. octofasciatus</i>	Pennant coral fish	<i>Heniochus acuminatus</i>
Ornate butterfly	<i>C. ornatissimus</i>	Threeband penant fish	<i>H. chrysotomus</i>
Spot-nape butterfly	<i>C. oxycephalus</i>	Singular bannerfish	<i>H. singularis</i>
Blueblotch butterfly	<i>C. plebeius</i>	Horned bannerfish	<i>H. varius</i>
Spotband butterfly	<i>C. punctatofasciatus</i>	Sixspine butterfly	<i>Parachaetodon ocellatus</i>
Latticed butterfly	<i>C. raffiesi</i>	Goldengirdled coral fish	<i>Coradion chrysozonus</i>
Mailed butterfly	<i>C. reticulatus</i>	Twospot coral fish	<i>Coradion melanopus</i>

4.3 - Human impacts and abiotic factors

In addition to the fish and benthic data, a fourth observer made a note of the following factors:

- Transect Orientation
- Depth
- Reef Zone
- Whether the site was sheltered or exposed
- Approximate steepness of the slope
- Horizontal and vertical visibility
- Weather
- Human and natural underwater impacts such as trash, nets, bleaching and coral breakage

Other physical data were also recorded as represented in the appendix (Table 7.2).

4.4 - Data analysis

A one-way ANOVA for single factor analysis was employed to assess the differences between data recorded in regions inside and outside of the MPA. A p value of less than 0.05 was considered significant. Fish biomass was calculated using length-weight regression curves with species specific parameters obtained from fishbase.org.

5 - Results

Results from the MPA surveys indicated that the combined biomass of selected fish species was significantly higher ($p < 0.05$) inside the MPA when compared to outside of the MPA (Figure 5.1). Species which contributed the most to the total biomass included (in order of highest biomass) parrotfish, snapper, fusiliers, butterflyfish and grouper. Species which accounted for most of the observed differences between regions inside and outside of the MPA included (in order of greatest difference) surgeonfish, parrotfish, snapper, triggerfish, butterflyfish and grouper (Figure 5.2).

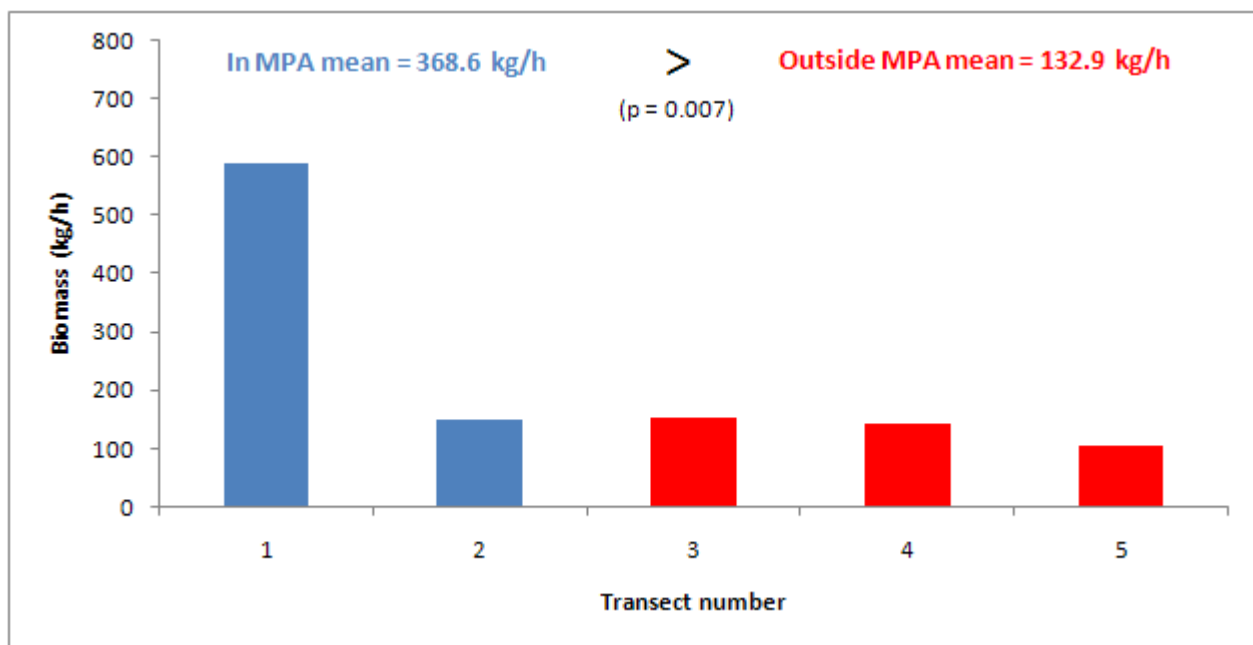


Figure 5.1. Results of the calculated total biomass of selected fish species (as in table 4.1). The mean biomass in kilograms per hectare inside the MPA was significantly higher ($p < 0.05$) than the mean biomass outside of the MPA.

