



Report on the activities of Coral Cay
Conservation in Southern Leyte,
Philippines during 2013:
Scientific and Community Work

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In partnership with:



The Provincial Government of Southern Leyte

With thanks to:



The Municipal Government of San Francisco

thewaterloofoundation*

The Waterloo Foundation

Executive Summary

- CCC have been operating the Southern Leyte Coral Reef Conservation Project (SLCRCP) in partnership with the Provincial Government of Southern Leyte (PGSL) and the Philippines Reef and Rainforest Conservation Foundation Inc (PRRCFI) since 2002.
- The project, currently based in Napantao, San Francisco, has three main objectives: 1) scientific data collection; 2) local capacity building; and 3) education and awareness raising.
- In general, 2013 was a successful year for the SLCRCP, although operations were temporarily halted during November and December due to Typhoon Yolanda.
- Key activities and events in 2013 included the following:
 - Introduced a new survey methodology, moving away from resource appraisal of Sogod Bay and towards ecological assessment of Marine Protected Areas (MPAs).
 - Conducted three full MPA assessments, one proposed MPA assessment and two crown of thorns seastar assessments in the municipalities of San Francisco and Limasawa.
 - Initiated an MPA assessment in Tabugon, Liloan and a proposed MPA assessment in Molopolo, Liloan.
 - Provided training to ten Filipino Scholars.
 - Developed modular training options for Southern Leyteños in full-time employment.
 - Provided training and capacity building workshops to over 900 individuals from Southern Leyte.
 - Developed a teacher training module for marine science in collaboration with Ocean Action Resource Center and delivered a pilot programme to teachers from Southern Leyte.
 - Developed a training scheme for Bantay Dagats in Southern Leyte.
 - Taught environmental lessons in 41 schools in the municipalities on San Francisco, Liloan, Pintuyan and Limasawa.
 - Developed the Seastars Environmental Award Scheme (SEAS) for local schools and began delivery in two schools in Liloan.
 - Developed and delivered seven community awareness days and five Reef Rangers programmes for local students.

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Servando Tio Jr., SB Secretary of San Francisco

The Barangay Captain and Barangay Council of Napantao

The members of the Napantao Fish Sanctuary Steering Committee

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Coral Cay Conservation

Founded in 1986, CCC is dedicated to:

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

CCC works in collaboration with government and non-governmental organisations within a host country and does not charge that country for the services provided (Figure 1). CCC is primarily self-financed through an innovative volunteer participatory scheme whereby international volunteers are given the opportunity to join a phase of each project in return for a financial contribution towards the project costs. Upon arrival at a project site, volunteers undergo a training programme in marine life identification and underwater survey techniques, under the guidance of qualified marine scientists, prior to assisting in the acquisition of data. Finances generated from the volunteer programme allow CCC to provide a range of services, including data acquisition, assimilation and synthesis, conservation education, technical skills training and other capacity building programmes.

CCC has been successfully operating volunteer based conservation programmes in developing countries over the past 26 years with several internationally notable accomplishments, including the establishment of several Marine Protected Areas around the world. Examples of CCC action include the creation of the UNESCO World Heritage Site in Belize, the Danjungan Marine Reserve and Wildlife Sanctuary for Negros in the Philippines, and the development of several no-take marine parks around Sogod Bay in the Philippines.

