

Introduction to Coral Cay Conservation (CCC)

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.

Barangay Bunga

The Philippines are an archipelagic nation comprised of over 7000 islands; Barangay Bunga is situated in Sogod Bay which is an important fishing area of Southern Leyte. Bunga has 740 people living within the Barangay, many of whom rely directly on the coastal resources in terms of a source of income and protein. The fishery is mixed gear; fishers predominantly use fish traps and / or handlines, the majority of fishers fish within the Barangay boundaries. Tropical nearshore fisheries are one of the most complex fisheries to manage as they involve many different species both transient pelagic species and demersal, reef associated fish that are linked to intricate and diverse habitats.

The reefs of Southern Leyte demonstrate a high faunal diversity; over 400 hermatypic coral species have been recorded and more than 7000 fish species. The Indo-Pacific region is renowned as one of the most diverse areas globally. However over 97% of the reefs are deemed at risk from a variety of natural and anthropogenic factors. Coral reefs are renowned for their intrinsic value to local coastal communities due to both high biological diversity and high rates of productivity. They also represent a crucial source of revenue and protein. Bryant estimated that 25% of the fish catch in the developing countries is provided from coral reef fisheries.

The artisanal and subsistence fisheries of Bunga are characterised by a multi species resource base and encompasses a diverse assemblage of demersal, reef associated species and pelagic species. Interviews with the Barangays fisherfolk revealed that the pelagic jack/trevally, tuna, mackerel, sardines and squid dominate the landings of the handline fisheries. Snappers, Groupers, Emperors, Parrotfish and Fusiliers are the main demersal species targeted by the mixed trap and handline industry, interestingly the trap fishery is characterised by Fusiliers. Catch rates are greatly influenced by the tropical monsoon seasons. Lowest catch rates are attributed to the SW monsoon season (July to September) and the strong converging currents of the Barangay. Highest catch rates of the target species occur during April to June - Fusiliers, Mackerel and Jack/Trevally's and June to July for Sweetlips, Emperors and Rabbitfish.

Underwater visual census (UVC) methodology

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.

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 at both 6m and 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 macro algae	Rock and block
<i>Foliose/cup</i>	Sponges	Coralline algae	Sand/Silt



A coral cay observer estimating benthic cover every 25cm along the transect line

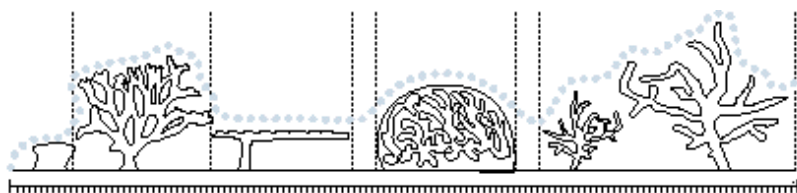


Fig. . Schematic diagram of a point intercept line laid over different coral lifeforms

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

Groupers (Epinephelinae)
Barramundi Cod (Cromileptes)
Snapper (Lutjanidae)
Sweetlips (Haemulidae)
Emperors (Lethrinidae)
Jacks / Trevally
Fusiliers
Coral Breams (spinecheeks)
(Nemipteridae)
Goatfish (Mullidae)
Triggerfish (Balistidae)
Butterfly fish (Chaetodontidae)

Wrasse (Labridae)
Humphead wrasse
Parrotfish (Scaridae)
Bumphead parrot
Surgeonfish (Acanthuridae)
Rabbitfish (Siganidae)
Rudderfish (Filefish) (Kyphosidae)

Damselfish (Pomacentridae)
Anthias (Anthiinae)
Moorish Idol (Zanclus cornutus)
Angelfish (Pomacanthidae)

families that were observed were chosen on the basis that they are (a) good indicator species for reef health or (b) Commercially important fish for sale or consumption, this would clearly indicate if the area was being over fished as the fish population numbers would be low or that the fish populations were recovering if the fish populations were steadily increasing. The following families were counted during the surveys:

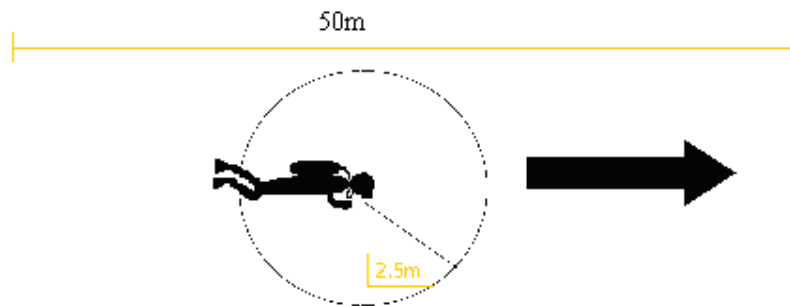


Fig. Fish visual survey method used to estimate fish abundance along the 50m line. The diver notes down any target fish seen 2.5m on their side of the line and also 5m above the survey area. The observer on the other side of the line does the same.

