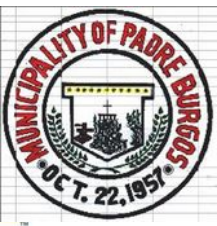


Santa Sofia Marine Protected Area monitoring results 2007



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Introduction to Coral Cay Conservation

CCC has carried out marine conservation projects all over the world, including in the Philippines, Belize, Honduras, Malaysia, Fiji and now in Egypt. CCC successfully set up Marine Protected Area's 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 recently 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.

At the invitation of the Provincial Government of Southern Leyte, CCC began its survey work in Sogod Bay in September 2002. 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.

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.

Santa Sofia MPA

In May of 2005, four Marine Protected Area's (MPA's) were installed in the municipality of Padre Burgos. The Barangays of Buenavista, Santa Sofia, Lungsodaan 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.

The MPA of Santa Sofia is approximately 4.5 ha large and is a community based MPA. This means that the Barangay community with an emphasis on the fisherfolk have been involved in setting up the MPA and their opinion and advice was used in the deciding on the location of the MPA. Furthermore, they were invited to a seminar about the importance of marine sanctuaries for sustainable fisheries and future livelihoods as fishermen. Municipal council members and other stakeholders, Barangay captains and representatives from CCC paid a visit to Apo Island Marine Reserve off the coast of Dumaguete to have a first-hand look at how a successful marine reserve operates and can be a major source of income and provide an alternative livelihood for the community. On the basis of this excursion, plans were developed to do something similar in Padre Burgos. Diving is restricted in the MPA's and a small fee of 50 pesos has to be paid per diver. This income goes to managing the MPA. The increase in diving eco-tourism in Sogod Bay makes the MPA's a potential source of income in the near future. Already, the MPA's are proving their value, offering some fantastic diving. This more than anything else, may help continuing the momentum in preserving the rich marine resources of Sogod Bay in general and Padre Burgos in particular. The long term effects will lead to improved fish catch outside of the MPA's as has been shown in Sumilon Isl., the first community based MPA that saw local fish stocks doubling in 10 years time. Only with the full support of the



community and upholding of the regulations and laws that apply within the sanctuary will the benefits become evident over the next years.



Map 1: Locations of four MPA's in Padre Burgos.

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 (see diagram below). 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 small fee to dive within the MPA. As long as the numbers of divers is restricted and diving is done without touching or interacting with the marine environment, the effects of eco-friendly diving have been proven to be minimal.

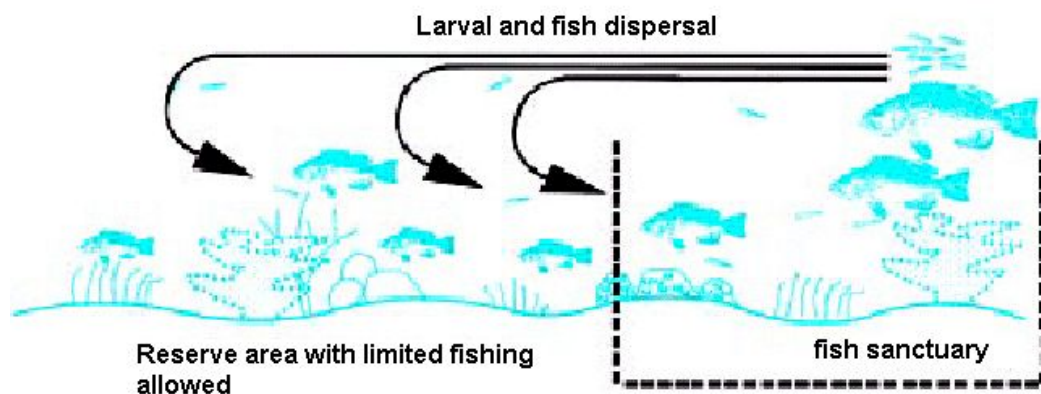


Fig.
1:

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 can only produce 3 tons. Bohnsack, 1990

Methods

In 2006, several comprehensive surveys were conducted within and outside the MPA which are used as baseline data to compare with the more recent data collection, in August 2007.

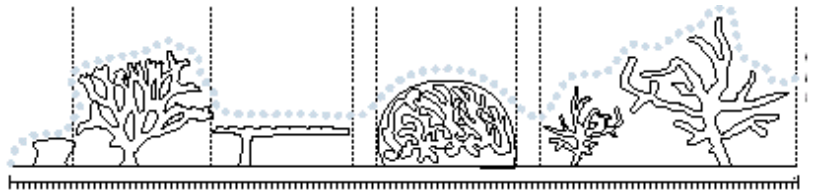
The survey method closely follows the one outlined in the 'Coral Reef Monitoring for Management' book put together by the Marine Science Institute of the University of the Philippines, Diliman; the Guiuan Development Foundation Inc. and the Volunteer Service Overseas.

Results from inside the MPA were collected in the first half of July, 2007. Results from outside the MPA were collected towards the end of July through to the end of August 2007. Results from before the installation of the MPA were collected at the beginning of 2005 and in July of 2005, and the first set of monitoring results collected after the MPA installation were collected at the end of July and beginning of August 2006. The surveys were carried out at a depth of 12 meters; this depth was chosen because it usually has the highest coral diversity.