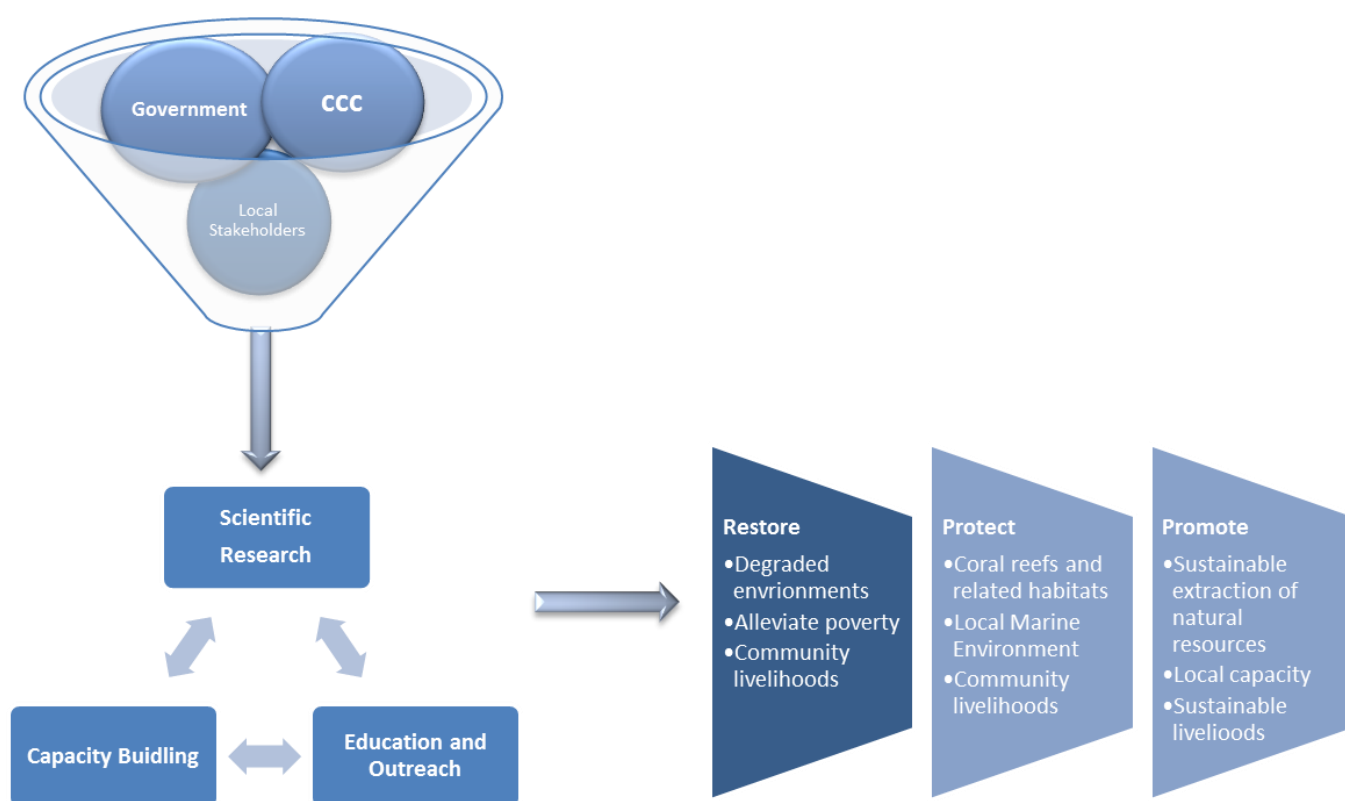


Figure 1 – Flow process diagram of CCC's implementation strategy

1. Introduction

1.1. Coral Reefs of the Philippines

Located at the heart of the 'coral triangle' the Philippines is renowned for its highly biodiverse marine ecosystems. Home to over 450 species of hard corals, representing around half of total global reef building coral diversity (Tun *et al*, 2004), and more than 2,500 species of fish (Lieske and Myers, 2001) the Philippines represents a key global hotspot for marine diversity.

Although many cities in South East Asia are developing very rapidly, most people in the Philippines remain highly dependent on coastal resources for their livelihoods, inducing pressure on the marine environment (Wilkinson, 2008). Coral reefs provide livelihoods for coastal communities through fishing, aquaculture and tourism. Reef fish are the primary source of protein for most Filipinos, whilst many invertebrates such as giant clams (*Tridacna* spp.) and sea cucumbers (Holothurians) are also commercially harvested, fetching high market prices. Coastal tourism and diving tourism in particular can provide alternative means of income for coastal communities as long as the industry is managed sustainably, in terms of the environmental effects of development and the local communities are in favour of it.

The majority of the population of the Philippines is concentrated along the coastline putting intense pressure on the marine resources through a range of impacts. The greatest anthropogenic impacts are caused by solid and liquid pollution, overfishing, habitat degradation and elevated sedimentation levels. These impacts, when coupled with the current global increase in temperatures, induce a severe threat to the survival of coral reefs (Wilkinson, 2008). Almost all of the reefs in the Philippines are threatened by local activities, with two thirds rated at high or very high risk. Overfishing and destructive fishing threaten 98% of reefs in the Philippines, while coastal development threatens nearly 60% and watershed pollution also threatens 60% (Burke *et al*, 2012).

