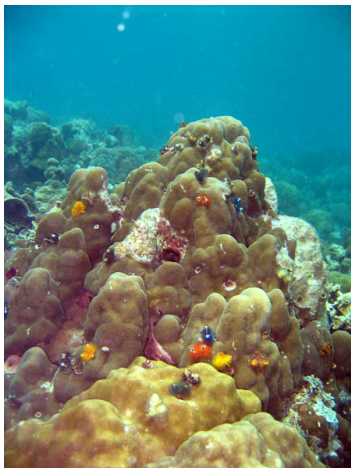


Molopolo & Santa Cruz

Marine Protected Area

monitoring results

Nov 2006



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1 - Introduction to 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 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.

2 – Molopolo/Santa Cruz Fish Sanctuary

The MPA of Molopolo and Sta. Cruz is managed jointly between the two neighbouring barangays (Sta. Cruz to the south and Molopolo to the west) and is located at 10°N 04.267 and 124°E 56.26. Established in 1996 as a result of heavy fishing pressure in the area it stretches some 300m along the shoreline and contains a considerable portion of mangrove forest and sea grass beds. At its outer limit marked by rocks visible above the surface, the reef is 5-6m deep. A 50m buffer zone on the seaward edge prohibits fishing to a depth of approximately 12m on the gently sloping reef. The core section of the MPA appears to be respected by local fishermen and is almost always under the watchful eye of the local community.

At the centre of the beach in the MPA an old bamboo walkway in dire need of repair extends seaward and was intended to allow viewing and feeding of the fish in the sea grass beds. Sea grass beds and mangroves provide important habitats in coastal ecosystems both trapping sediments and acting as nursery areas for young fish to grow before moving out to the coral reefs and other fishing grounds.

CCC was requested to survey the MPA by the Provincial Tourism Office in order to assess its potential for use as a tourist attraction with respect to SCUBA diving and fish viewing/feeding from the walkway. A full MPA survey was completed in order to also assess its success as a fish sanctuary.



Fig. 2.1 The bamboo walkway extends seaward into the sea grass beds near to the mangroves along the shore of the MPA at Molopolo/Sta. Cruz.

3 - Marine Protected Areas

MPAs 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 MPAs 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 MPAs 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 and snorkellers pay a small fee to dive within the MPA. As long as the number 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.

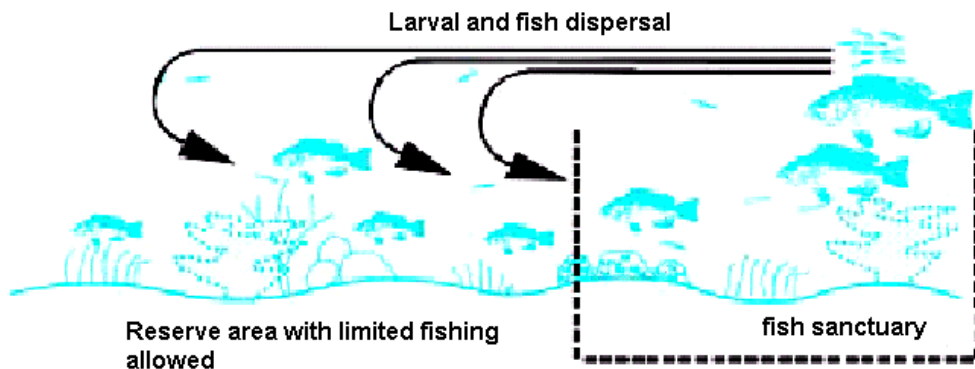


Fig. 3.1. Schematic diagram of MPA functioning. The large, protected fish within the MPA produce larvae which settle and grow outside the MPA where they can be caught by fishermen. In addition, the corals inside the MPA are not disturbed by direct human impacts. One square km of healthy reef can produce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

4 - Methods

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 in front of the MPA (“inside”) and to each side of the MPA (“outside”) were collected between 31 October and 2 November 2006. Five SCUBA surveys were carried out at a depth of 12m inside and outside the MPA. This depth was chosen because it usually has the highest coral diversity. In addition, four snorkelling surveys were completed inside and four outside the MPA simultaneously in the sea grass beds on 7 November 2006.

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. “Benthic” refers to the animal and plant life growing on the seabed. A 50m transect line was laid out along a constant depth 12m. A note was made of the benthic cover every 25cm along the line. The total number of points along the transect line was 200. Benthic categories were chosen as follows:

Live hard coral	Other benthos types		
<i>Branching</i>	Soft coral	Other animals	Seagrass
<i>Massive</i>	White dead coral	Turf Algae	Rubble
<i>Flat/encrusting</i>	Dead coral w/ algae	Fleshy macroalgae	Rock and block
<i>Foliose/cup</i>	Sponges	Coralline algae	Sand/Silt



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

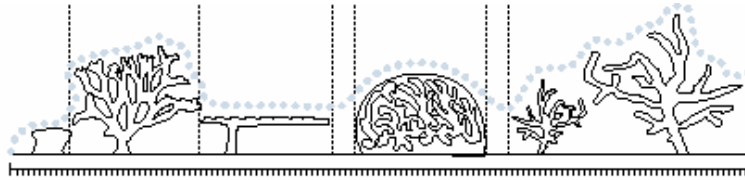


Fig. 4.2. Schematic diagram of a point intercept line laid over different coral lifeforms

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.