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 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.

Socio-economic interviews with fisherfolk of Bunga

The 1992 UN conference on Environment and Development has helped to stimulate an already burgeoning interest in the importance of indigenous knowledge and its contribution towards a better understanding of sustainable development of natural resources (ref12). Indigenous knowledge is dynamic and is the culmination of years of experience; either personal and/or passed down through generations, new knowledge as a result of changes to habitats are also continuously added. It is a key element of the social capital of the people of developing countries; communities can use such knowledge at a local level as a basis for decision making pertaining to natural resource management (ref13). Incorporating fishers' knowledge into fishery management makes management more equitable by giving those people who have the most at stake in management decisions a greater say in those decisions. Community understanding and support is a crucial element of effective fisheries management.

Face to face interviews were conducted using a semi-structured questionnaire with both licensed and non-licensed fisherfolk of Barangay Bunga. The semi-structured questionnaire was comprised of both closed, dichotomous questions and open-ended questions. An informal approach was adopted. The questionnaire was trailed in a pilot study and adjusted accordingly. The interviews were carried out with the assistance of an interviewer and there were no more than two respondents at a time so as to reduce the chances of influencing answers. The questionnaires were structured in such a way as to determine the fishers' perception of their fishery and possible causes of noted changes. A simple map of the Barangay was used to enable the fisherfolk to illustrate the spatial distribution of their fishing grounds. Pictures of target species were also utilised to ensure the identification of target fish families and limit confusion between English and local names. The informal interviews explored individuals' knowledge of MPA's, attitudes towards them and perceptions of their fishery and areas of managerial concern.

The primary aim of the fisherfolk interviews was to gain insight to the state of the inshore reef fisheries of Bunga, Padre Burgos, So. Leyte through stakeholder (fisherfolk) participation. The following objectives aim to address the main issues: 1) To determine fishers knowledge and understanding of Marine Protected Areas (MPA's). 2) To elucidate fishers perception of trends in their fishery over a period of ten years. 3) To establish if and when a change in target species was noticed. 4) To determine if fishers gears and or sites have changed in response to a perceived change in their fishery. 5) To determine the fishers' perceptions of managerial changes required – if any. The answers will be used to highlight the importance of stakeholder knowledge/perception so that policies can reflect local characteristics and thus account for local's priorities and needs.

A comparative analysis of catch composition was conducted on CCC underwater visual census data and the fisherfolks stated catch composition. Unfortunately there is no underwater data available for 5 & 10 yrs ago time frames as covered in the interviews. Fishers perceived changes of their fishery shall be explored.

Results

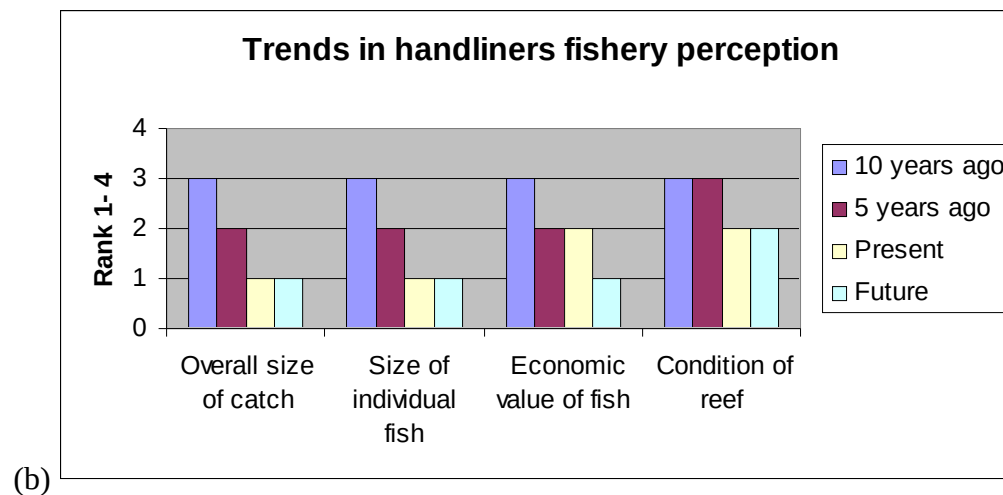
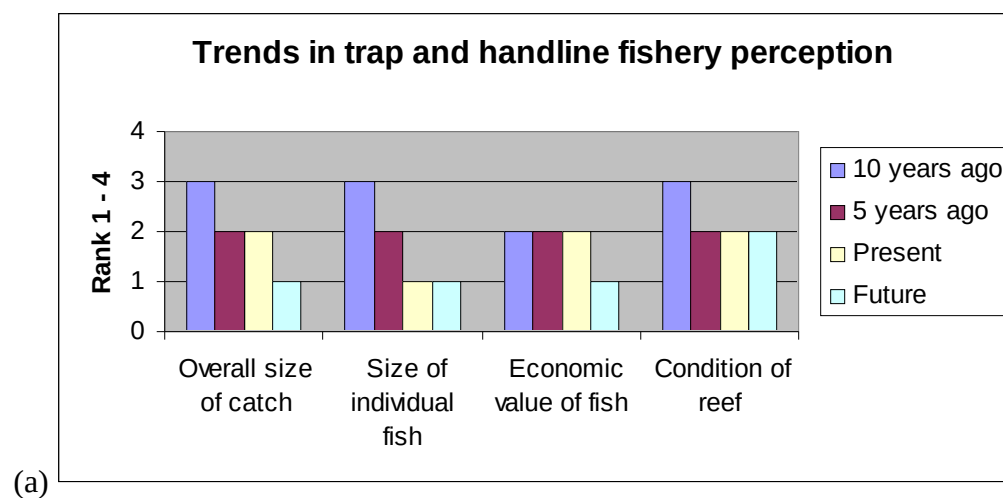
What follows is a summary of the most important findings from the belt transect (fish abundance estimates), point intercept (benthic cover as a percentage) and general reef health and abiotic (non-living) factors. Results from the interviews are also discussed with reference to the UVC data where relevant.