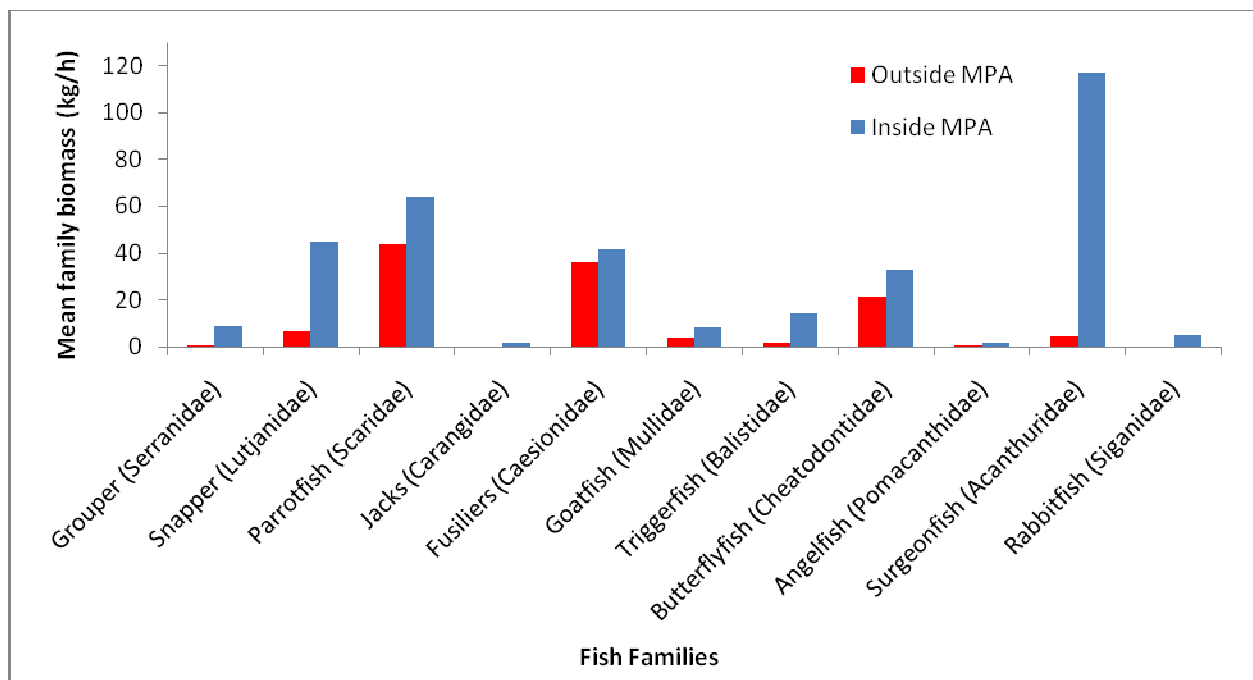


Figure 5.2. Results representing the biomass in kilograms per hectare of selected fish families inside and outside of the MPA. Biomass for all families is higher inside the MPA.

Butterflyfish diversity was significantly higher ($p < 0.05$) inside the MPA than it was outside of the MPA (Figure 5.3). There were 11 butterflyfish species that were only present inside of the MPA which included *Chaetodon lineolatus*, *C. melannotus*, *C. ocellicaudus*, *C. ornatissimus*, *C. raffiesi*, *C. reticulatus*, *C. unimaculatus*, *Forcipiger flavissimus*, *Hemitaurichthys polyepsis*, *H. singularis* and *Coradion melanopus*. The total butterflyfish biomass was also found to be significantly higher ($p < 0.05$) within the MPA (Figure 5.4). The same species of butterflyfishes dominated regions inside and outside of the MPA and included (in order of highest abundance) *C. baronessa*, *C. trifasciatus* and *Hemitaurichthys varius*. Species which were relatively abundant inside the MPA but not outside of it included (in order of highest abundance) *C. lunula*, *C. melannotus*, *C. ulietensis* and *Forcipiger flavissimus*.