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

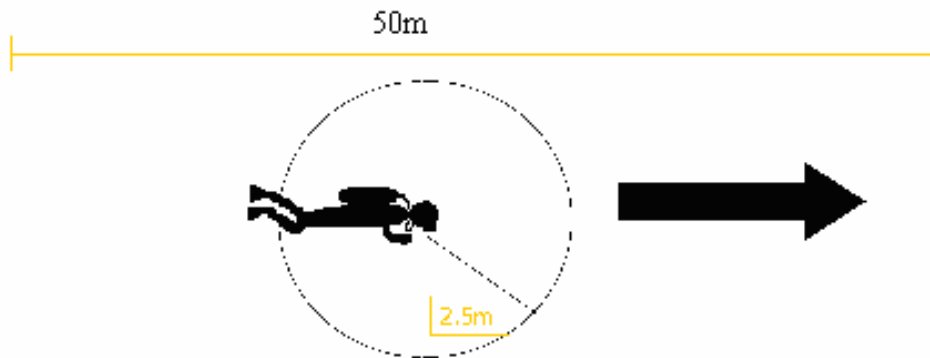


Fig. 4.3. Fish visual survey method used to estimate fish abundance along the 50m line. The diver notes down any target fish seen 2.5m to either side and 5m above. The observer on the other side of the line does the same.

4.3 - Invertebrate surveys

On each transect completed, a fourth observer would record the numbers of target invertebrates 2m either side of the survey line. These invertebrates were:

<i>Diadema</i> urchins	Pencil urchins (<i>H.mammilatus</i>)
Crown-of-thorns star (<i>Acanthaster</i>) (COTS)	Giant clam (<i>Tridacna</i>)
Triton shell (<i>Charonia tritonis</i>)	Lobster
Sea cucumber	Banded coral shrimp (<i>S. hispidus</i>)

These invertebrates are selected for MPA surveys either due to their commercial importance (e.g. lobsters, triton shells) or because they can be indicators of environmental condition (e.g. COTS, *Diadema* spp.).

4.4 - Human impacts and abiotic factors

In addition to the fish and benthic data, a fifth observer laid down the transect line for the other observers to follow and made notes 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 notes of human impacts, drew a map of the area and noted transect locations with a Global Positioning System (GPS) for future reference. Fishing boats, trash, gleaners and many other human influences were also recorded.

4.5 - Sea grass bed surveys

The sea grass beds were surveyed in a similar manner as above using snorkel equipment to lay a 50m line and observe the fish and invertebrates within 2.5m and 2.0m respectively either side of the line. The sandy seabed was not surveyed in the same manner as the coral reef but observations of sea grass and algal cover were recorded.

5 - 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.

5.1 - Differences in coral reef fish abundance

Table 5.1. Fish families observed on surveys in common English, latin and Visayan name.

Fish	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)	timbongan
Triggerfish (Balistidae)	pakol
Butterfly fish (Cheatodontidae)	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

Inside the MPA a total of nine butterfly fish species were recorded and eight species outside. An overall total of 13 species were observed (only 12 during surveys) and are shown below:

Eastern triangle, <i>Chaetodon baronessa</i>	Pacific double saddle, <i>Chaetodon ulietensis</i>
Raccoon, <i>Chaetodon lunula</i>	Copper banded, <i>Chelmon rostratus</i>
Humphead banner, <i>Heniochus varius</i>	Orange banded, <i>Coradion chrysozonus</i>
Redfin, <i>Chaetodon trifasciatus</i>	Kleins, <i>Chaetodon kleinii</i>
Ornate, <i>Chaetodon ornatissimus</i>	Pyramid, <i>Hemitaenichthys polylepis</i>
Chevron, <i>Chaetodon trifascialis</i>	Spot tail, <i>Chaetodon ocellicaudus</i>
Vagabond, <i>Chaetodon vagabundus</i>	