A total of 26 interviews were carried out with artisanal and subsistence fishers of Barangay Bunga. The respondents were comprised of 14 handliners (pasol) and 12

mixed gears fishers of both trap and handliners (bobo and pasol). As some questions were open ended, multiple responses were gained, therefore the data was transformed into percentages of the frequency for each response given, thus many do not add up to 100%.

Fishers perceptions of fisheries trends

Fishers were asked to rank the overall size of their catch, size of individual fish caught, economic value of catch and the condition of the reef on a scale of one to four, where 1 is poor and 4 is very good. This was applied over a time frame of: 10 years ago, 5 years ago, present and their predictions for the future. The overall trends in the fishers perceptions are illustrated in figure...



Graphs illustrate fishers perceived trends of the fishery over a 10 yr time frame for (a) mixed gear-trap and handline fishers and (b) handline fishers. Respondents were asked to rank each criterion on a scale of 1 to 4, where 1 is poor, 2 medium, 3 good and 4 is very good.

Both the mixed trap and handline fishery and the handline fishery show trends of decline in all four categories. The trap fishers rank the condition of the reef as lower 5 yrs before the handliners, one could speculate that this is because trap fishers are more aware of the condition of the reef than handliners as they target demersal species associated with the reefs, trap fishers also set their traps on and adjacent to the reef. It is also noteworthy that despite a decrease to both overall size of catch and size of individual fish there was little change to economic value of catch. This may have masked the decline in the fishery, as even though the quality of the catch has deteriorated significantly, the value of the catch remained unchanged. 10 yrs ago the

economic value of catch of the was ranked as 3 (good) yet 5 yrs ago it was ranked as 2 (medium) this decline could be linked to illegal commercial longliners fishing within the bay, the handliners suggest that their catch in Tuna, Jacks/Trevally's declined dramatically since the increased incidence of superlights.

