

Lilo-an Marine Protected Area Monitoring Results 2011



Kate Longhurst and Jan-Willem van Bochove
Project Scientist & Head of Marine Science
CORAL CAY CONSERVATION
Napantao, San Francisco, Southern Leyte, Philippines
Email: lrcp@coralcay.org www.coralcay.org
Tel: 09282149599 / 053 5730307



1 - Introduction to Coral Cay Conservation

Coral Cay Conservation (CCC) is a not for profit organisation, founded in 1986 by a British scientist. CCC's mission is:

Providing resources to help sustain livelihoods & alleviate poverty through the protection, restoration & management of coral reefs & tropical forests.

In order to achieve this mission, CCC has carried out 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.

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. The project in Southern Leyte has been extended twice, most recently with a move to Napantao in the municipality of San Francisco on Panaon Island in 2008.

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. Communities living in coastal areas are recognized as the stewards of their marine resources and CCC is working closely with local stakeholder groups to raise awareness and increase understanding of the need for greater conservation efforts in the Philippines.

2 - Marine Protected Areas (MPAs)

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 protect pristine reefs from harmful human actions. A properly managed MPA can begin to show benefits in just a few years.

Protected within an MPA, fish can grow larger (as they live longer), and a larger fish produces proportionately more offspring than a smaller fish. Eventually, as fish numbers inside the MPA increase, a 'spill over' of fish from within the MPA to outside the MPA allows fishermen to catch more fish in this area and ensures that a healthy fish community remains in the protected area (see Fig. 2.1). One square km of healthy reef can support over 20 tons of fish per year, whereas one square km of damaged or destroyed reef can only produce 3 tons (Bohnsack, 1990).

Community based MPAs have proven to be an effective method of producing sustainable fisheries and maintaining peoples livelihoods. MPAs can provide an income from eco-tourism, with divers paying 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.

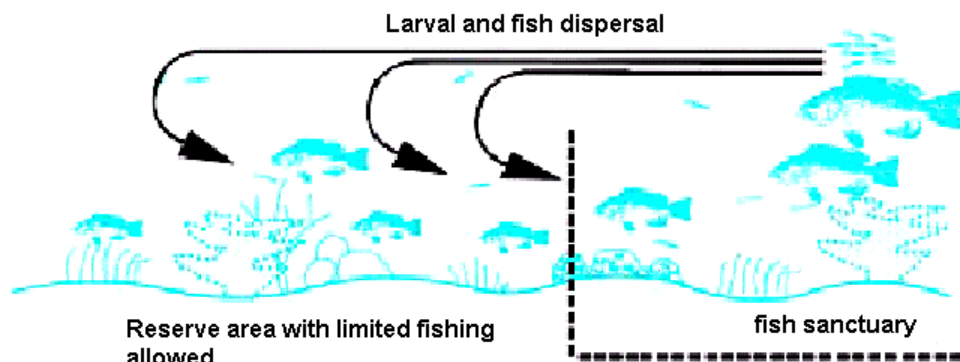


Fig. 2.1. Schematic diagram of MPA functioning. Protected fish in the MPA grow larger and produce more offspring, this leads to 'overspill', increasing fish numbers outside the MPA. In addition, the corals inside the MPA are not disturbed by direct human impacts.

3 – Lilo-an MPA

The MPA in Lilo-an has a total area of 19.6 hectares and was established in 1993. Currently, its location is not marked with buoys and, while there is a guard house present (Fig. 3.1), this is not manned. Thus the MPA is difficult to distinguish and largely unmonitored. Fishing was observed within the MPA during the course of CCC's surveys there.



Fig. 3.1. The Lilo-an MPA guardhouse

The primary, long term goal of an MPA is often to improve fish catch outside of the area as has been shown in Sumilon Island; the first community based MPA that saw local fish stocks doubling within 10 years. Only with the full support of the community and upholding of the regulations and laws that apply within the sanctuary will these benefits become evident.

Additionally, the increase in diving eco-tourism in Sogod Bay makes MPAs a potential source of income from these activities. The presence in the region of other well established MPAs and, of particular interest, a booming whale shark watching industry has the potential to be a great asset to the whole region. However, the maximal benefit of eco tourism can be reached only through an integrated, regional rather than local approach. A region oriented set up for tourism, where the whole of Panaon Island, with all it's assets, is promoted, would be able to attract a much larger total number of tourists in the area than a uncoordinated, local approach could ever do.

4 - Methods

The designated Marine Protected Area was assessed with 10x 50m full survey transects, in January to March 2011. The surveys were carried out at a depth of 6m due to the topographical nature of the MPA. For comparison, additional 10x 50m survey transects were assessed in an area outside the MPA at a depth of 6m. The survey method closely follows that 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.