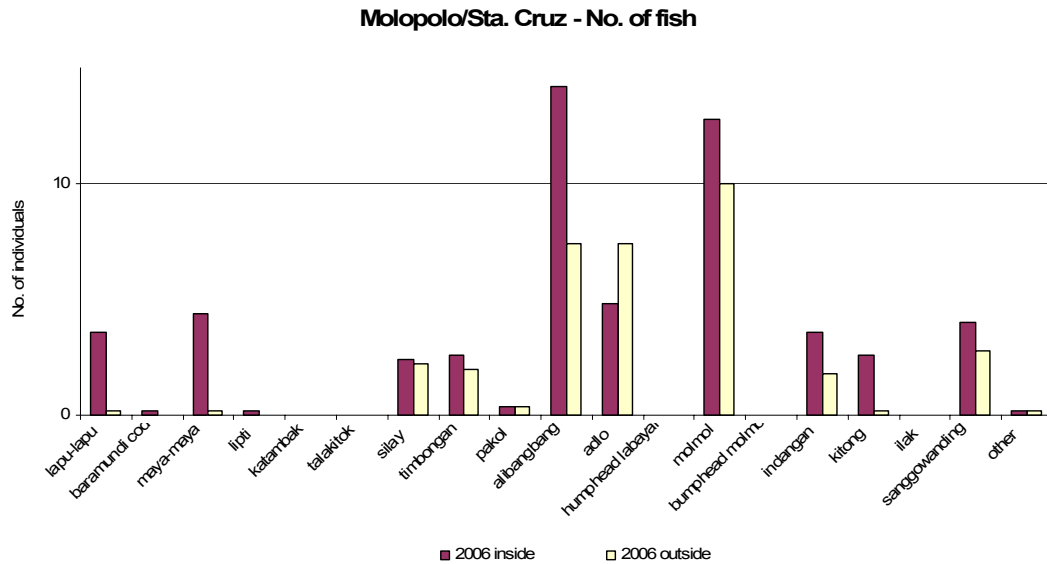


Fig. 5.1. Numbers of fish in front of the buffer zone (“inside”) compared to outside the buffer zone at the Molopolo/Sta. Cruz MPA. The results indicate a higher abundance of most fish families directly in front of the MPA in comparison to the areas either side, especially regarding grouper and snapper. The high abundance of butterfly fish is a very positive result as these species indicate that the reef is in good health.

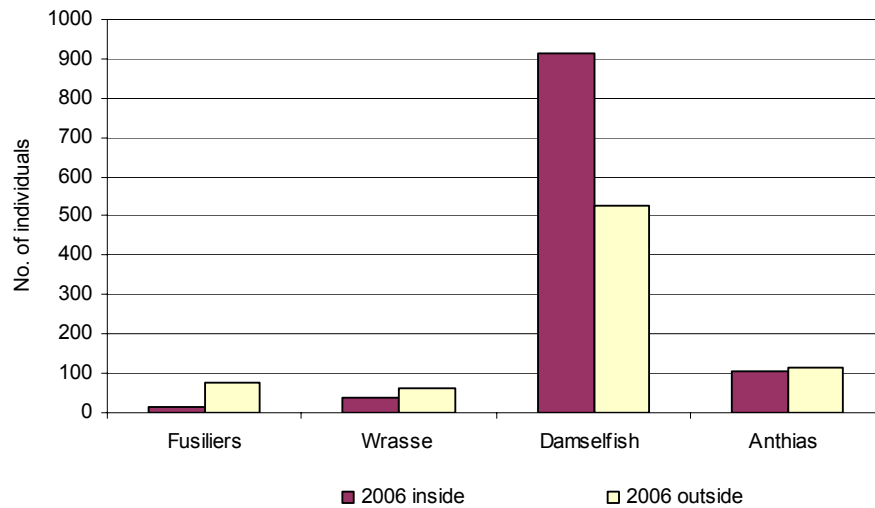
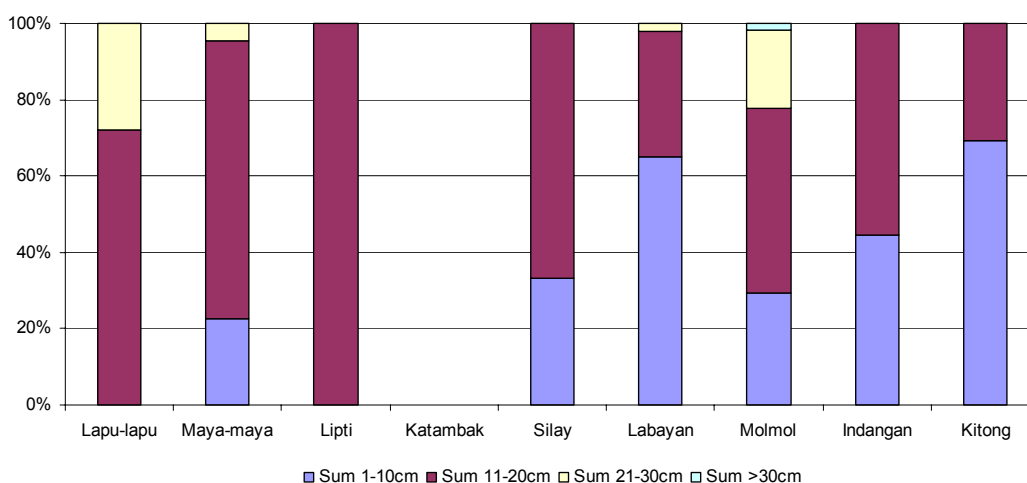


Fig. 5.2. Differences in the numbers of more abundant, smaller fishes observed in front of the buffer zone (“inside”) compared to outside the buffer zone at the Molopolo/Sta. Cruz MPA. Considerably more fusiliers (solid) were observed outside the MPA compared to inside though in general damselfish (palata) were the most prolific species observed.