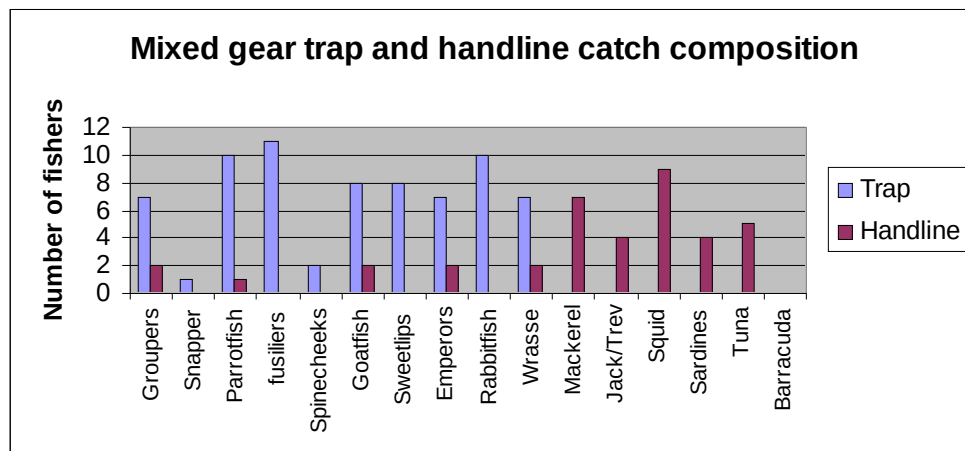
Causes of change to fishery

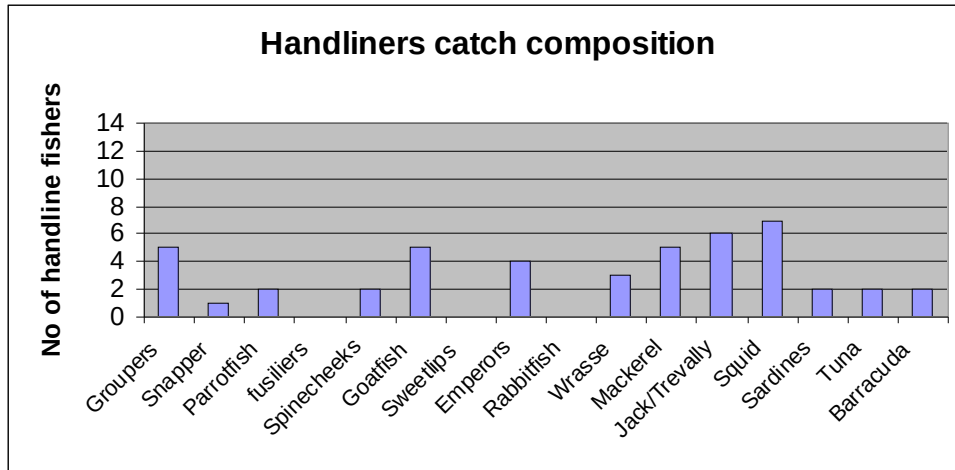
Causes of decreased quality in fishing	% of respondents
Commercial fishers	19
Other illegal fishers (hookah, cyanide)	11.5
Decreasing number of fish	35
Smaller fish	27
Corals not as healthy	8
Divers scare away the fish	8
Storms	3.8
Siltation	3.8

92% of respondents stated that there had been a change in the quality of fishing grounds in the last 10yrs. On being asked how it had changed 35% of respondents stated that the greatest change to quality of fishing is the overall decline in fish stocks. This can in part be attributed to the incidence of illegal fishers, both commercial superlights (19%) which would directly affect the handliners as they target transient pelagic species (tuna in particular) and on a smaller local scale compressor (hookah) 19% and cyanide fishers 11.5%. Only 8% of respondents attributed the decline in fish stocks to a decline in overall coral health. (See UVS damage data). In 1982 and 1984 there were large typhoons which caused significant damage to the reefs. None of the respondents attributed the decline in stocks to over-fishing.

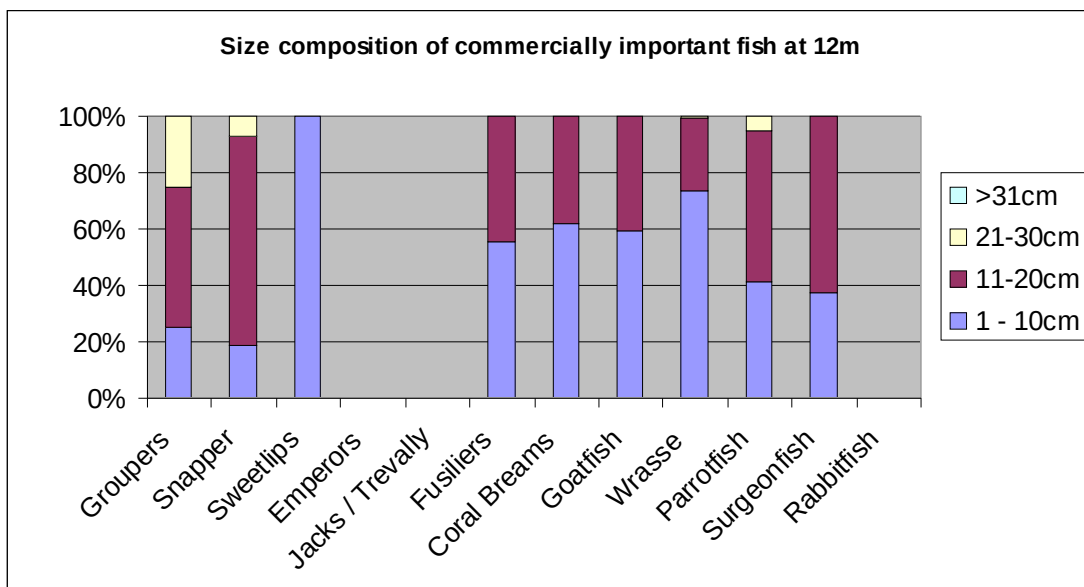
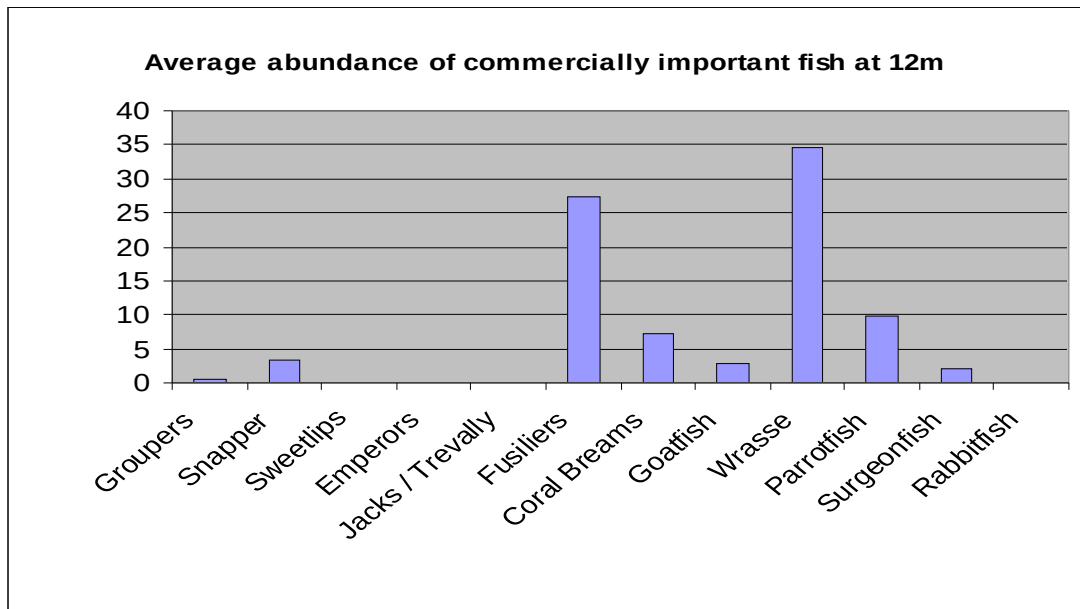
Change in catch composition?