In addition, at the request of the Municipal Government, the waters around Pong-Oy island were surveyed to assess their potential as a dive site. Two transects were assessed perpendicular to the shore from a depth of 24m. The survey method used was CCC's standard baseline technique.

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 (figure 4.1). "Benthic" refers to the animal and plant life growing on the seabed. A 50m transect line was laid out along a constant depth 6m. A note was made of the benthic cover every 50cm along the line. The total number of points along the transect line was 100. From these results, the percentage cover of the various substrate types could be calculated. 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 with algae	Fleshy macroalgae	Rock and block
<i>Foliose/cup</i>	Sponges	Coralline algae	Sand/Silt

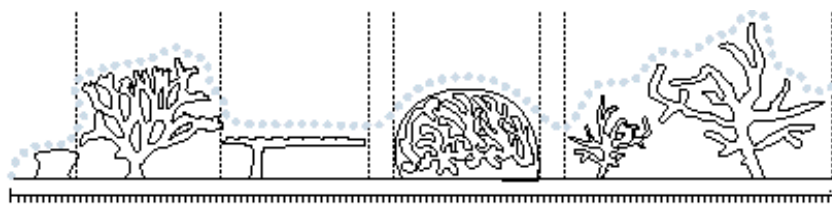


Fig. 4.1. Schematic diagram of a point intercept line laid over different coral lifeforms.

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 swam side by side and counted numbers of target fish 2.5m to either side and 5m above of the 50m transect line (figure 4.2). Swimming speed was controlled and there was 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 of 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:

English name (Scientific name)	Bisaya name
Groupers (Epinephelinae)	Lapu-lapu
Snapper (Lutjanidae)	Maya-maya
Sweetlips (Haemulidae)	Lipti
Emperors (Lethrinidae)	Katambak
Jacks / Trevally	Talakitok
Fusiliers	Dalagang bukid
Coral Breams (spinecheeks) (Nemipteridae)	Silay
Goatfish (Mullidae)	Timbongan
Triggerfish (Balistidae)	Pakol
Butterfly fish (Cheatodontidae)	Alibangbang
Wrasse (Labridae)	Labayan
Parrotfish (Scaridae)	Mulmul
Surgeonfish (Acanthuridae)	Indangan
Rabbitfish (Siganidae)	Kitong
Rudderfish (Filefish) (Kyphosidae)	Ilak
Moorish Idol (Zanclus cornutus)	Sanggowanding
Angelfish (Pomacanthidae)	Adlo

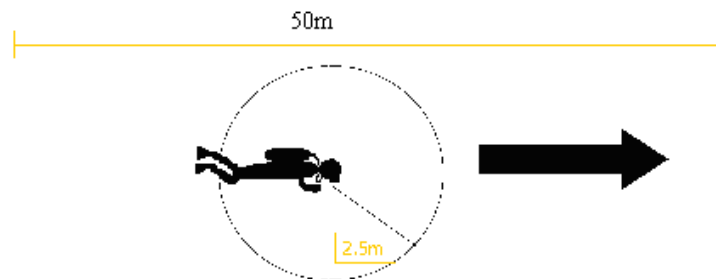


Fig. 4.2. Fish visual survey method used to estimate fish abundance along the 50m line. The diver notes down any target fish seen 2.5m to either side and 5m above.

The size of each fish recorded was also noted as a healthy fish stock will contain individuals of a range of sizes. Additionally, large adults of predatory fish such as lapu-lapu (groupers), maya-maya (snappers) and lipti (sweetlips) will produce proportionally more offspring than smaller individuals

and are therefore important in the recovery and maintenance of fish stocks. Size was recorded by class: 1-10cm, 11-20cm, 21-30cm or >30cm.

4.3 – Invertebrate survey

Invertebrate numbers were recorded 2.5m either side of the 50m transect line, a total area of 250m². The species recorded are either commercially important (e.g. giant clams, lobsters, sea cucumbers) or are good indicators of reef health (e.g. *Diadema* urchins, crown-of-thorns starfish). The species recorded were:

Target invertebrate	Importance
<i>Diadema</i> urchins	Found in high numbers on degraded reefs
Pencil urchins (<i>H. mammilatus</i>)	Commercially important
Crown-of-thorns starfish (<i>Acanthaster planci</i>)	Eat coral, can threaten reefs in high numbers
Giant clam (<i>Tridacna</i>)	Commercially important, now threatened
Triton shell (<i>Charonia tritonis</i>)	Eat crown-of-thorns starfish
Lobster	Commercially important
Sea cucumber (non-synaptid)	Commercially important
Banded coral shrimp (<i>S. hispidus</i>)	Commercially important, eaten by fish
Nudibranch	Indicators of a healthy, diverse reef system
Drupella	Eat coral, can be damaging in high numbers