A – “Inside” MPA



B – Outside MPA

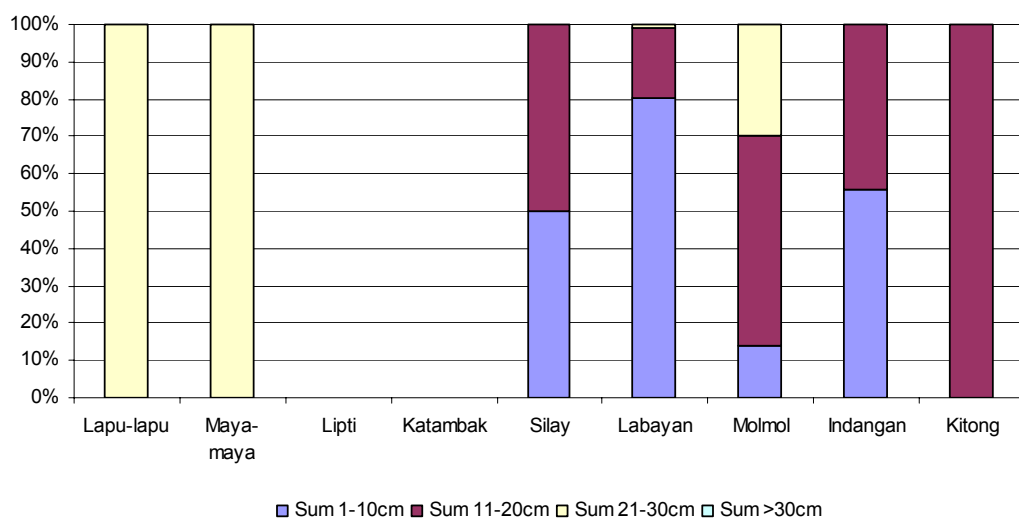
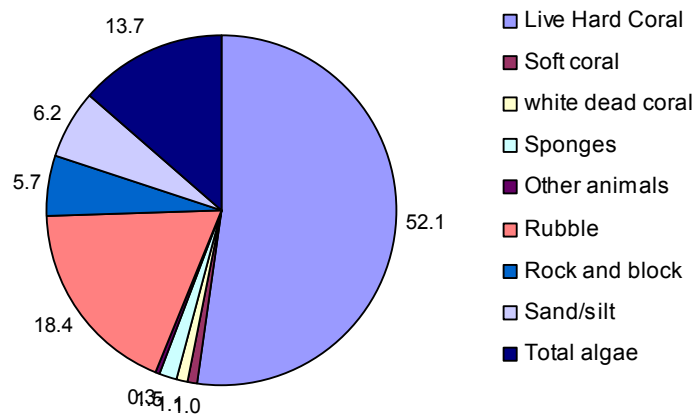


Fig. 5.3. Composition of commercially important fish from 2006 “inside” (top) and outside (bottom) the MPA. There is generally a higher percentage of larger fish inside the MPA for most species compared to outside. A healthy fish stock will contain individuals of all sizes and the size of fish surveyed appears to be more varied within the MPA compared to outside. Large adults of predatory fish (groupers, snappers and sweetlips) provide many more offspring than young adults and therefore it is important to let these adults grow to their maximum size.

5.2 – Coral reef benthic cover and human impacts

A – “Inside” MPA



B – Outside MPA

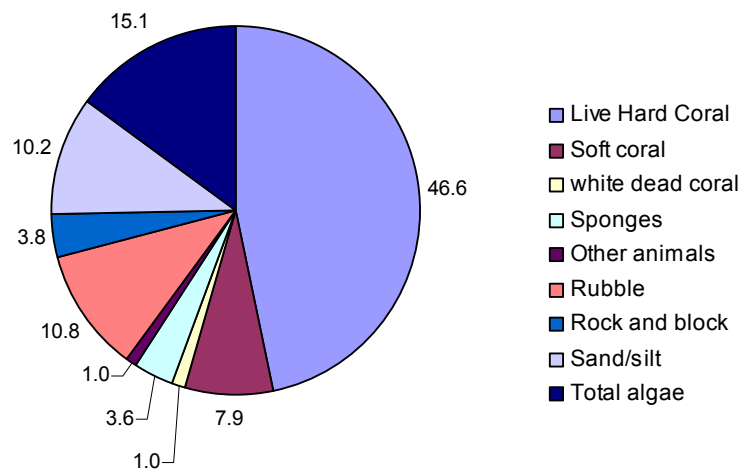


Fig. 5.4. Benthic composition “inside” and outside the MPA in 2006. Live hard coral (LHC) cover is slightly higher “inside” the MPA though the differences are minimal. Overall the reef environment “inside” and outside the MPA is very similar in benthic composition.