1.2. Coral Reefs in Southern Leyte

Southern Leyte, one of the six provinces of the Eastern Visayas (Figure 2) is bounded in the north by Leyte province, in the south by the Mindanao Sea, in the east by the Pacific Ocean and in the west by the Canigao Channel. Sogod Bay (10° 12' N, 125° 12' E) is surrounded by 131.67 km of coastline and is shared by 11 municipalities: Padre Burgos, Malitbog, Tomas Oppus, Bontoc, Sogod, Libagon, Liloan, San Francisco, Limasawa, Pintuyan, and San Ricardo.

Sogod Bay is an important fishing ground and the area is rich in tuna, flying fish, herrings, anchovies, shell-fish and spanish mackerel. It is also a feeding ground for attractive mega-fauna such as pilot whales, melon-headed whales, dolphins, manta rays and whale sharks. The bay is characterised by naturally limited mangrove areas, narrow fringing coral reefs, limited seagrass beds and narrow intertidal areas and beaches (Calumpong *et al*., 1994). While the reefs of Sogod Bay are, in many places, in exceptionally good condition, they do face a number of anthropological threats. Signs of overfishing are widespread, with commercially important species such as parrotfish (mulmul),

groupers (lapu lapu), snappers (maya maya) and sweetlips (lipti) present in low numbers throughout the bay (Longhurst *et al*, 2013).