4.4 – Human impacts and abiotic factors

In addition to the fish, invertebrate and benthic data, another observer made a note of negative impacts on the reef, both natural and human induced. These include:

- SEDIMENTATION Sediment prevents light reaching the corals, restricting their growth and can lead to coral death if severe or prolonged
- BLASTING PATTERNS From illegal dynamite fishing
- ANCHOR DAMAGE From boats mooring inappropriately
- OTHER BREAKAGE Caused by many factors including bad weather or irresponsible diving
- CORAL BLEACHING A reaction to stress, can cause coral death if prolonged
- GHOST FISHING GEAR Fishing equipment abandoned in the area, continues to catch and kill marine animals
- FISH TRAPS Illegal fishing in the MPA
- CORAL DISEASE Caused by many factors, can devastate whole coral communities
- SEAWEED OVERGROWTH Prevents light reaching coral and can lead to death, often caused by low numbers of seaweed-eating fish
- CORAL-EATING SNAILS Can be destructive in high numbers
- CROWN-OF-THORNS STARFISH Outbreaks can destroy entire reefs
- PLASTICS Do not break down quickly, accumulate on reefs and harm corals, fish and other animals

The level of these impacts was graded as 0 – none, 1 – low, 2 – medium or 3 – high.

4.5 – Baseline surveys of Pong-Oy island

In order to establish the suitability of this location as a dive site, baseline surveys were carried out around the island. A team of four divers swam along two transect lines perpendicular to the shore, starting at 24m and continuing until the water was too shallow to dive. Along each transect, the divers recorded the hard coral cover, fish species abundance, invertebrate abundance and underwater impacts, such as sedimentation and litter. The divers assessed the area's biological and aesthetic characteristics as either 'poor', 'average', 'good', 'very good' or 'excellent'.

5 - Results

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

5.1 – Benthic cover

The benthos outside the MPA is dominated by sand, with dead coral, rock and silt also abundant (Fig. 5.1b). Hard coral cover outside the MPA is low (11.7%), less than half that of inside, and the area can be described as poor both biologically and aesthetically. The higher percentage of hard coral cover inside the MPA may be due to optimum coral reef substrata, with higher rubble cover and lower sand and silt cover; coral usually grows faster on dead coral or layers of rubble in comparison to sand which is uneven and soft. However, while hard coral is the most abundant benthic category recorded inside the MPA (26.8%, Fig. 5.1a), this is actually still a relatively low level of coral cover. Abiotic (non-living) categories such as sand, dead coral, rubble and rock were prevalent indicating an impoverished biotic community inside the MPA (Fig. 5.2).