Point-intercept transect

For estimating the relative abundance of living and non-living on the reef bottom, a benthos point-intercept transect was used by SCUBA divers. A 50m transect line was laid out along a constant depth of 12 meters depth. A note was made of the benthic cover every 25cm along the chain. The total number of points along the transect line was 200. Benthic categories were chosen as follows:

Hard Coral <i>lifeforms</i>:	Soft Coral	Turf Algae	Rock and block
Branching	White Dead Coral	fleshy macroalgae	
Massive	Dead Coral with algae	Coralline algae	Sand/silt
Flat/encrusting	Sponges	Seagrass	
Foliose/cup	Other animals	Rubble	



Figures 2 & 3- *Left: A Coral Cay observer estimating benthic cover every 25 cm along the transect line.*

Right: Schematic diagram of a point intercept line laid over different coral lifeforms

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

Fish Visual Census

Fish families were counted and a note was made of their size within a defined area, along the same transect line as used to estimate benthic cover. Two divers swim side by side and count numbers of target fish 5m to either side of the 50m transect line. 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 and hence an indicator of overfishing if their numbers are found to be low or fishery recovery if their numbers are found to be relatively high. The following families were counted during the surveys:

Groupers (Epinephelinae)	Wrasse (Labridae)
<i>Barramundi Cod (Cromileptes)</i>	<i>Humphead wrasse</i>
Snapper (Lutjanidae)	Parrotfish (Scaridae)
Sweetlips (Haemulidae)	<i>Bumphead parrot</i>
Emperors (Lethrinidae)	Surgeonfish (Acanthuridae)
Jacks / Trevally	Rabbitfish (Siganidae)
Fusiliers	Rudderfish (Filefish) (Kyphosidae)
Coral Breems (spinecheeks) (Nemipteridae)	Damselfish (Pomacentridae)
Goatfish (Mullidae)	Anthias (Anthiinae)
Triggerfish (Balistidae)	<i>Moorish Idol (Zanclus cornutus)</i>
Butterfly fish (Cheatodontidae)	Anthias (Anthiinae)
Angelfish (Pomacanthidae)	<i>Moorish Idol (Zanclus cornutus)</i>

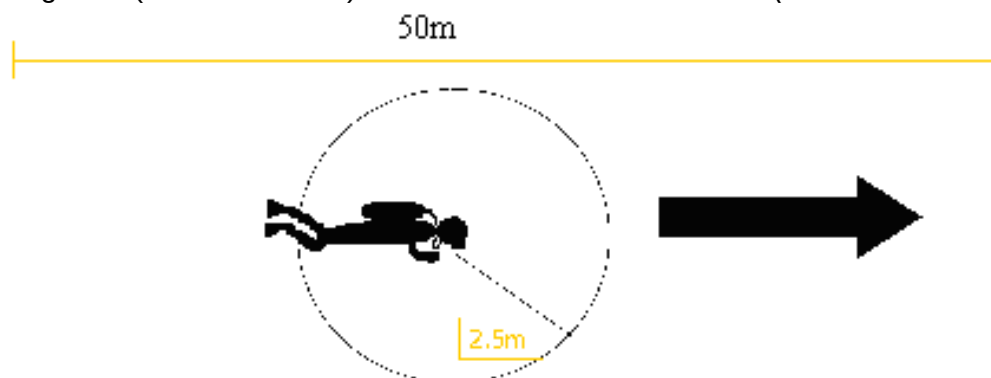


Fig. 4 - Fish visual survey method used to estimate fish abundance along the 50m line. The diver notes down any target fish seen 2.5m to either side and 5m above. The observer on the other side of the line does the same.

Human impacts and abiotic factors

In addition to the fish and benthic data, a fourth observer laid down the transect line for the other observer to follow and 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

A boat marshal made a note of human impacts and drew a sketch map of the area and locations of the transects with the aid of a Global Positioning System (GPS) for future reference.

Numbers of fishing boats, trash, gleaners and many other human influences were filled in on a form.

Results

What follows is a summary of the most important findings from the belt transect (fish abundance estimates), point intercept (benthic cover as a percentage) and general reef health and abiotic (non-living) factors.

Changes in fish abundance

FISH

Groupers (Epinephelinae)
Snapper (Lutjanidae)
Sweetlips (Haemulidae)
Emperors (Lethrinidae)
Jacks / Trevally
Fusiliers
Coral Breems (spinecheeks) (Nemipteridae)
Goatfish (Mullidae)
Triggerfish (Balistidae)
Butterfly fish (Cheatodontidae)
Angelfish (Pomacanthidae)
Wrasse (Labridae)
Parrotfish (Scaridae)
Surgeonfish (Acanthuridae)
Rabbitfish (Siganidae)
Rudderfish (Kyphosidae)
Damselfish (Pomacentridae)
Anthias (Anthiinae)

Visayan

lapu-lapu
maya-maya
lipti
katambak
talakitok
solid
silay
timbongan
pakol
alibangbang
adlo
labayan
molmol
indangan
kitong
ilak
palata
bilang-bilong

sanggowandin
g

Moorish Idol (*Zanclus cornutus*)
 Fish families observed on surveys in common English, Latin and Tagalog name.