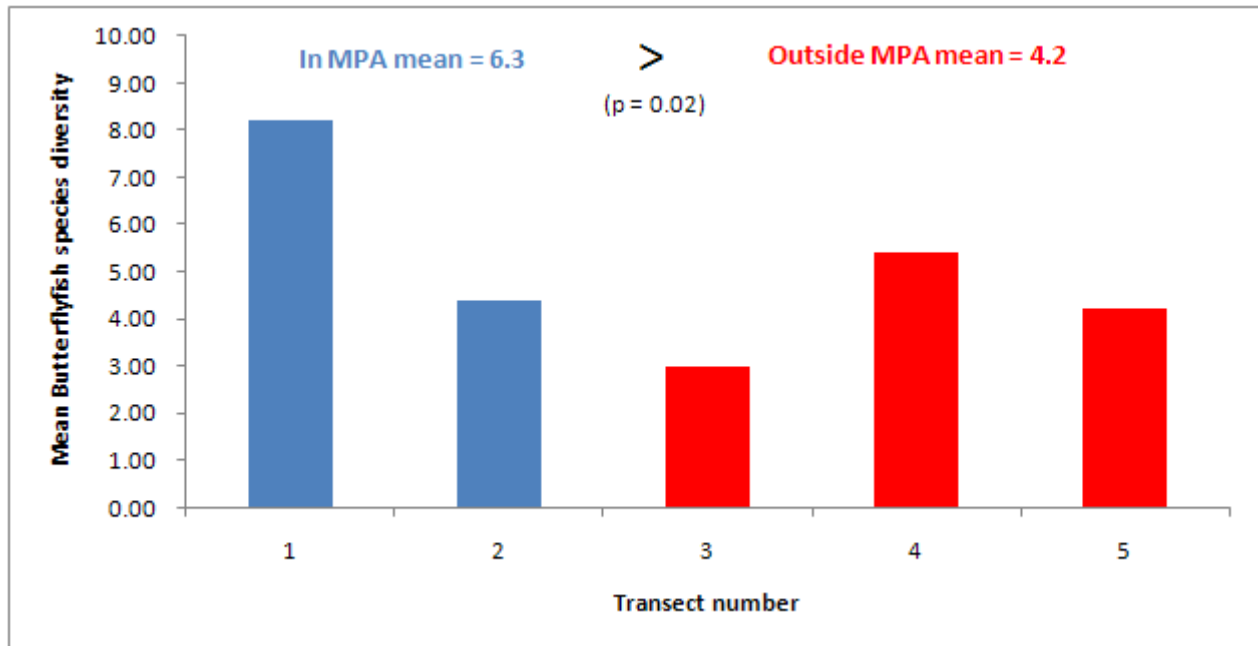


Figure 5.3. Results showing the mean butterflyfish species diversity as observed per transect. This data shows that the mean diversity of butterflyfish species is significantly higher ($p < 0.05$) inside the MPA than it is outside of the MPA.