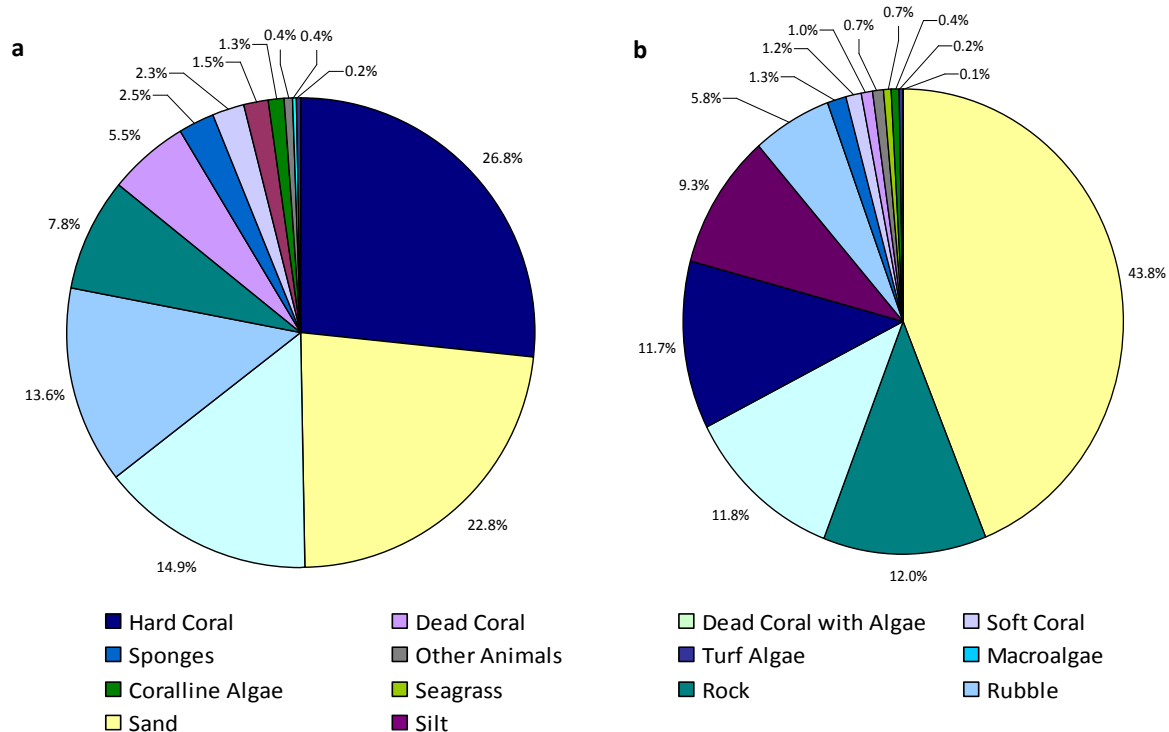


Fig. 5.1. Benthic cover (a) inside and (b) outside the MPA.



Fig. 5.2. Abiotic benthos (rubble) in the Lilo-an MPA

5.2 - Fish abundance

In total, the average number of fish recorded per survey was significantly higher inside the MPA than outside (43.1 inside, 17.1 outside, $p < 0.01$). The average number of fish in each target family was similar inside and outside the MPA (Fig. 5.3), though there were significantly higher numbers of Alibangbang (butterflyfish) and Kitong (rabbitfish) inside the MPA ($p < 0.01$).

Alibangbang (butterflyfish) population and diversity was significantly greater inside the MPA than outside, indicating better reef health. Five additional butterflyfish species were observed only within the MPA: the Redfin butterflyfish, Eastern triangle butterflyfish, Pacific doublesaddle butterflyfish, Horned Bannerfish and Klein's butterflyfish.

However, it is important to note that the fish abundance both outside and inside the MPA is particularly low. Of particular concern are the low numbers of several significant food fish such as Lapu-lapu (groupers), Maya-maya (snappers), Lipti (sweetlips), and Labayan (wrasse) in both areas.

The proportion of individuals in each size class inside and outside the MPA is shown in Fig. 5.4a and Fig. 5.4b respectively. The majority of fish recorded were between 1 and 20 cm in length, with very few larger individuals present. Inside the MPA the majority of fish recorded were in the 11-20 cm size class, whereas outside the MPA the majority of individuals were in the 1-10 cm size class.

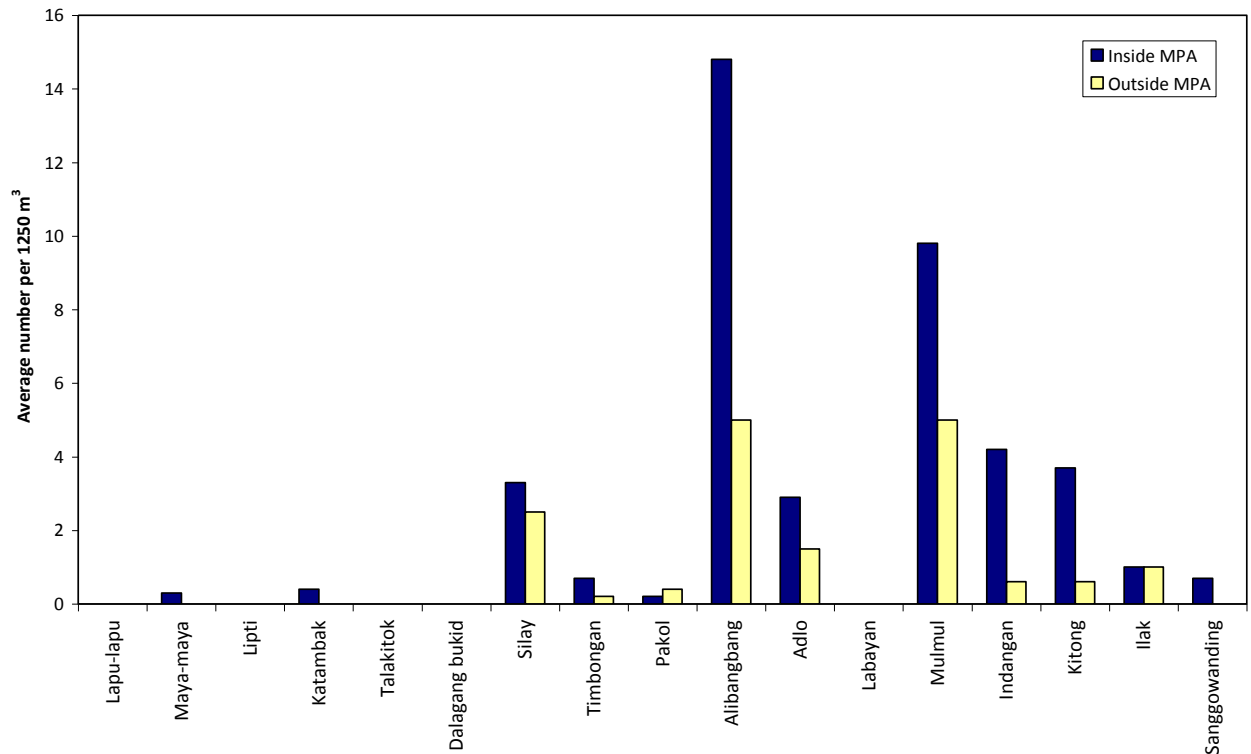


Fig. 5.3. Average number of fish in target families recorded per transect inside (blue) and outside (yellow) the MPA.