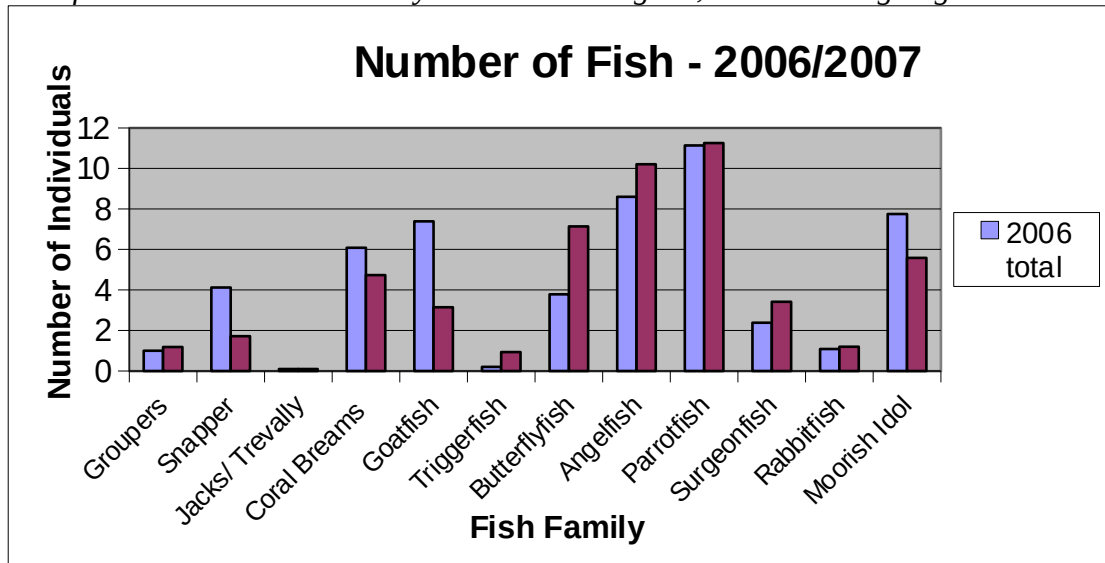


Fig. 5 - Average numbers of fish per 50m transect for 2006 vs. 2007 – including transects inside and (nearby) outside the MPA. The results indicate a steady population for most of the fish families, with some slight increases for important foodfish such as lapu-lapu, kitong and molmol. The increase in butterflyfish is substantial, but decreases are noted for snappers, coral breems and goatfish.

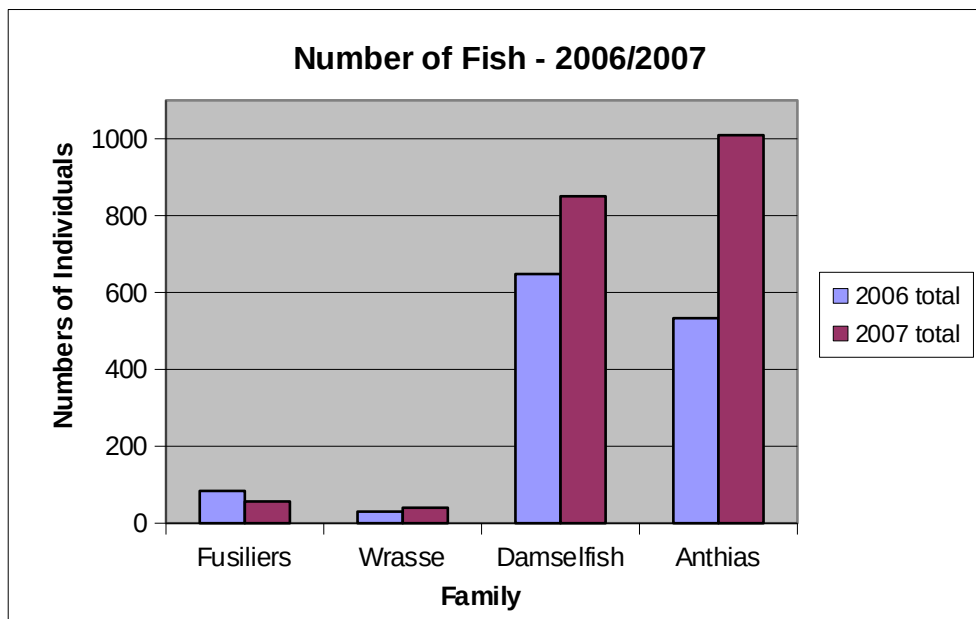


Fig. 6 -Changes in the numbers of more abundant, smaller fishes observed one year after MPA installment. A large increase was found for Damselfish and Anthias families, with stable populations of wrasse and fusiliers.