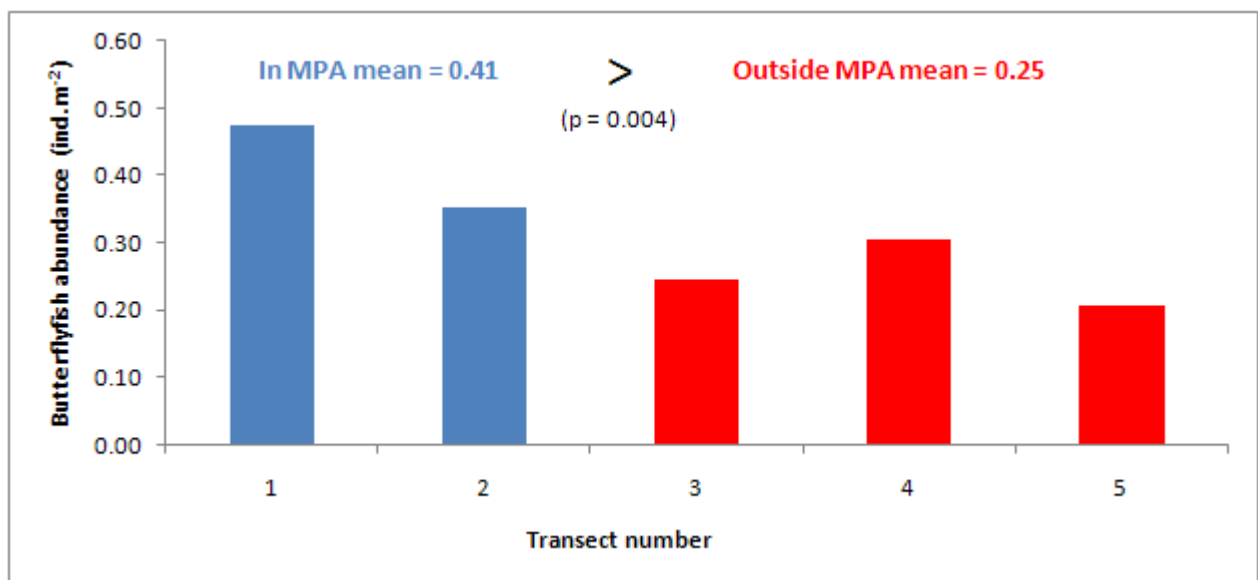


Figure 5.4. Results showing the abundance of butterflyfish observed per meter squared. The data indicates that the abundance of butterflyfish inside the MPA is significantly higher ($p < 0.05$) than it is outside of the MPA.

The benthic cover in regions inside and outside of the MPA were largely similar (Figure 5.5). Hard coral cover was however moderately higher inside the MPA when compared to outside of the MPA. Thus we can presume that the habitat types are similar inside and outside of the MPA. Hard coral damage outside of the MPA was found to be generally higher when compared to regions outside of the MPA (Figure 5.6). Damage from sedimentation, bleaching, disease, drupella (coral eating snails) and crown of thorns starfish had a relatively higher impact to hard coral outside of the MPA. This suggests that coral inside the MPA is generally in better condition and may be more protected from damaging impacts.

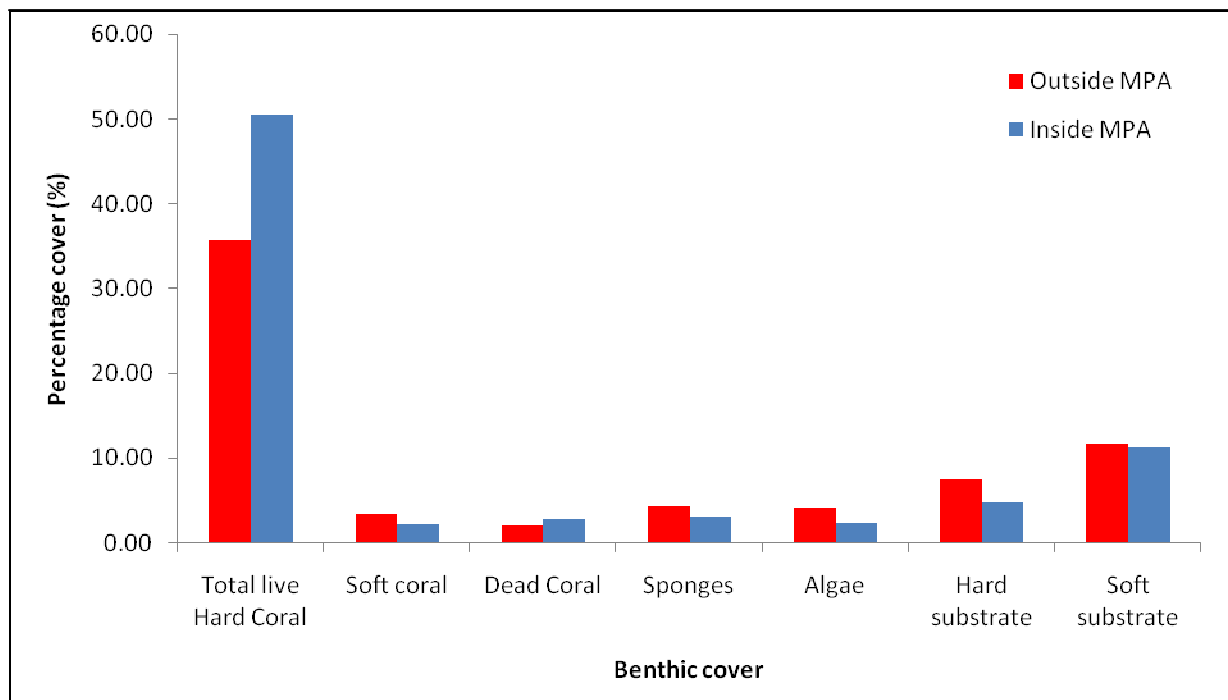


Figure 5.5. Results showing the benthic cover of regions inside and outside of the MPA. This data indicates that there is moderately more hard coral cover within the MPA and the remaining benthic types show similar cover inside and outside of the MPA.