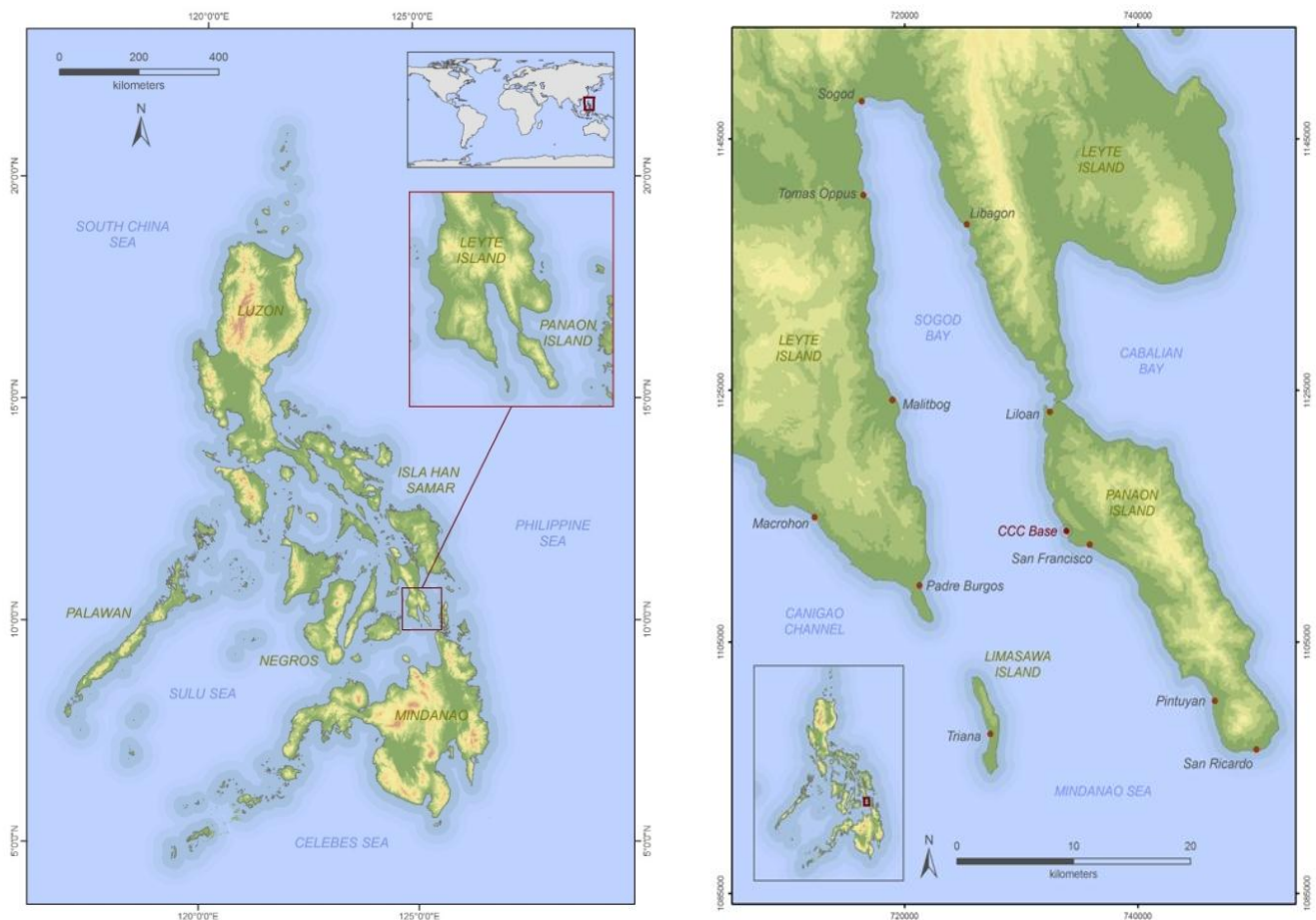


Figure 2 – Map of the Philippines (left) and Southern Leyte Province (right) with Sogod Bay at the centre. The CCC project site is located in the Municipality of San Francisco on the south-eastern side of the bay

1.3. The Southern Leyte Coral Reef Conservation Project

In 2002 Coral Cay Conservation, in partnership with the Philippines Reef and Rainforest Conservation Inc. (PRRCFI) and the Provincial Government of Southern Leyte (PGSL), established the Southern Leyte Coral Reef Conservation Project (SLCRCP). The project has three main objectives:

1. To conduct scientific assessments of the coral reefs and associated marine habitats in Sogod Bay in order to produce habitat maps and support the sustainable management of marine resources.
2. To build capacity within government bodies, local organisations and the communities of Southern Leyte to enact sustainable management of marine resources through training schemes.
3. To raise awareness of marine conservation issues within the population of Southern Leyte through community engagement and educational programmes.

Between 2002 and 2012 scientific surveys focused on mapping and evaluating the overall status of the reefs in Sogod Bay, with the ultimate goal of identifying key areas of biodiversity for protection. During this time, Marine Protected Areas (MPAs) were established throughout Sogod Bay, many with the assistance of CCC. As this occurred, demand increased for ecological monitoring activities within MPAs, to enable successful adaptive management. In 2013 a summary of baseline survey data was produced (Longhurst *et al*, 2013) and the decision was taken, in collaboration with project partners at the PGSL, to refocus survey work predominantly on MPA monitoring. Alongside this monitoring work, it was agreed that CCC would, when requested, assess specific sites proposed as MPAs.

This report presents the work of CCC in Southern Leyte throughout 2013. It provides a summary of scientific research, capacity building and education work conducted during the year. In general 2013 has been an extremely successful year for the SLCRCP, with the effective introduction of a new survey methodology and the completion of three comprehensive MPA assessments, one proposed MPA assessment and two crown of thorns seastar assessments. Additionally educational and capacity building work has been conducted with individuals and communities throughout the province. With survey work ongoing and plans for further community work, CCC had hoped to finish 2013 on a high note. However, the unexpected and unprecedented passage of Typhoon Yolanda through Southern Leyte in November 2013 put a halt to all project related activities. Eager not to put a strain on now limited resources and obliged to ensure the safety of international volunteers, CCC closed down project operations following Typhoon Yolanda. Reopening in January 2014, we hope that the SLCRCP will be able to continue to support the sustainable use of coral reef resources, especially considering the pressures that will be put on food resources in the coming months.

2. Scientific Research

In 2013 CCC adopted a new survey methodology, marking a permanent shift in the structure and purpose of CCC's research programme. With several MPAs now established throughout Southern Leyte, ensuring the effective management of these areas is a top priority for marine conservation. Effective management of MPAs requires continuous feedback to achieve objectives and ecological monitoring is a key element in this on-going process (Pomeroy *et al*, 2004). By providing ecological data, comprehensive MPA surveys allow resource managers to assess progress towards goals and targets and to make informed management decisions.