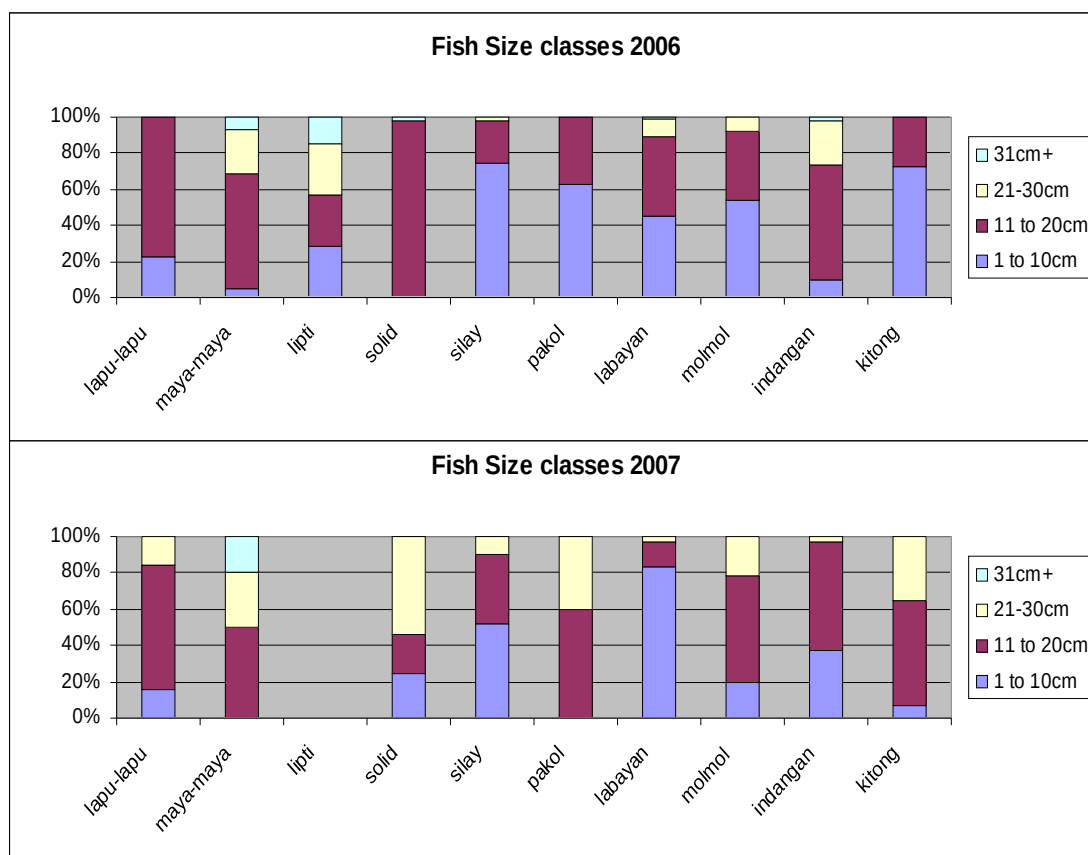


Fig. 7 - Composition of commercially important fish from 2006 (top) to 2007 (bottom). Higher percentages of larger (21cm or more) individuals for lapu-lapu, kitong, maya-maya and solid are indicated in the results. No lipti were observed in 2007.

Changes in Reef Impacts

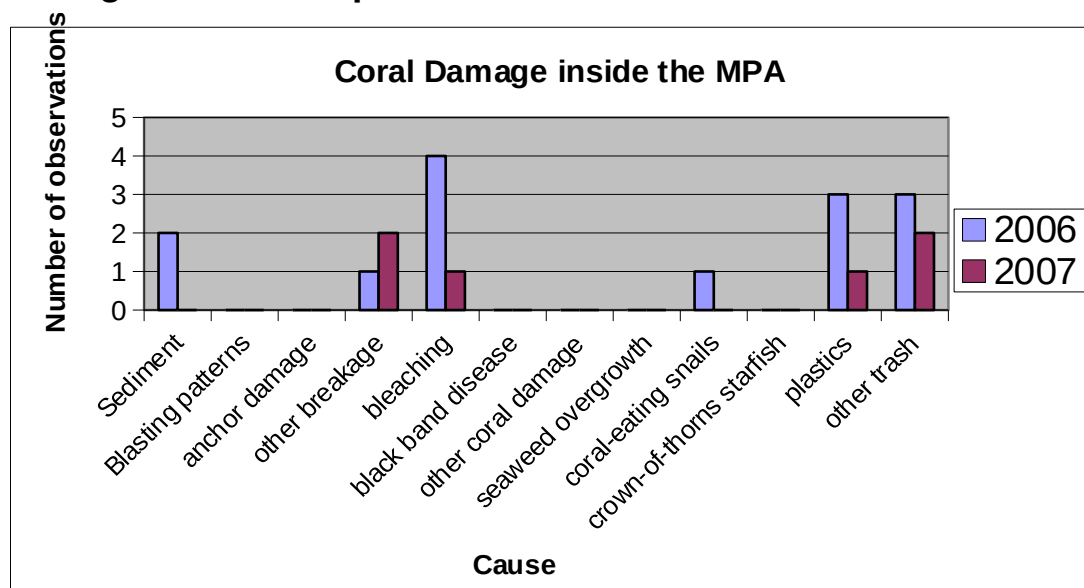


Fig. 8 - Reef impacts observed within the MPA in 2006 and 2007. Less observations of plastics and other trash are noted in 2007, as well as less bleaching and no sedimentation – often these are also human related impacts.