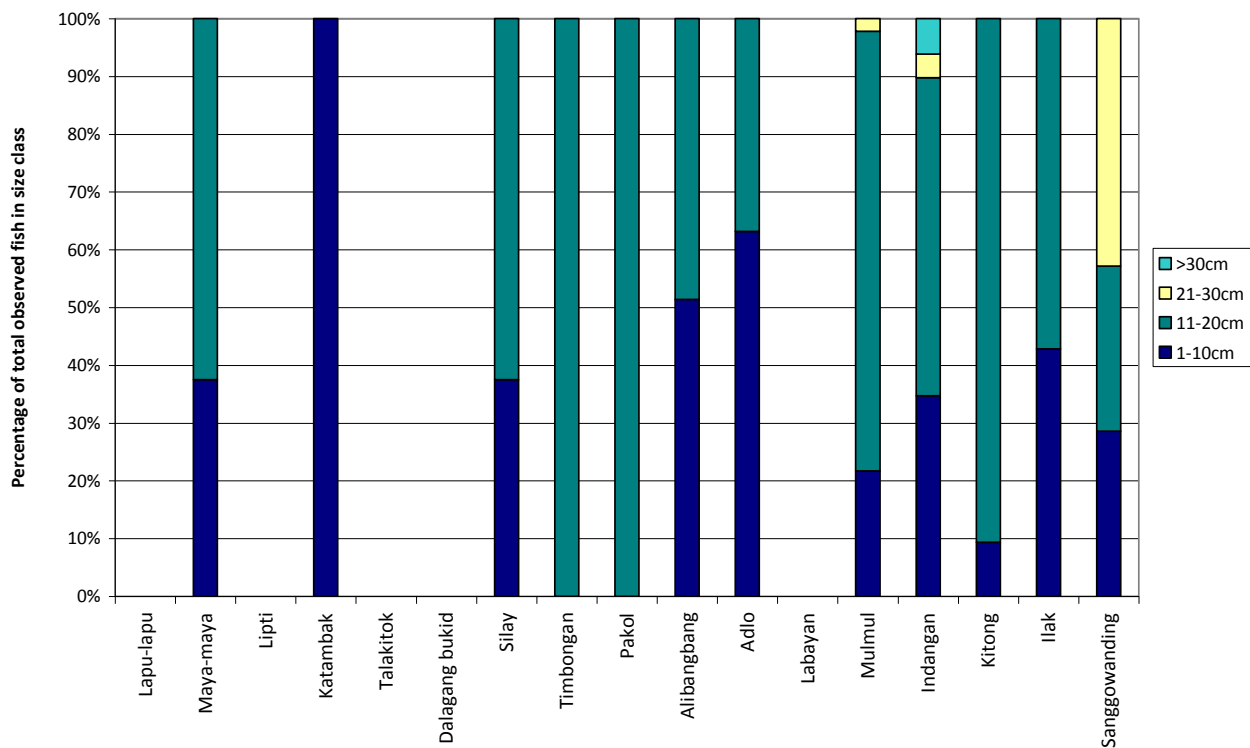


Fig. 5.4a. Proportion of fish in target families in each size class inside the MPA.