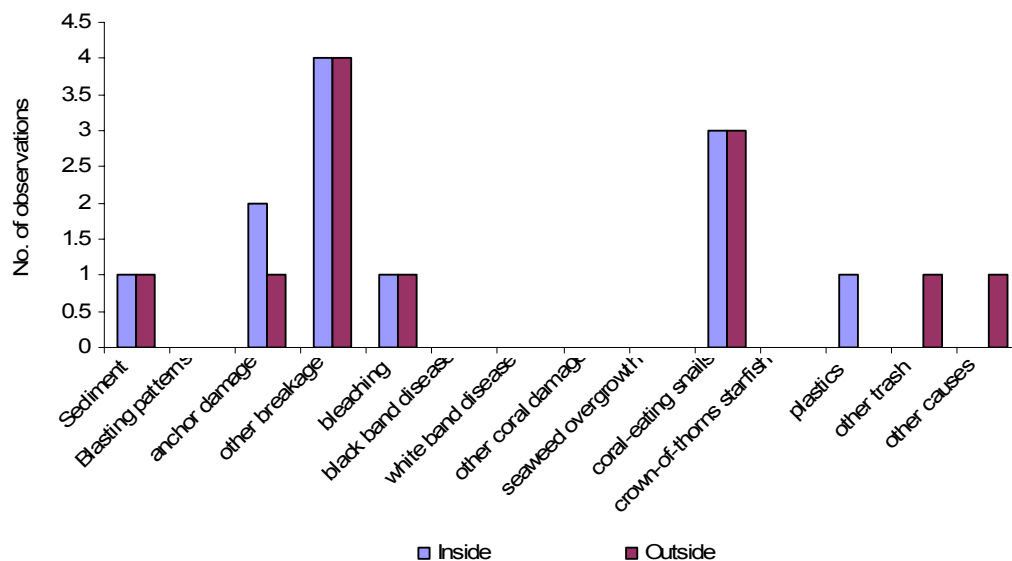


Fig. 5.5. A summary of the coral damage and human impacts found “inside” and outside the Molopolo Sta. Cruz MPA. A similar number of negative impacts such as anchor damage and trash were noticed both “inside” (in front of the buffer zone) and outside of the MPA. As much as possible should be done to protect the areas used for fishing in order to further enhance fish catches.

There was little difference in coral damage and other human impacts directly in front of the MPA compared to the areas surveyed to either side. There was also little difference in algae cover “inside” the MPA compared to outside though in general algae cover was high compared to other reef areas in the region e.g. reefs in Padre Burgos. This increased algae cover (Fig. 5.4) may be a sign of pollution from the land that allows algae to flourish and overgrow corals. Alternatively it may simply be due to the high abundance of rubble in the area providing a suitable substrate for algal growth.

Visibility was found to be around 12-20m on all survey dives. The temperature was 28-29°C for both the surveys conducted.

5.3 – Reef invertebrates

Differences in invertebrates in front of the MPA buffer zone compared to other outside areas were small but giant clams and triton shells were not observed in areas well outside the MPA (Fig. 5.6). The occurrence of other non-target invertebrates such as nudibranchs (sea slugs) was similar both inside and outside the MPA. The real effect of the MPA with respect to invertebrate protection can be seen in the sea grass bed results in section 5.4

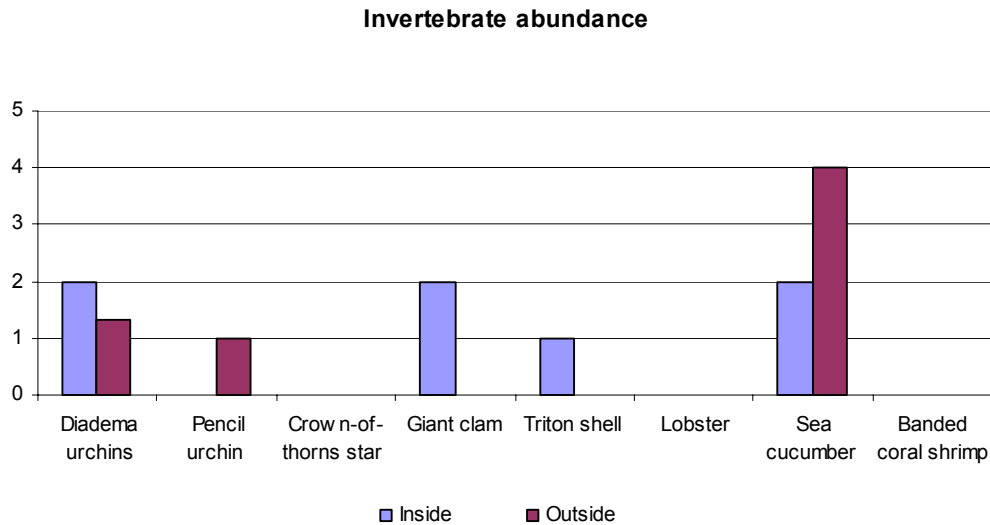


Fig. 5.6. Summary of the target invertebrate life surveyed at 12m in front of the buffer zone of the MPA at Molopolo/Sta. Cruz.

5.4 - Sea grass bed surveys

The sea grass beds inside the MPA were compared to those outside the MPA. The techniques used were not ideal as the water was very shallow and visibility was limited to around 3m. As a result of this it was difficult to observe the shoals of snapper and emperors known to be in the area. However, juvenile fish of many species were observed (Fig. 5.7) as well as others not on the survey list such as lion fish adding to the evidence that sea grass beds are important nursery grounds for juvenile fish. Blennies and gobies were also prolific on the sea grass beds inside and outside of the MPA.