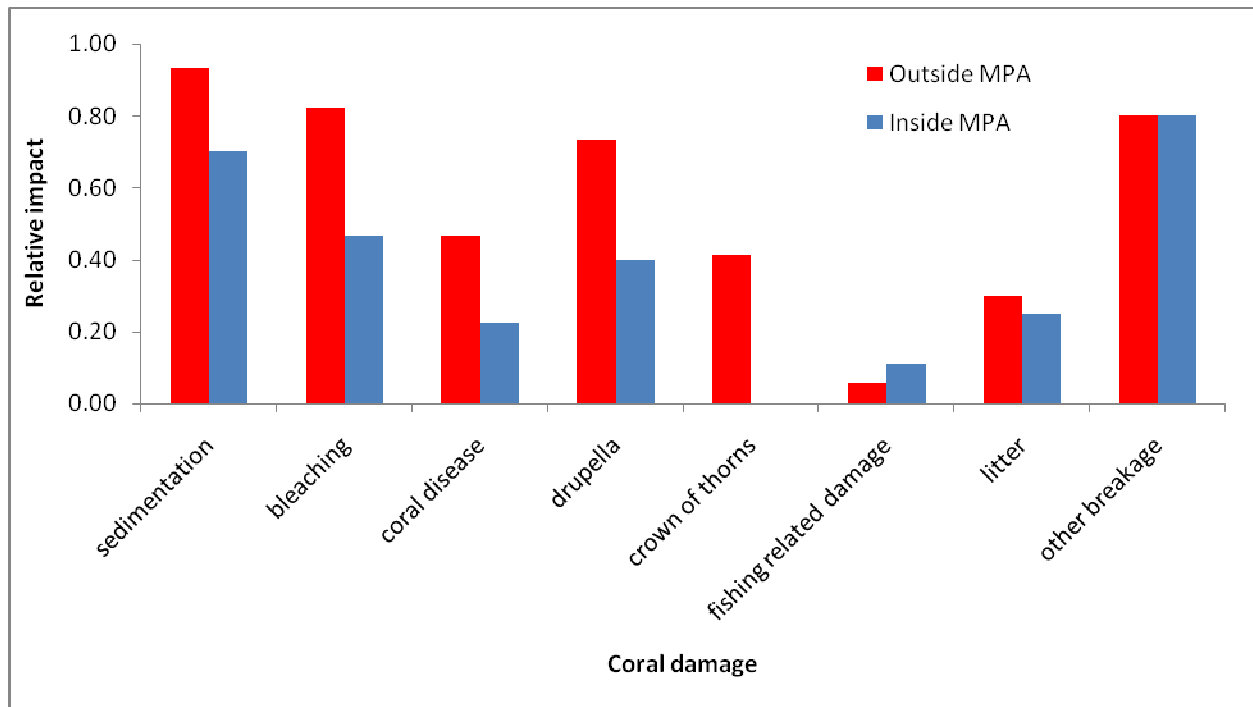


Figure 5.6. Results showing the types of hard coral damage in regions inside and outside of the MPA. This data indicates that sedimentation, bleaching, disease, drupella (coral eating snails) and crown of thorns starfish are all substantially higher outside of the MPA when compared to regions inside the MPA. The remaining impacts appear to be similar both inside and outside of the MPA.

6 - Conclusion

The results from the surveys conducted as part of this investigation shows that commercially important fish biomass and butterflyfish abundance and diversity is significantly higher ($p < 0.05$) within the Napantao Fish Sanctuary (NFS). As the habitat types found in regions inside and outside of the MPA are largely similar (Figure 5.5), we can presume that the higher fish abundance and diversity found within the NFS is largely due to the protection from fishing afforded to fish within the boundaries of the MPA. The higher diversity of butterfly fish within the MPA may also reflect a healthier reef with less disturbance. As can be seen from figure 6, hard coral is affected more from various impacts outside of the MPA. This also suggests that the NFS does provide a measure of protection to hard coral from these impacts. It is uncertain whether or not these impacts were induced by human activity. In conclusion, the results from this investigation suggest that the NFS has been largely successful in providing protection to commercially important fish species as well as sustaining the health of the reef. Due to the increased

biomass of commercially important fish within the NFS, it is likely that surrounding areas will also benefit from increased fish stocks.