2.1. MPA Survey Methodology

MPA assessments are conducted using an enhanced Reef Check method. The Reef Check methodology is widely recognised and is used to survey coral reefs around the world. It was developed in the 1990s with the aim of gathering as much data as possible about the global status of coral reefs (Hodgson, 1999). The data from around the world is analysed on a yearly basis and updates about the status of coral reefs are published. Reef Check provides a general picture of the ecological status of a reef and the human impacts affecting it. CCC has augmented the methodology by adding additional target species of fish, coral and other invertebrates to better reflect the high biodiversity of the area (see Appendix A for target species).

Survey transects are conducted at depths of 6 metres and 12 metres where topography allows, both inside and outside the MPA (Figure 3). The total number of transects assessed depends on the size of the MPA, with a minimum of three inside and three outside. Each transect is 100 metres long and divided into 4 replicates of 20 metres each. Between each replicate there is a 5 metre gap where no data is recorded. This survey set up allows for robust statistical analysis of the collected data.

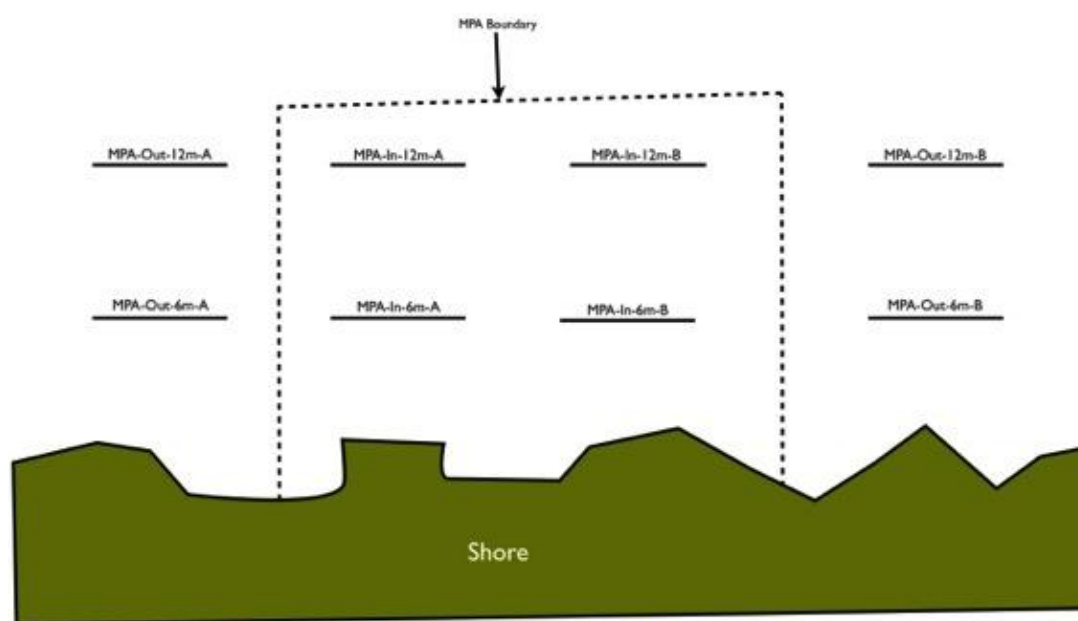


Figure 3 – Survey plan of the MPA assessment. Each transect is 100 meters long and is divided into 4 replicates.

2.1.1. Fish

Fish diversity and abundance data is collected using Underwater Visual Census. Selected fish families and species recognized as being good indicators of fishing pressure, aquarium collection and reef health are recorded. Three families of commercially important fish are also recorded by size: Groupers (Lapu Lapu, Serranidae), Parrotfish (Mulmul, Scaridae) and Snappers (Maya Maya, Lutjanidae).

Fish data is recorded along a 'belt' transect, where fish are counted within an imaginary 5x5x5m box along the four 20m replicates (Figure 4). Surveying is carried out by two divers swimming slowly side by side along the transect and counting the indicator fish. The divers stop every 5 metres and wait 1 minute for the indicator fish to come out of hiding before proceeding to the next 5 metre stop-point.