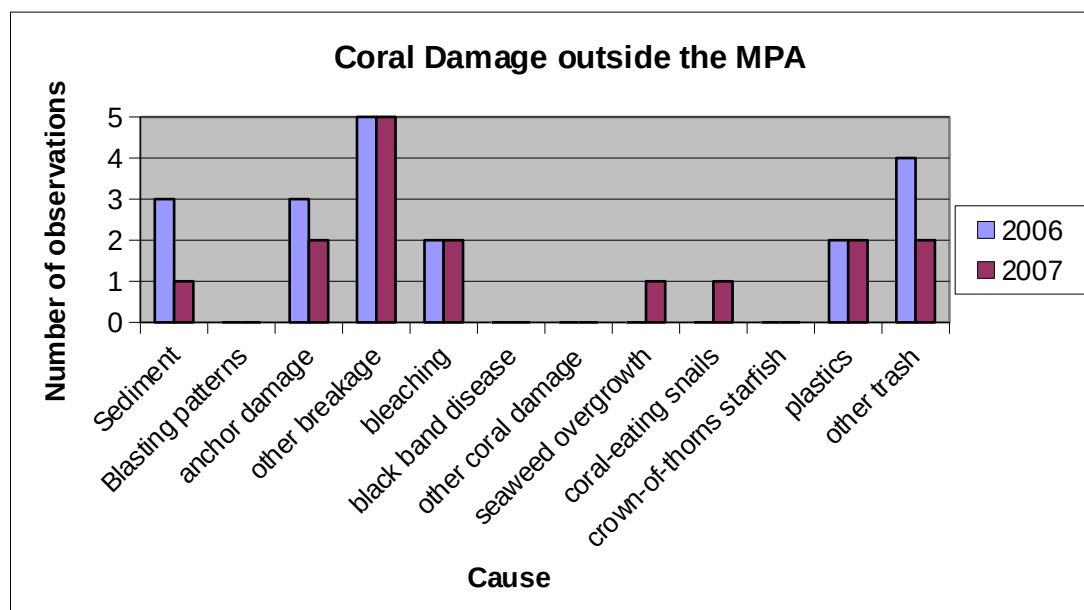
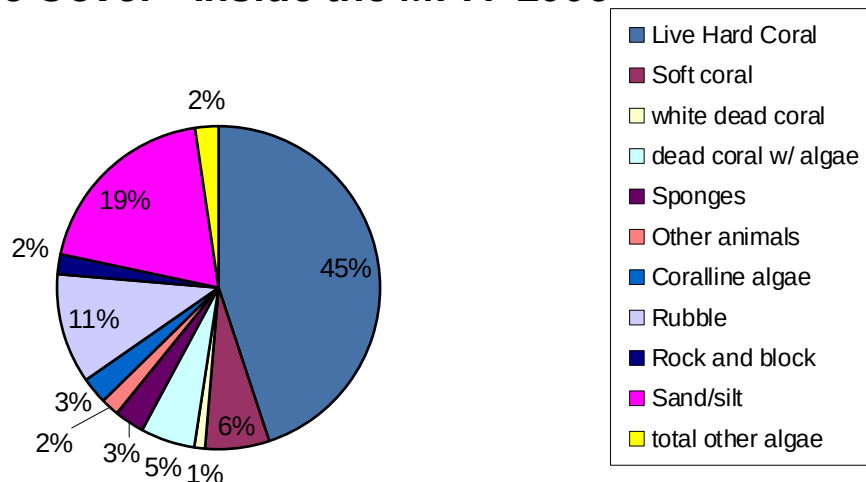


Fig. 9 – Reef impacts observed nearby outside the MPA in 2006 and 2007. Trash and breakage were significant human impacts seen on survey.

Benthic Cover Comparison

Benthic Cover - Inside the MPA 2006



Benthic Cover - Inside the MPA 2007

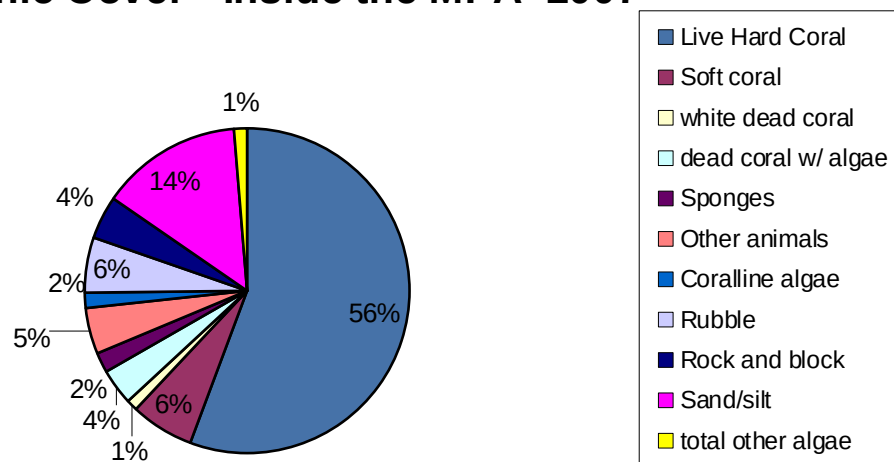
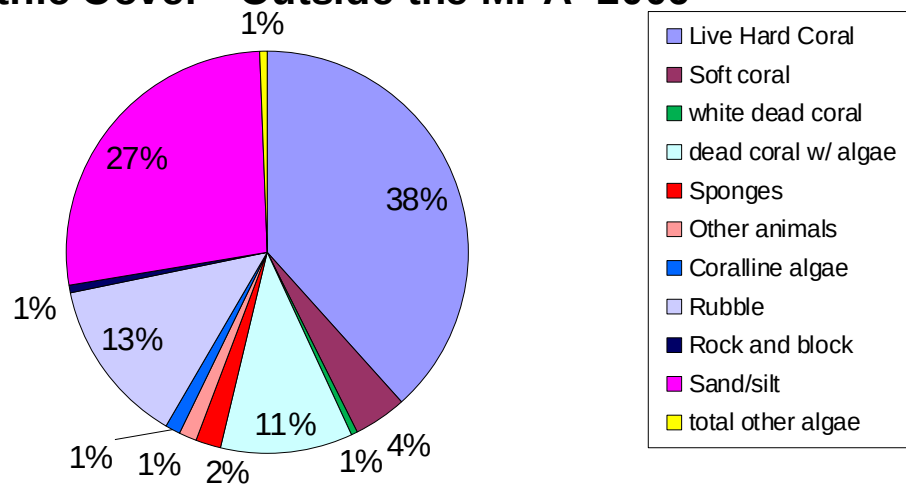


Fig. 10 - Changes in benthic composition within the MPA between 2006 (top) and 2007 (bottom). A slight increase in hard coral cover is indicated, and together with the lower number of reef impacts observed, this is a positive result. The 2007 data suggests a suitable environment for protection – a healthy reef is made up of a variety of different benthic organisms and substrates to encourage diversity of fish and other creatures.