One effective means to assess local fish stocks in surrounding areas is through a fish catch monitoring program. This is in progress at the moment and depends on local fishermen who are part of the Napantao fishing organization to complete data sheets by providing basic area specific information such as fish species caught, the number of fish caught and the size of the fish caught. This will feed into continued monitoring of the NFS as trends in the fish stock surrounding the sanctuary are important to assess if the fishing pressure is sustainable and if not, further management strategies may need to be put in place.

Further aspects of an effective management strategy for the NFS should include continued annual monitoring of the reef along the permanent transects for comparative purposes. This will allow us to continually assess the effectiveness of the MPA and adjust management strategies accordingly to maintain the effectiveness of the MPA. Management strategies should be formulated by the Napantao Oversight Committee which has recently been formed and now meets once a month. Members include relevant people from the local municipality, the Napantao barangay captain and relevant members from Coral Cay.

Increased support from the local community would also compliment effective management of the sanctuary. If the local community could see more direct benefits from the sanctuary it is more likely that they would take more responsibility for this resource and help to insure the sustainability and upkeep of it. One of the ways the sanctuary may directly financially benefit the local community is through eco-tourism. At the moment the NFS has at least five commercial diving operators that dive in the sanctuary. Currently the MPA fees which the divers pay go to the barangay, the local municipality and the Bantay Dagat and very little goes directly to residents of Napantao. The fisherfolk could be encouraged to get involved in actively managing the sanctuary if they were to receive some of the profits made from visiting divers. A similar program being conducted in Sonok MPA, San Ricardo, has helped instill a sense of ownership amongst the community and has greatly improved the effectiveness of this sanctuary.

A livelihood program initiated in Napantao through CCC and TESDA at the end of 2008 taught skills to the local women who can now make crafts from coconut materials. The women also received basic business skills training from the Department of Trade and Industry and have up until now been formulating a basic business plan, improving and diversifying their product and have recently registered the business. One of the potential markets for these products are the divers who visit the NFS. So far the plan is for the women to paddle out to the moored diving boats to show them their products, as up until now the divers do not come onto shore. So far this is in its infancy but there is huge potential and hopefully the women from the livelihood program will start to see a direct financial benefit from the NFS which attracts customers for their products.

In conclusion, the best case scenario would be for local fishermen to observe increased and sustainable catches around the NFS so that continued support from the local community may be enjoyed. This along with good management and enforcement of regulations within the NFS should lead to a sustainable sanctuary which may benefit many future generations of fishermen and others in the local community through income from tourism related activities in the NFS.

6 - References

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7 – Appendix

Table 7.1. Visayan equivalents of English common names for some of the fish families and species assessed in this study.

Common English names	Visayan
Groupers (Epinephelinae)	lapu-lapu
Snapper (Lutjanidae)	maya-maya
Sweetlips (Haemulidae)	lipti
Emperors (Lethrinidae)	katambak
Jacks / Trevally	talakitok
Fusiliers	solid
Coral Breams (spinecheeks) (Nemipteridae)	silay
Goatfish (Mullidae)	timbangon
Triggerfish (Balistidae)	pakol
Butterfly fish (Chaetodontidae)	alibangbang
Angelfish (Pomacanthidae)	adlo
Wrasse (Labridae)	labayan
Parrotfish (Scaridae)	molmol
Surgeonfish (Acanthuridae)	indangan
Rabbitfish (Siganidae)	kitong
Rudderfish (Filefish) (Kyphosidae)	ilak
Damselfish (Pomacentridae)	palata
Anthias (Anthiinae)	bilang-bilong
Moorish Idol (<i>Zanclus cornutus</i>)	sanggowanding

Table 7.2. Other abiotic data recorded per replicate for each permanent transect.

Abiotic Data
Water Temp @ surface (°C)
Water Temp @ depth (°C)
Current direction (0-360°)
Current strength (high, medium, low)
Vertical vis (m)
Horizontal vis (m)
Salinity @ surface (ppm)
Salinity @ depth (ppm)