Anecdotal evidence from local people and personal observations from the end of the bamboo walkway confirm the presence of large shoals of young snappers (maya maya) and emperors (katambak) (Fig. 5.8). The MPA will help to protect these fish until they are large enough to move outside to the coral reef where they will reproduce and be available for capture by the fishermen.

In addition to the fish observed in the sea grass beds, the invertebrate life and algae/sea grass present were also recorded. Sea grass cover was extensive and the species observed included *Thalassia* and *Halophila* spp. The most prominent algae species observed included *Halimeda* sp. and *Padina* sp. However, these were not counted in the same manner as the coral cover due to a reduced number of available surveyors at the time.

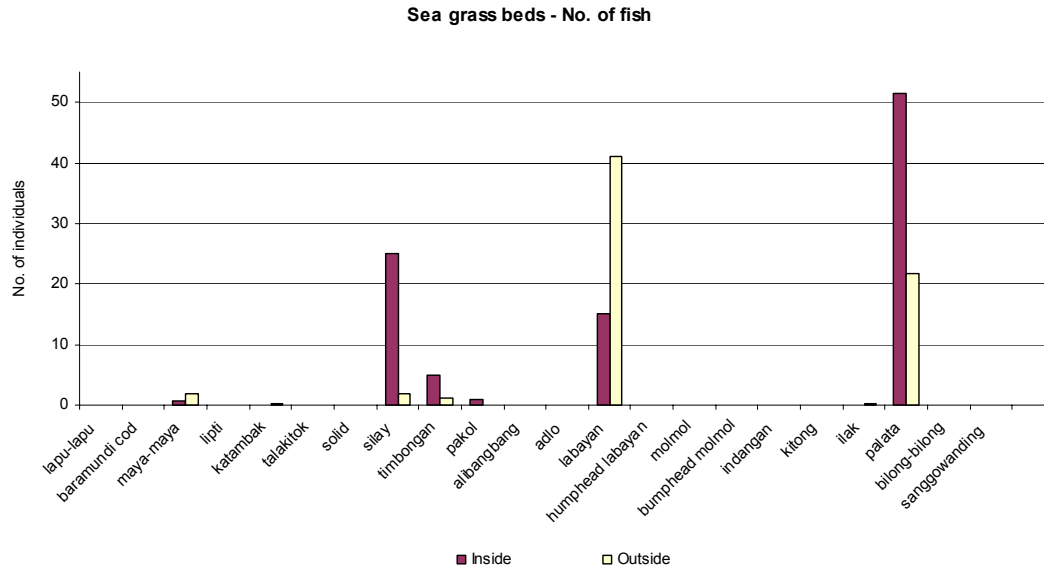


Fig. 5.7. Average numbers of fish observed in the sea grass beds inside the MPA compared to the sea grass beds outside the MPA at Molopolo/Sta. Cruz. The results indicate a higher abundance of some species within the MPA but the survey techniques combined with the poor visibility inside the MPA make it difficult to draw any real conclusions from this data. No real differences can be seen in the commercially important fish species though anecdotal evidence confirms the presence of large numbers of snapper and emperors within the MPA.



Fig. 5.8. Snapper and emperors observed from the walkway at the Molopolo/Sta. Cruz MPA. The fish ranged between approximately 20-40cm total length and were present in large numbers (>250).

The invertebrate life surveyed on the sea grass beds displayed clear differences between the protected and unprotected areas (Fig. 5.9). Sea cucumbers and urchins were abundant within the MPA whereas outside the MPA they were few, most likely due to the gleaning of the shallow areas by local people (Fig. 5.10.). The sea star *Protoreaster nodosus* was

also extremely common on the sea grass beds existing at densities of up to 1 per square metre in some areas inside the MPA (Fig. 11). These results clearly show that the protection of this area of sea grass bed supports a large number of animals and plants that can continue to overspill into areas outside the MPA for locals and fisherfolk to harvest.

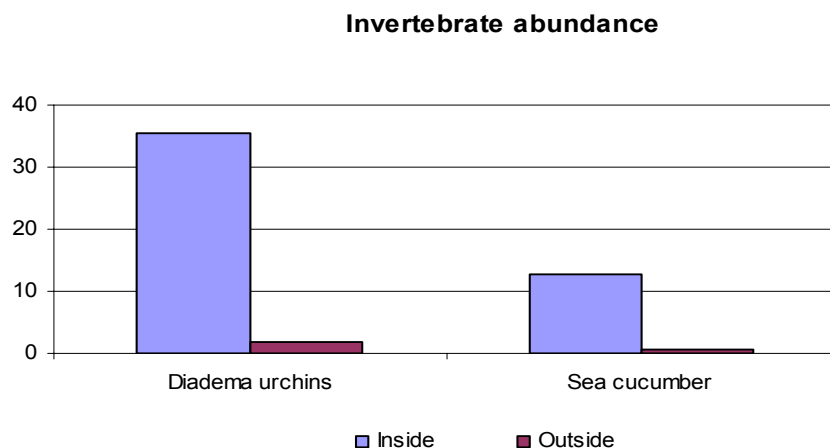


Fig. 5.9. Summary of the target invertebrate life surveyed on the sea grass beds at Molopololo/Sta. Cruz. Urchins and sea cucumbers are far more abundant within the protected zone compared to outside.