Benthic Cover - Outside the MPA 2006



Benthic Cover - Outside the MPA 2007

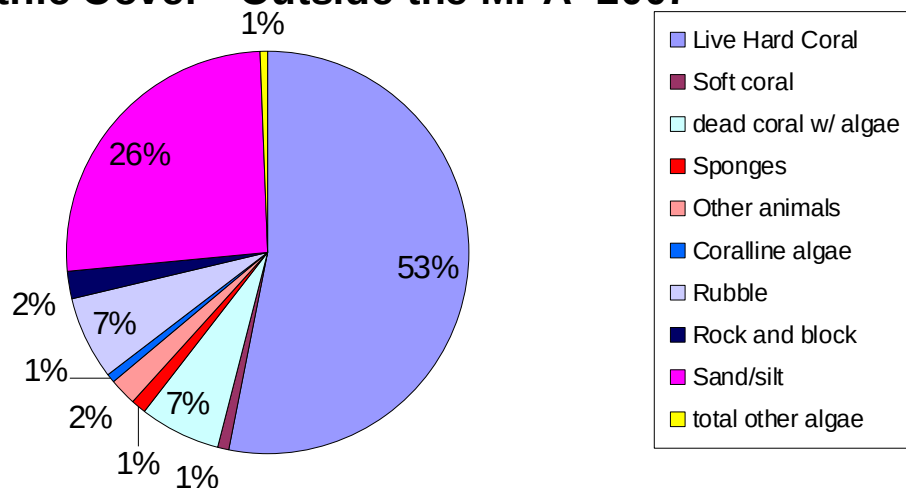


Fig. 11 - Benthic cover outside the MPA – 2006 vs. 2007. The data indicates an increase in hard coral cover between 2006 and 2007, with less dead coral and rubble noted, although the reef impacts seen on the surveys, notably breakage, seaweed overgrowth as a result of increased nutrient runoff, and trash, are likely to impede a steady recovery if they remain at current levels or higher.

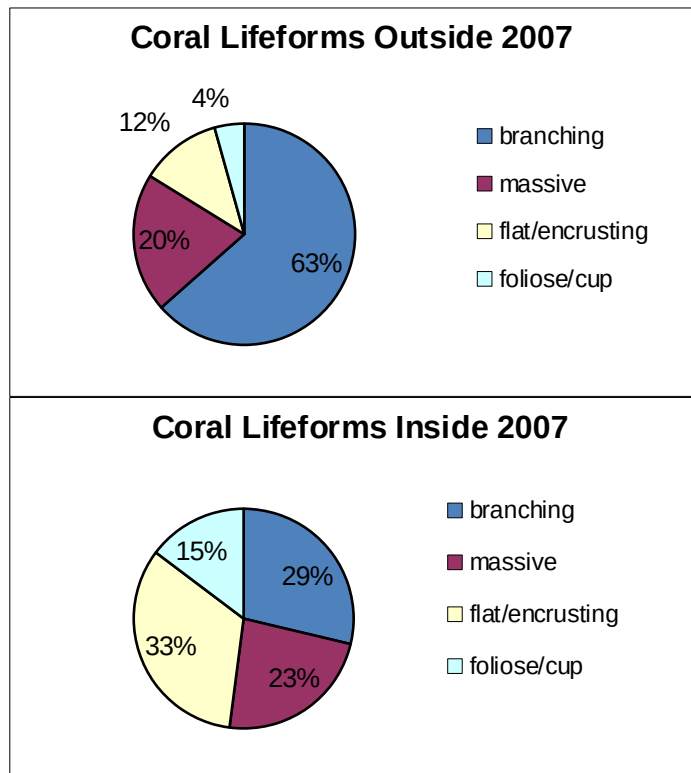


Fig. 12 – The composition of hard coral lifeforms recorded on surveys inside and outside the MPA. Branching lifeforms are the faster growing species of coral, and branching and encrusting forms tend to be younger colonies. Outside the MPA consists of primarily fast growing branching colonies like acropora corals, whilst inside the MPA contains a more diverse and evenly proportioned mix of coral lifeforms. A high diversity of species will in turn encourage a higher diversity of invertebrates and eventually fish.