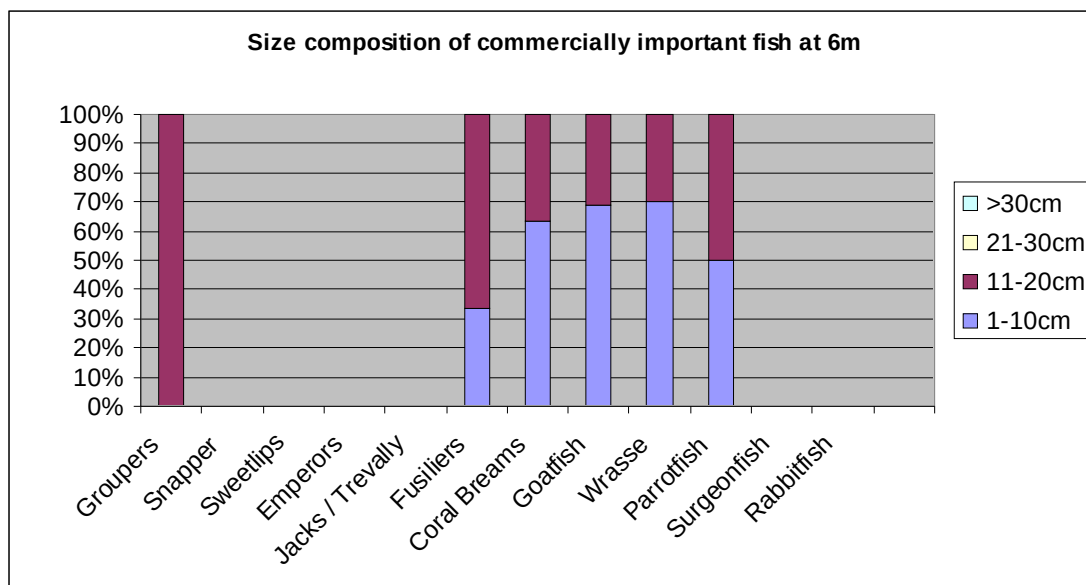
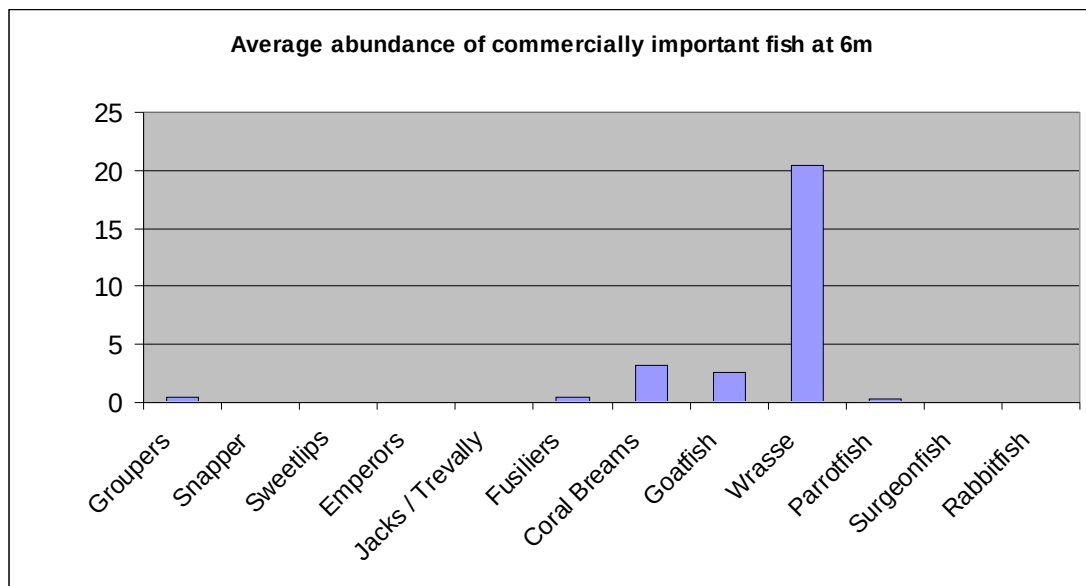
68% of respondents agree that there has been a change in species caught. 32% disagree and state that there is no change.