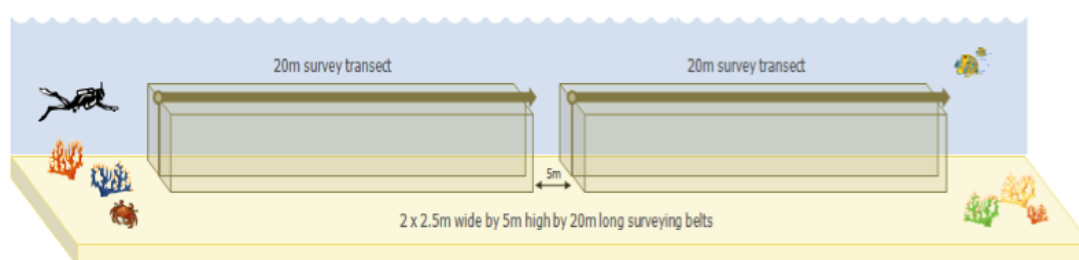


Figure 4 - Survey method for recording fish. The diagram shows 2 of the 4 replicates in a 100m transect.

2.1.2. Invertebrates

The same areas used for the fish belt transect are used to record the diversity and abundance of selected invertebrate species typically targeted as food species, collected as curios or important to the ecological balance of the reef. The divers record invertebrates 2.5m either side of the transect line (Figure 5). Divers look in holes and under overhangs to look for organisms such as lobsters, sea urchins or other cryptic species.

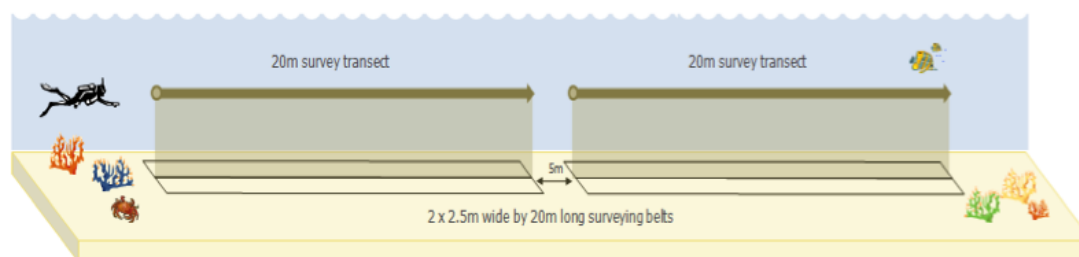


Figure 5 - Survey method for recording invertebrates. The diagram shows 2 of the 4 replicates in a 100m transect.

2.1.3. Substrate

Benthic diversity is measured by recording living and non-living benthic categories along a point intercept transect. Along the transect line, benthic organisms and substrate types are recorded at

50cm intervals (Figure 6). To minimize bias, a plumb line is dropped at each designated 50cm point and the substrate type underneath is recorded. Every replicate contains 40 benthic points.

Benthic categories are: sand, rock, rubble, silt/mud, nutrient indicator algae, sponge, recently killed coral, soft coral, hard coral and any other biotic lifeforms. Hard corals are further classified by lifeform and certain targets are also noted to genus or species level (see Appendix A).

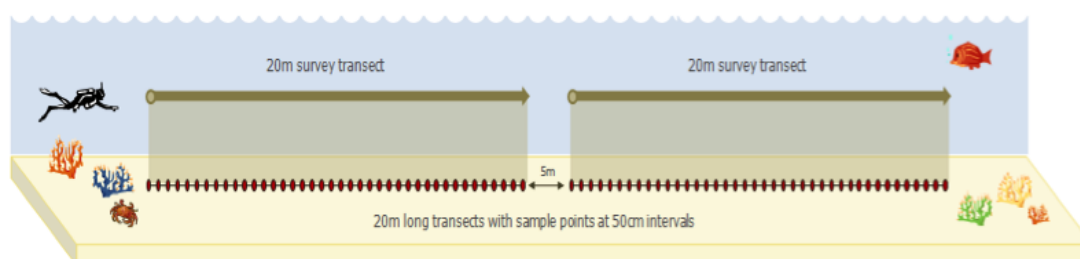


Figure 6 - Survey method for recording substrate data. The diagram shows 2 of the 4 replicates in a 100m transect.