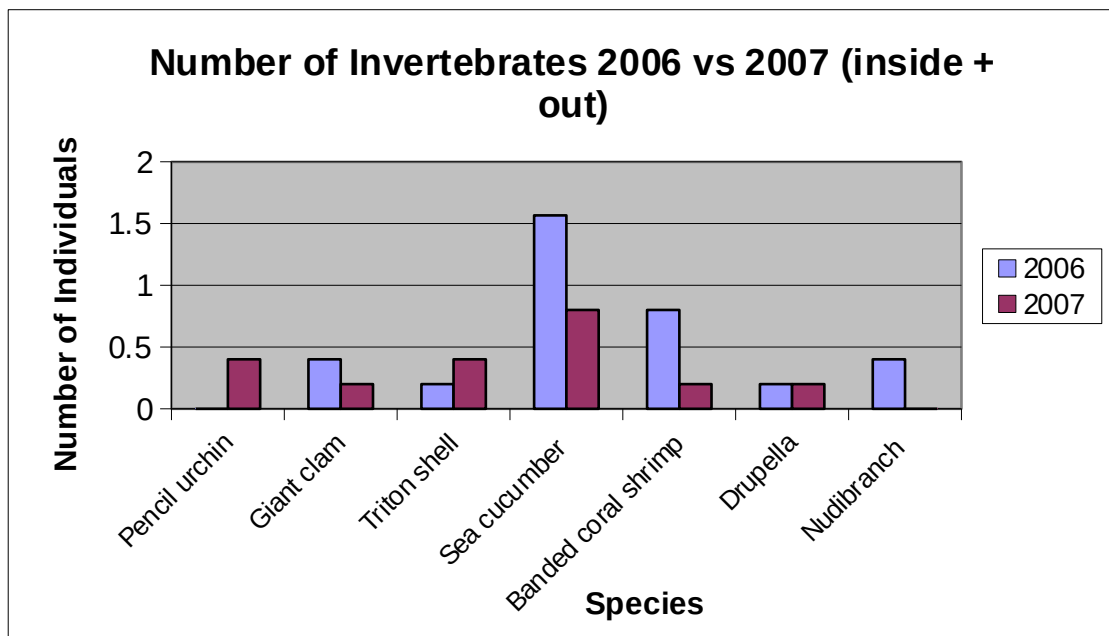


Fig. 13 – Key invertebrates recorded inside the MPA in 2006 and 2007

Fish abundance inside and outside the MPA

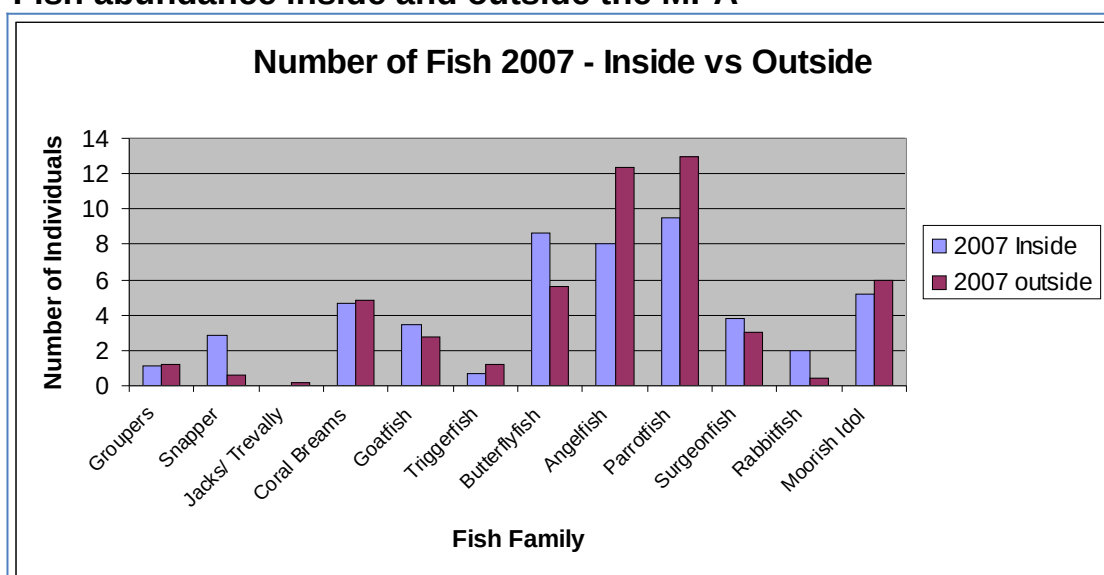


Fig. 13 – The average number of fish found per transect inside and outside the MPA. Most of the populations are similar inside and outside, but the highly territorial butterflyfish are good indicators of high and healthy coral cover, so to see a higher number inside confirms the suitability of the MPA as a diverse habitat and breeding ground for larger predatory foodfishes.

Human impacts inside and outside the MPA

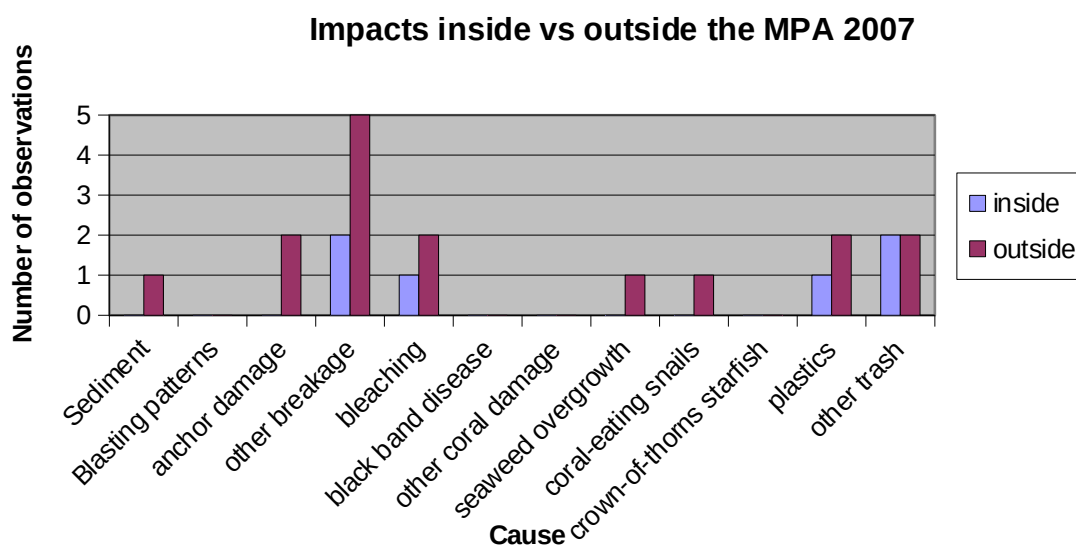


Fig. 14 - A summary of the coral damage and human impacts found inside and outside the Santa Sofia MPA. The number of human impacts noted outside the MPA is considerably higher than inside, which would correlate with the higher human activity in the waters closer to Padre Burgos. Sedimentation and trash are concerns which should be addressed as a high priority, as these can affect large areas and are directly related to poor waste management.