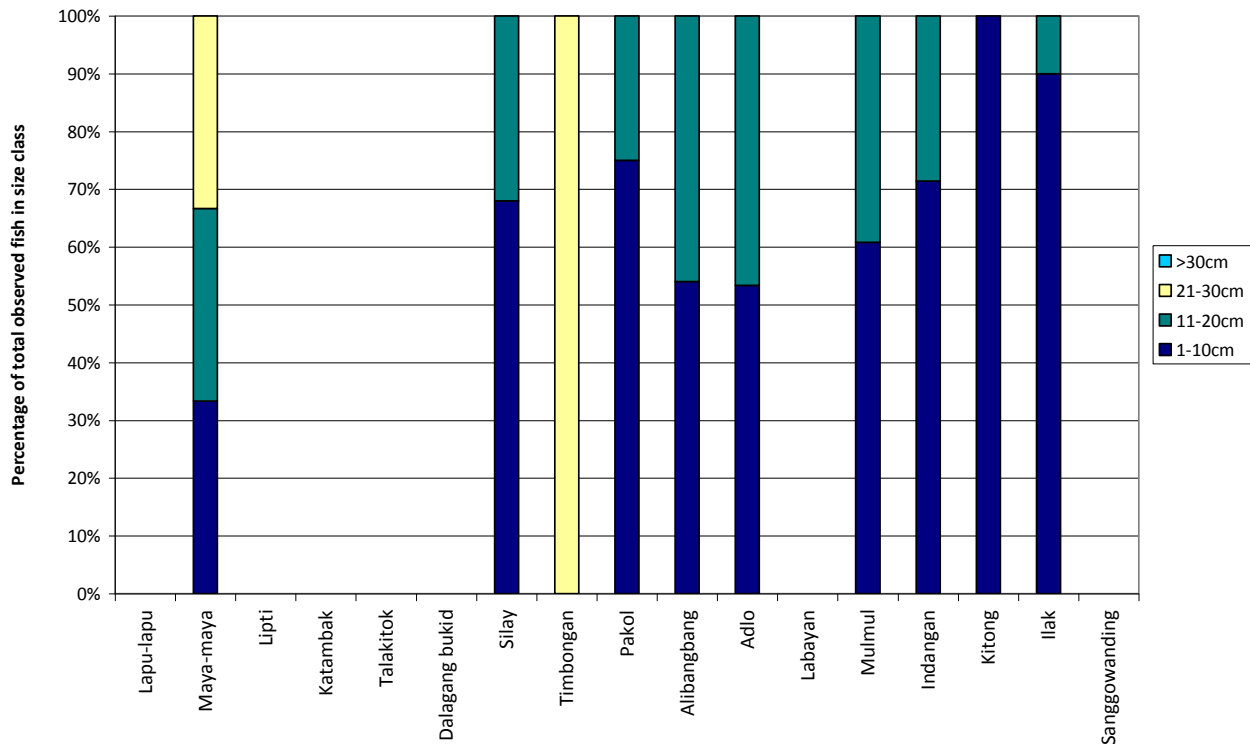


Fig. 5.4b. Proportion of fish in target families in each size class outside the MPA.

5.3 – Invertebrate abundance

In general the average number of invertebrates was very low both inside and outside the MPA (Fig. 5.6); however, there are some notable exceptions. *Diadema* urchins were prevalent in both areas, as were crown-of-thorns starfish (Fig. 5.5). While both of these groups were more common outside the MPA than inside, their numbers inside the MPA are still higher than might be expected in a healthy reef system. Additionally, *Drupella*, gastropods which feed on coral were relatively abundant inside the MPA. Overall, the low numbers of invertebrates recorded inside the MPA is likely to indicate an impoverished biological community in this area.

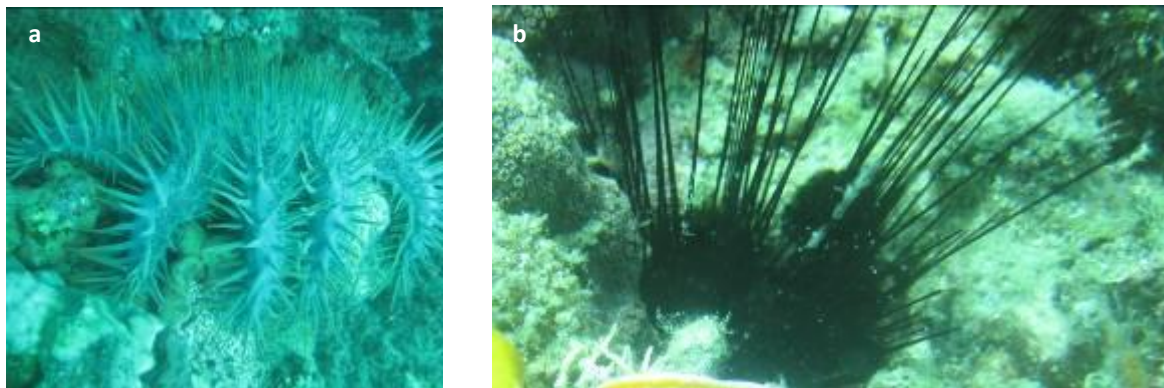


Fig. 5.5. (a) Crown of thorns starfish and (b) *Diadema* urchin in the Lilo-an MPA