Fig. 5.10. Diadema urchins feeding on the sea grass beds within the MPA at Molopololo/Sta. Cruz.



Fig. 5.11. The sea star, *Protoreaster nodosus* inside the MPA at Molopololo/Sta. Cruz. In places they exist at high densities ($>1 \text{ m}^{-2}$).

6 - Discussion

Fish

The high abundance of butterfly fish observed on the surveys is a very positive result indicating that the reef area is in good health. The general observation of greater numbers of fish in the area in front of the MPA shows that protection of the area is working. With regard to the commercial species, the best results were for snapper and grouper whereby many more were observed in front of the protected area, giving these individuals a greater chance to grow and reproduce, providing more fish in years to come (Fig. 5.1.).

The age structures of the fish population in front of the MPA was also better than that to either side, with larger individuals observed (Fig. 5.3). A healthy fish stock will contain individuals of all sizes and with proper MPA management this will happen in time. It is also interesting to note that a large snapper of 12 kg will provide as many offspring as 100 1kg snappers resulting in higher fish yields in the future. This really underlines the importance of allowing fish to grow and reproduce in an undisturbed environment so that maximum offspring outputs can be attained.



Fig. 6.1. An ornate butterfly fish (alibangbang isda) swimming on the reef at Molopolo/Sta. Cruz. The presence of many different butterfly fish species indicates the coral reef is healthy.

Corals

Although a fairly high amount of broken and damaged coral was observed along with coral rubble, the nature of this damage appears to be due to the topography (physical structure) of the reef itself. Small walls are present in some of the reef areas dropping from around 5m down to 8-10m. However, the remaining reef has a very shallow sloping structure. During the months of the habagat (June – Aug/Sep) the reef lies in a very exposed position to the prevailing wind and wave action. The shallow slope makes it

likely that a greater surface area of reef will be damaged during particularly strong storms, thus resulting in more overturned corals and coral rubble.

Both inside and outside the MPA, the dominant hard coral life forms observed were branching corals (50% and 30% respectively of all hard corals recorded). These are the faster growing coral species and are likely to be dominant here as they quickly take advantage of new spaces created to settle and grow after storm damage occurs. The coral damage caused by the habagat is a natural process and is not a cause for concern. The reef supports plenty of fish life and healthy corals and sponges as indicated by the abundance and diversity of butterfly fish.

The proportion of algal cover on the reef was quite high but might be due to the high percentage of dead coral and coral rubble on the seabed. However, increased algal growth can also indicate nutrification (too many nutrients in the water from land run-off and pollution). Algae (in particular *Cyanobacteria*) can out compete and overgrow corals when there is an increase in certain nutrients in the water. This is a more complex problem that requires an integrated approach to the local coastal management. The Barangays could assess their waste disposal methods to ensure that land run-off is minimised.

Sea Grass Beds

The sea grass beds appeared to be teeming with juvenile fishes. The survey methods used were not wholly suited to the shallow water encountered but no other method was available. In comparison to the area outside the MPA, the protected area of sea grass supported a huge diversity of life from juvenile fishes such as trigger fish, snapper, emperors, spinecheeks and parrot fish to a high abundance of sea cucumbers, urchins and starfish. The differences in invertebrate and many fish species between inside and outside the MPA (where a lot of gleaning occurs) were clear. The higher numbers of invertebrates and many fish observed inside the MPA are proof that the protection of the area is working and that it can act as a breeding ground for fish and invertebrates to move outside the MPA to be harvested by local people and fishermen.

The mangrove areas directly in front of the sea grass beds provide good protection for the reef from silt and nutrients running off from the land and also act as an important nursery ground for young fish. Any sediments and nutrients passing through the mangroves become trapped in the seagrass beds protecting the reef from land run-off. In turn, the coral reef, reef flat and seagrass beds provide a buffer during storms that protect the mangroves and Barangay inhabitants. The continued protection of all these habitats is in the best interests of the local people.

Management suggestions

The reef at Molopolo/Sta. Cruz is a very shallow sloping reef. As a result, one must travel a long distance from shore to obtain any real depth. The buffer zone at the edge of the reef flat is only 50m wide and fishermen can fish beyond this. The depth of water at this point is still shallower than 20m. Many fish such as grouper, snapper and sweetlips will live deeper than this and therefore will not be protected from fishing. The reef and its fish

would be best protected if the buffer zone was extended offshore to include depths of up to 30m. In time more fish will be able to grow larger, produce more offspring and move outside the MPA where the fishermen can catch them. The inclusion of three key habitats (mangroves, sea grass and coral reef to **30m depth**) within the core MPA would almost certainly lead to improved fishing yields in time.

The installation of offshore buoys to mark the extended outer corners of the MPA would provide a cheap and effective method of marking clear boundaries. The removal of these during the habagat would be recommended to avoid losing them in strong waves.