Community perception of Santa Sofia MPA

MPA	Support for MPA	MPA has benefited community*	Increased fish catch due to MPA*	Perception of MPA management being good/excellent	Overall MPA management ranking	Community involvement in MPA management & decision making	Anticipated future of MPA
Santa Sofia	100%	95%	75%	90%	2	85%	Successful (94%)
*Based on result from 'agree' and 'strongly agree' categories							

Fig. 15 – The results of community surveys carried out in September 2006, showing clear support from a sample section of the public for the Santa Sofia MPA. The majority of people surveyed for all four Burgos MPA Barangays were aged between 35 and 50 years old and 80% of participants were male. Nearly half the people surveyed relied on the ocean for their livelihood.

Visibility was found to be around 20m on all survey dives. The temperature was around 30 degrees for all sets of surveys conducted in 2005, 2006 and 2007. Changes to benthic and fish abundance and composition are expected to be minimal due to the long recovery times of most large fish species and corals.

Conclusion and recommendations



Comparing the results from 2006 and 2007, the numbers of foodfish and large predatory fish like mol-mol, solid and lapu-lapu are generally similar, with some small increases, and there were a greater percentage of larger individuals noted for many species such as kitong, lapu-lapu, molmol and maya maya, which is encouraging, indicating a trend of recovering numbers of mature adults. Larger mature individuals are able to produce much higher numbers of offspring than smaller mature fish; hence the importance of protecting fish stocks now to allow increased populations in the long run. The benthic composition has shown a small increase of around 10% for hard coral cover inside the sanctuary, and the current composition is a healthy and diverse habitat.

Surveys between selected sites inside and outside the protected area indicate that the numbers of fish seen are fairly similar whether inside the MPA or outside. This is not unusual; larger species such as kitong and lapu-lapu often have large territories that extend for hundreds of metres. Their presence alone is positive, as it suggests that the habitat found in the area is well suited to their continued breeding success. Butterflyfish generally have a smaller territory than the larger foodfish species, and their higher concentration within the MPA is an indication of the suitability of the site – Butterflyfish have very specific feeding requirements depending on the species, and ten different species were noted inside the MPA, whilst four were seen outside. This infers good coral health and high diversity, which in turn is a precursor for increased numbers of larger commercial species that take longer to recover and show larger numbers of mature individuals, but still rely, in turn, upon a suitable habitat.

The coral cover inside and outside the MPA was fairly similar (figs.10 and 11); there was slightly better coral cover inside the MPA (56% vs. 53% hard coral cover) but

there were more living benthic points recorded inside the MPA (soft corals, sponges and other animals 13% inside vs 5% outside). Combined with the more even distribution of the four coral lifeforms recorded inside the MPA versus outside (fig. 12), this confirms that the area chosen for the MPA is well suited, with high species diversity – when compared to the data from 2006 (fig. 10), there is also some evidence that the MPA is continuing to recover from the time of establishment.. Figs. 8 & 9 show the anthropogenic and natural coral impacts recorded inside and outside the MPA in 2006 and 2007, and whilst outside the MPA, human impacts like anchor

damage, sedimentation (usually linked to settlement areas) and trash are still fairly high and have remained at 2006 levels, impacts inside the MPA have for the most part decreased, which is a positive finding. Coastline clean-ups carried out by NGO's, local schools and businesses in Burgos throughout the year have helped to some degree to reduce the instances of trash noted, but in order to attain the healthiest and most aesthetically pleasing area possible for fish stock recovery and tourism income through diving, effective waste management is crucial. Plastics and other non-biodegradable materials can cause severe harm to corals, fish and other animals, so Coral Cay Conservation in conjunction with the local government and education system has begun to focus on this issue, and any ideas for reducing waste in the Barangay - such as increasing recycling opportunities and providing proper channels for waste disposal - would be welcome at a municipal level.

In terms of potential for income through ecotourism, the southern end of the MPA in particular has fantastic topographic complexity, and it is worth noting that during the survey period, a whale shark was seen in this area by volunteers, and several more sightings recorded from the Burgos pier – all these factors are likely to cement the area's appeal for dive companies operating in the region.

The marker buoys recently installed around the sanctuary, together with the newly available patrol boat, both provide an extremely positive image to the local community of the barangay's support for effective management of the MPA. If the Barangay government shows continued commitment to maintaining a well managed protected area, the local fishermen and coastal community are likely, with continued education, to, in turn, maintain their support. Consequently, effective monitoring of the sanctuary, via use of the patrol boat and manning of the guard station, are essential. In order for this to be most effective, a suitable plan for use of the patrol boat is crucial; currently, the situation of the patrol boat being shared between the Barangays on a rotation system is not maximising its potential to discourage illegal fishing.

A further recommendation would be to combine the MPA of Tangkaan with the MPA of Santa Sofia to set aside a 900m area of coastline. Larger MPA's have a far better chance of recovering fish stocks. At this time, the neighbouring MPA of Tangkaan is not properly managed. This will need to be discussed with the council of Tangkaan. The combined efforts of both Barangays may be the key to successful management and law enforcement. It will also save on costs such as marker buoys and help improve inter-barangay relationships.

Acknowledgements

Coral Cay would like to thank all the CCC volunteers for their hard work and dedication to providing accurate survey results. We would also like to extend our gratitude to the Barangay council of Santa Sofia and Captain Ganda in particular for allowing us to dive within the MPA and their continued support and motivation in creating a sustainable fisheries management in their Barangay. We also thank the Municipal office of Padre Burgos for assisting us in so many ways.