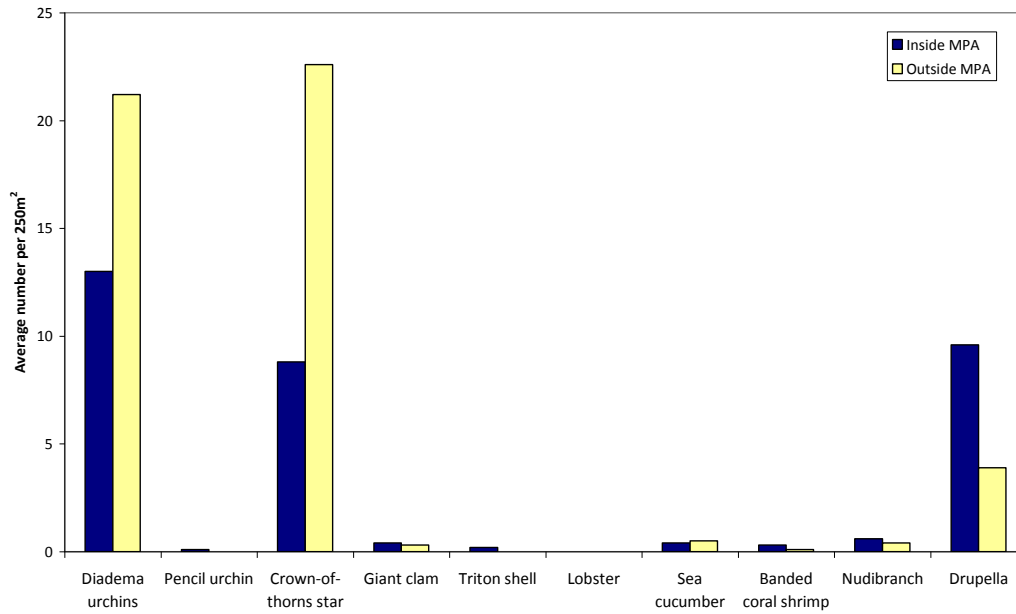


Fig 5.6. Average number of individuals in target invertebrate groups per 250m² inside (blue) and outside (yellow) the MPA.

5.4 – Human impacts and abiotic factors

Generally anthropogenic and abiotic impacts were low (< 1 impact level), with the exception of sedimentation and crowns-of-thorns starfish which had a medium impact level. Interestingly, for the majority of categories the average impact level was higher inside the MPA, with exception of ghost fishing gear, fish traps and seaweed overgrowth.

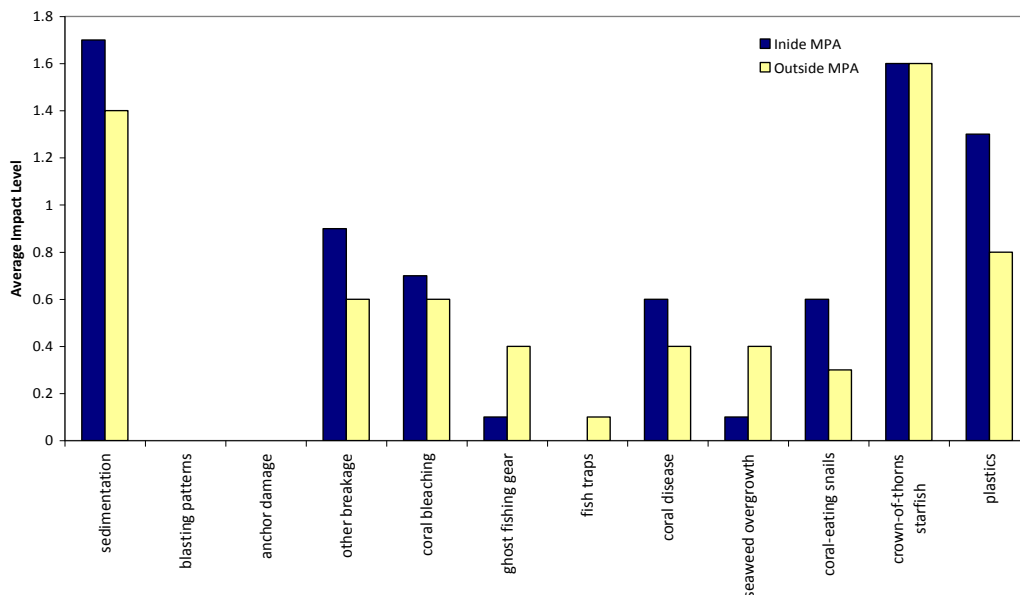


Fig. 5.7. Average level (0 – none, 1 – low, 2 – medium, 3 – high) for negative impacts on the reef inside (blue) and outside (yellow) the MPA.



Fig. 5.8. Impacts in the Lilo-an MPA. **(a)** and **(b)** litter, **(c)** coral disease, **(d)** crown of thorns starfish.