Underwater visual census data – fish abundance and size composition of commercially important species.





Which species have reduced in abundance the most?

All respondents agreed that all target species had significantly reduced in both *size* and *abundance*. The handliners state that the transient pelagic species such as Tuna, Jacks and Trevally's and Mackerel have decreased. The mixed gears fishers state that

reef associated demersal species such as Snappers and Parrotfish have declined the most. The UVC data supports this, no Snappers were seen on the 6m surveys and only 4 on the 12m survey the majority of which fall into the two smaller size categories. However, this could be attributed to depth at which the surveys were conducted; Snappers are known to live at depths far exceeding 12m. Anecdotal evidence from divers (pers. coms) suggests that once abundant Snappers have declined greatly.

It is significant to note that the size compositions of the commercially important species as seen on the UVC tend towards the lower size classes, thus confirming the fishers statements. The majority of species are capable of growing in excess of 30cm (the highest size group assigned for the surveys) in particular Groupers whose max lengths depending on the species range from 30-70+cm, Snappers (30-50+cm) and Sweetlips (50-70+cm) these species characterise the inshore trap fisheries. It is therefore possible to surmise that the species recorded were in general in juvenile and intermediate stages. The absence of such mature adults can be indicative of over-fishing/ high fishing pressure. This is important as juvenile fish place all their energy into growth, once mature their energy goes into reproduction. If the juvenile fish are being caught, they are being removed long before they have reached their reproductive potential. A 12 kg Snapper can have as many as 212 juveniles; a 1 kg Snapper can produce 10 juvenile Snappers. (Bohnsack ref). None of the handliners target species were seen on the surveys. This is attributable to our survey depths of 6 and 12m on the coral reef. Such transient species despite having an element of reef specificity are not as closely associated with the reefs.

When was a change in quality of fishing noticed?

Table... Respondents perceived number of since change in fishing grounds noticed

No. of years	% of respondents
>10 yrs	31
10 yrs	31
5 - 10 yrs	8
< 5 yrs	19
Don't know	11

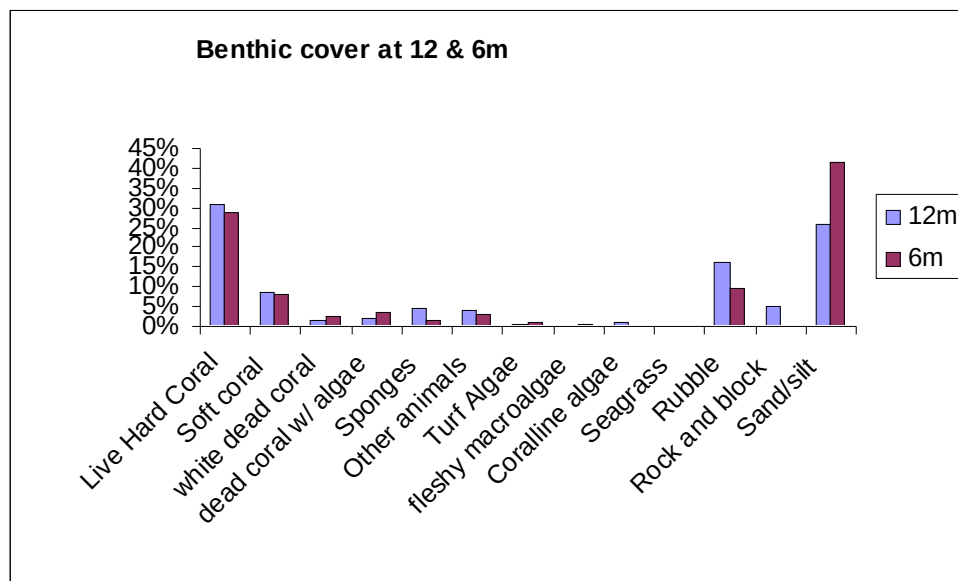
In 1992 the fishery sectoral program banned the use of hookah, cyanide (poisons) and nets. Only two respondents commented upon this and stated that since then there was a noticeable improvement to coral reef health. All other respondents state that the quality of fishing grounds have deteriorated and that illegal fishing persists.