CCC believes now would be a good time to extend the outer buffer zone. Although the MPA is already well managed the implementation of a buffer zone would protect an extended area of reef. Boat and diver access within the buffer zone should be allowed but any fishing must be prohibited. The following image shows a buffer zone that is typical of many MPAs in the Philippines. Only by proper management and enforcement of regulations will the fishermen be able to realise the true potential of the increased fish yields that an MPA can offer.

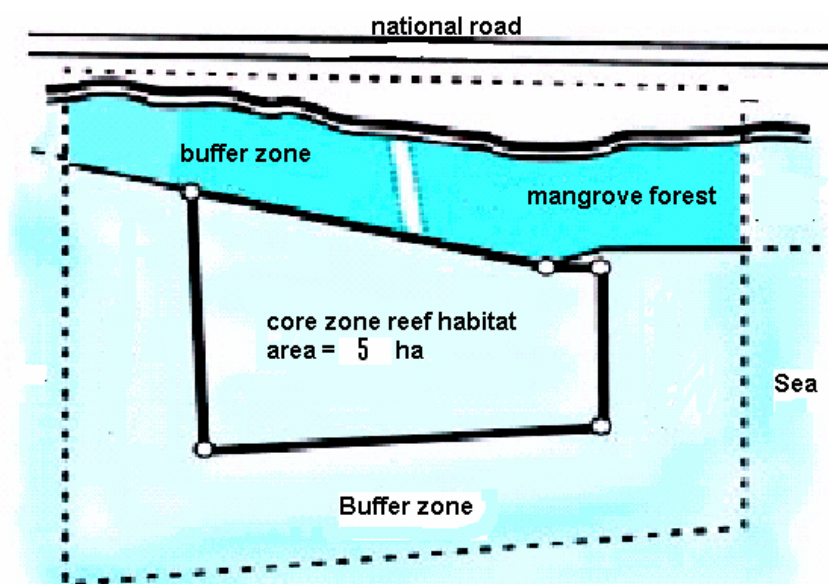


Fig. 6.2. Diagram of a 5ha MPA with buffer zone to prevent disturbance of fish from just outside the core zone. At this time, Tangka'an has only an unmarked core zone. A buffer zone is recommended.

For now, it is crucial that the MPA wardens watch the area at all times and make sure there are no violations such as illegal fishing and passage inside the MPA. The community must remain involved in future decisions and their voice should be heard. Without community support, the MPA cannot work.

It is a good thing that a small patrol boat exists already for the MPA even though it is a paddle boat. On our first visit to survey the MPA, although we had informed people of our intentions, we were immediately approached and asked our business. It is a good thing that the community keeps such a watchful eye over its MPA as it acts as a good deterrent for illegal fishing. Indeed, it is in the interests of local fishermen to actively

guard their MPA whilst fishing outside it. They should also take on the responsibility of warning off other fishermen intent on fishing within the MPA boundaries and buffer zone.

The Eastern Visayas Tourist Board is currently promoting Southern Leyte as a tourist destination and is on the lookout for suitable tourist attractions and venues. With the right promotion people may wish to visit the mangroves and sea grass beds and learn about the vital habitats contained within the MPA. Repairing the walkway would be a good start to improving access over the sea grass beds and charging a small fee to tourists wishing to use it and take part in bird watching and/or fish feeding. The latter activity already occurs but needs to be carefully monitored so as not to disrupt the natural food chain.

Diving within the MPA could also provide an extra source of revenue for the MPA management. Contrary to some people's belief, divers do not scare fish away from an area and can actually act as a source of valuable information such as the condition of an MPA. If diving were to be encouraged in the area, the site would be best reached by boat to avoid damaging the reef flat and lagoon on the long walk out. The reef itself, both in front of and to the sides of the MPA is generally in good health although it appears to suffer extensively from storm damage, probably during the habagat. As a result, parts of the reef are not very scenic. Given the location and easy nature of the diving, the MPA is probably best suited to new and inexperienced divers rather than advanced divers wishing to explore greater depths and challenges.

If tourism improves in Southern Leyte and more people come to visit Molopolo, then it will not just be the fishermen that benefit from the MPA. Opportunities may arise for extra local businesses to develop to serve the tourist trade. Improved fish numbers would likely attract more divers to the area and dive operations may consider investment in the MPAs. With careful management and community involvement the MPA has the opportunity to serve the community well and provide resources for present and subsequent generations.

Various sources of financial assistance and/or management advice are available for the MPA. However, these must be sought out proactively by the local barangays. The Provincial Environment and Natural Resources Management Office (PENRMO) based in the Capitol building in Maasin has a coastal management team run by Ma'am Eva Abad who can offer a range of advice regarding management and sourcing funding for MPA repairs and improvement such as guard houses, information boards and public awareness campaigns. The Federation of Omega Beneficiaries International (FOBI) are also able to offer some limited funding for community based projects. Their office is based in Ma'asin and the staff are easily approachable. Coral Cay is also available for further talks regarding management of the MPA but only has very limited funding for improvement projects.

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