5.5 – Baseline survey of Pong-Oy island

Sand dominated the benthic cover at almost all sites, a majority of sites ranged between 31-100% cover of sand; in comparison hard coral cover was generally low, with the highest recorded percentage cover between 11-30%. At several locations around Pong-Oy Island the observed number of individual organisms (including fish, algae, invertebrates etc) was <15 indicating a sparsely populated and low diversity reef. Anthropogenic impacts may be affecting species abundance as locations with low biological diversity and a poor aesthetic value also recorded several counts of small-scale and commercial fishing pressure. With regard to the area being used as a dive site, both aesthetic and biological values were observed to be poor or average at all sites, with low coral cover (<10%) at a majority of locations deeper than 15m. Some of the shallower areas (<15m) had an aesthetic value of 'average' and had the highest hard coral cover (11-30%), as such the location may be more suitable for snorkelling.

6 - Conclusion and recommendations

At the present time, the coral reef within the MPA at Liloan cannot be considered to be a thriving ecosystem. While, hard coral cover and fish abundance were both higher inside the MPA than outside, both were still considered low for a healthy reef system. Although there was a significantly higher abundance of Alibangbang (butterflyfish) and Kitong (rabbitfish) inside the MPA, both of which are considered good indicators of reef health, the abundance of commercially important

species were still considered low. The majority of fish inside the MPA were in a larger size class than those outside, suggesting that the no take zone may be allowing fish to grow to a larger size; this is important as the size of the fish is usually proportional to the number of eggs produced and thus can affect abundance. However, very few fish inside the MPA were larger than 20cm, thus these benefits will be limited. Although invertebrate abundance was low, the number of *Diadema* urchins and crown-of-thorns starfish inside the MPA was higher than would be expected for a healthy reef. Anthropogenic and abiotic impacts are also affecting the health of the reef. Sedimentation, plastics and crown of thorns starfish are the most severe impacts.

The differences between inside and outside the MPA may reflect an improvement in reef health within the MPA, with the recovery process still ongoing. However, it is also important to note that the higher hard coral cover and fish numbers inside the MPA may simply be a reflection of the fact that this site was more diverse to begin with, hence its selection as a location for an MPA.

In relation to the Pong-Oy Island site, results suggest the location would be more suited to snorkelling rather than as a dive site. Hard coral cover was generally low, especially in deeper areas (>15m) and a majority of the sites were judged to have poor or average aesthetic and biological value.

Following here, a brief list of issues that the management is encouraged to consider.

The local stakeholders should identify partners able to provide support and specific training for the MPA managers. While NGO's can be of great help in the short term, the long term partnership should be with provincial and national agencies such as PENRMO and DENR. The Provincial Environment and Natural Resources Management Office in particular, being the body in charge of the MPA's management in the whole province, shall also be notified of major initiatives concerning the MPA and its management. It is our opinion that the long experience with the topic makes this office a strong ally to face the challenges of managing an MPA.

The lack of enforcement of the MPA rules is likely to be a major contributor to the poor health of the reef in the MPA. On-going fishing within the MPA will prevent the recovery of fish stocks and the increase in size of fish within the MPA. To effectively enforce the rules, a very strict warding system must be in place. This is best achieved through the use of the guardhouse and the availability of a patrol boat. Even a small number of violators can strongly affect the success of the MPA, and must therefore be discouraged. It is crucial that MPA wardens (bantay dagats/local police/coastguard) watch the area at all times and make sure there are no violations such as illegal fishing and passage inside the MPA. A full time warding system can create costs that the LGU can't afford; it's been shown in many cases that volunteer-based warding can be effective. However, the commitment of the wardens should be regularly assessed.

The first step to take, in order to discourage violators, is to have simple, understandable rules that are extensively explained to the community. Misunderstanding is a source of frustration and may undermine the support of the community. Boundaries of the protected areas, indicated by marker buoys as well as on-land references, need to be clear and explained to the community. Marker buoys, unfortunately, do incur maintenance costs and have the irritating habit of being washed away by wave action. Wherever possible, natural features shall be used as supplementary signs. In our experience, it is well worth investing an initial considerable budget to install structures that are

durable and long-lasting, rather than having to spend a fair amount of money every year to maintain a cheaper but less solid initial set up.

Another important step would be to establish a consistent monitoring scheme in order to determine whether there are any changes in hard coral cover, fish size and abundance, and invertebrate abundance over the years. This will enable managers to determine whether the reef health is improving or declining and adapt their strategy accordingly. Ideally this should be carried out at least annually by trained stakeholders and members of the local community.

Social surveys are very valuable in order to get a better picture of community awareness, appreciation and opinions about the MPA. The community must remain involved in future decisions and their voice should be heard. Without the support of the community in and around Liloan, the MPA cannot work.

The MPA at Lilo-an has great potential. The reef is resilient and improved enforcement of the MPA rules is likely to lead to recovery of coral cover and fish stocks over time.