Benthic cover: corals hard and soft, sponges, invertebrates, sand, rubble and bedrock

Coral Life-forms	Depth	
	12m	6m
Branching	11.8	17.2
Massive	7.6	8.8
Flat/Encrusting	10.1	2.4
Foliose/Cup	1.6	0.4

Hard coral life forms illustrate the main coral growth forms and are important to consider as they in turn allow a rough estimate of the age and thus the health of the reef. Branching and to some extent foliose and cup life forms are the fastest growing

and youngest corals whereas massive and encrusting corals are slow growing and usually much older. A healthy reef should have all such life forms present, in terms of a conservation management value a reef that has a high percentage of massive and encrusting corals is desirable as a more mature reef is considered to offer fish a better quality of habitat as its structure is more complex therefore overall rugosity is higher, they are also in general more robust and well adapted to it's environment and therefore are more resilient to a variety of stress factors including wave intensity and bleaching. The UVC data has a higher incidence of the faster growing corals but also illustrates comparatively fair amounts of massive structures at both depths. It is important to remember that the reefs are patchy and discontinuous, this is illustrated by the benthic cover chart below. Live hard coral coverage is approximately 30% for both depths but we can see that there is a lot of sand present 40+% particularly at a depth of 6m.



It is encouraging that there is only a small amount of both white dead coral – (indicative of newly dead coral) and dead coral with algae which is old dead coral that has since been colonised by algae. Overall diversity and abundance of soft corals, sponges and invertebrates are low. Live hard coral cover and sand/silt are the dominant benthic assemblages. There are no seagrasses or mangroves present within

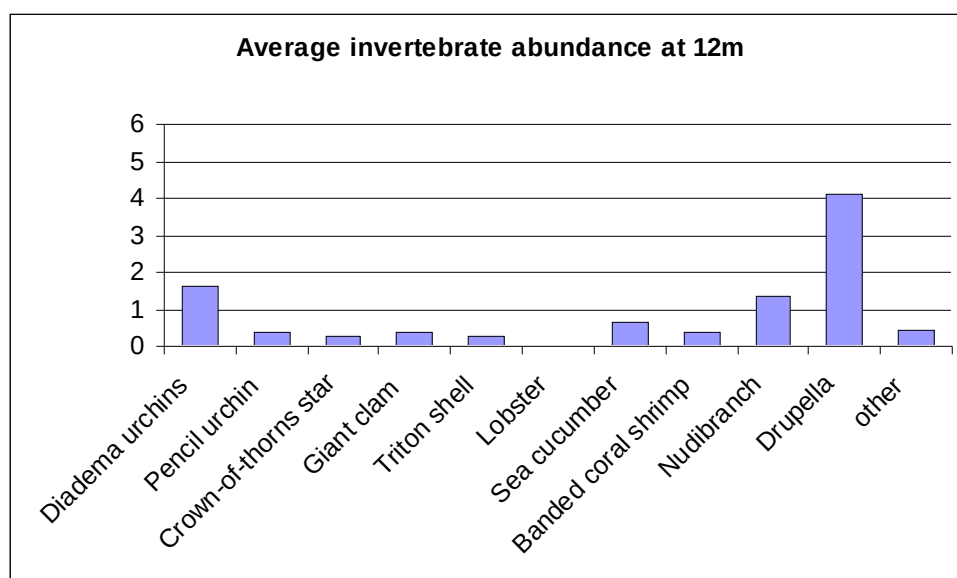
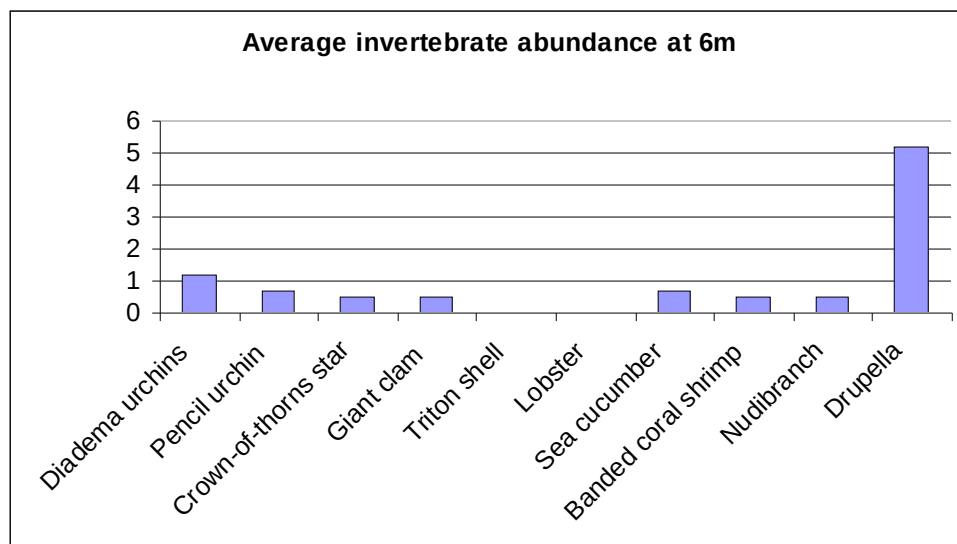
Causes of coral damage	Depth	
	12m	6m
Sediment	50.0%	16.7%
Blasting patterns	0.0%	0.0%
anchor damage	12.5%	0.0%
other breakage	62.5%	33.3%
bleaching	25.0%	0.0%
black band disease	0.0%	0.0%
white band disease	0.0%	0.0%
other coral disease	12.5%	16.7%
seaweed overgrowth	0.0%	0.0%
coral-eating snails	50.0%	66.7%
crown-of-thorns starfish	25.0%	50.0%
plastics	25.0%	33.3%
other trash	50.0%	50.0%
other causes	0.0%	0.0%

the Barangay. The presence of rubble is indicative of damage and may be through natural processes such as large waves or human impacts.

Anthropogenic impacts

There are several causes of coral damage that are directly attributable to human impacts. The elevated incidence of rubble in the benthic cover category can in part be due to anchor damage, however 62.5% was categorised as other breakage. From both underwater observations and interviews with the fisherfolk some

fish traps are set onto the corals themselves. In some cases tabulate corals have been broken off and set on top of the trap. Corals have also been broken by the traps being dragged up the reef and onto shore as opposed to lifted directly up to the boat. Sedimentation is also a concern as many corals were covered with a layer of silt, when corals are smothered it becomes difficult for them to feed as time and energy is put into removing the sediment. Over time these corals may die. Sedimentation could be from fluvial run off. Trash including other plastics is also an issue that requires immediate attention. Plastics can cover the corals stopping it from feeding and photosynthesising, again if for a prolonged period the corals will die. Turtles often mistake plastic bags for jelly fish which they feed on; when they consume trash they choke and may die. Proper disposal of trash is an integral part of coastal zone management plans. The presence of crown of thorn sea stars and coral eating snails on the reef is in fact normal, although these invertebrates are usually associated as having a deleterious effect on the reef. There were not any abnormal counts of these invertebrates when considered per hectare. Little is known about what factors trigger population blooms.



Management issues:

Who is responsible for managing and protecting reefs?

The overwhelming response was one of accountability lying with the community itself (61.5%). This includes the Barangay Captains (23%), Fisherfolk (15%),

Barangay Tanod and Bantay Dagat (27%) with assistance from the Provincial government including Dept. of Environment and Natural Resources.

How to improve the fishery?

Action	% of respondents
Enforce banning of illegal fishers	42
Establish an MPA	19
Don't know	31
Stop Bobo fishery	4
Payao ordinance	4

Illegal commercial fishing continues to be a persistent problem within Sogod Bay. The handliners have been affected by this the most and state that catch rates of Tuna have declined. When asked if there would be enough fish for the future, 77% stated that there would but stipulated only if illegal fishers were stopped. Only one respondent answered that there would only be enough fish if people stopped over fishing.

Fishers understanding of term Marine Protected Area (MPA)?

What understood by term MPA?	% of respondents
An area that is not disturbed	8
Area where fish are not disturbed	19
Fish <i>and</i> corals not disturbed	8
Place for fish to spawn and grow	31
No fishing allowed	19
Stops illegal fishing	15

Fishers were asked what they understood by the term Marine Protected Area (MPA)/ Sanctuary. Overall 35% agreed that it was a discrete area that wasn't disturbed by man. It is interesting to note that only 22% of those respondents stated that the corals were not disturbed and were left to grow, the main perception of MPA's is one of prohibiting fishing rather than habitat protection. No respondents commented on the relationship between reef health and fish abundance. It is also noteworthy that 31% of fishers stated that an MPA is an area where fish can spawn and grow. However, on being asked if they knew of target species spawning aggregations, none were able to identify such locations. Further questioning also revealed that 100% of fishers believed that target species spawning grounds should be incorporated into MPA's.

Support for MPA in Barangay Bunga

100% of respondents stated that MPA's are effective in managing fish stocks and also agreed that each Barangay should have their own MPA. 96% of fishers interviewed support the establishment of an MPA within Barangay Bunga.

Placement of MPA

Where to place MPA?	% of respondents
Mid Bunga to San Juan	27
Mid Bunga to Sta. Rosario	35
Mid Bunga	8
Anywhere	19
Don't know	11

Size of MPA

Size of MPA?	% of respondents
1-2 hectares	31
3-4 hectares	8
4-6 hectares	11
1/4 hectare	4
Up to council	4
Don't know	42

Conclusions and management recommendations

SPAGS