2.1.4. Impacts

Within the same area assessed for invertebrates divers record a number of impacts on the reef. They estimate the total percentage of the coral population effected by bleaching, as well as the estimated percentage of each individual coral colony that is bleached. Coral diseases are recorded as a percentage of the population infected and where possible, the disease is identified. Damage is recorded in three categories: 'boat/anchor', 'dynamite' and 'other', on a categorical scale from 0 to 3 (0 = none, 1 = low, 2 = medium, 3 = high). Impact on the site from trash is recorded on the same scale and separated into 'general' and 'fishing nets/traps'.

2.1.5. Data Analysis

Each 20m belt transect is treated as an independent replicate. This produces a minimum of $n=12$ inside the MPA and $n=12$ outside the MPA. To test for statistically significant differences between inside and outside the MPA, Mann-Whitney U tests are used. Species diversity of fish and invertebrates is calculated using the Fishers α index. These index values too are then submitted to the Mann-Whitney U test to check for significant differences.

2.1.6. Visual Assessment

Where possible, survey teams conduct a visual assessment of the area to produce a map of reef habitats, as well as a photographic record of the area surveyed and the species encountered. Visual assessment is presented in survey reports to enable resource managers and users to visualise the reef that has been assessed. Photographs are available for MPA promotion and publicity on request from CCC.

2.2. Surveys Conducted in 2013

In 2013, CCC conducted three full MPA assessment surveys and one proposed MPA assessment. Teams were on track to complete one further MPA assessment and one further proposed MPA assessment by the end of the year but unfortunately these surveys were put on hold when the project was shut down. In addition to full MPA assessments, CCC also conducted two crown of thorns seastar (*Acanthaster planci*) assessments, to evaluate the population levels of these potentially destructive species within MPAs. Summaries of all of these assessments are presented below and in Appendix B. Further information is available in the full reports which can be found on our website: www.coralcay.org or through CCC's Science Department: science@coralcay.org.

2.2.1. MPA Assessment at Sana Paz Sur, San Francisco

Surveys were conducted in the MPA at Santa Paz Sur, also known as Anna's Garden, between January and March 2013. Key findings of the surveys were as follows:

- Overall, fish abundance was not significantly higher inside the MPA and at 12m more fish were recorded outside the MPA.
- Target invertebrate species were significantly more abundant inside the MPA.
- Generally, crown of thorns seastars were observed in low numbers, though a high concentration was found outside the MPA at a depth of 6m.
- Hard coral was more abundant outside the MPA and sand was more abundant inside the MPA.
- Commercially important species such as groupers (lapu lapu), sweetlips (lipti), giant clams, Triton's trumpet shells and sea cucumber species, were observed in low numbers or were entirely absent.
- Damaging impacts such as household trash, discarded fishing gear and anchor damage were observed in very low frequency or not observed at all.
- Low abundances of commercially important species both inside and outside the MPA is indicative of unsustainable fishing pressure and poaching inside the MPA.



Coral reef inside the MPA at Santa Paz Sur

Based on the findings of the surveys, CCC made the following recommendations:

- The MPA management committee should seek to increase enforcement of the MPA rules, which can be supported by the following actions:
 - Ensure Bantay Dagats are present at all times;
 - Provide training to Bantay Dagats;
 - Construct a guard house;
 - Provide Bantay Dagat equipment such as flashlights, megaphones and a patrol boat;
 - Prosecute violators;
 - Conduct an information, education and communication campaign to raise awareness of the importance of the MPA and its rules within the local community.
- The management of the MPA should be assessed using the MPA Management Effectiveness Assessment Tool (MPA MEAT) to determine successes and highlight areas for improvement (Philippines CTI NCC, 2011).

2.2.2. MPA Assessment at San Agustin-Lugsongan, Limasawa

Surveys were conducted in the MPA at San Agustin-Lugsongan between March and April 2013. Key findings of the surveys were as follows:



- Overall fish abundance was not higher inside the MPA though butterflyfish (alibangbang) were significantly more abundant inside the MPA.
- Overall abundance of invertebrates was not significantly different between inside and outside the MPA.
- Crown of thorns seastars were observed in low numbers across the entire survey area.
- Hard coral was significantly more abundant inside the MPA and sand and rubble were more abundant outside.
- Commercially important species, such as groupers (lapu lapu), sweetlips (lipti), giant clams and Triton's trumpet shells, were observed in low abundances or were entirely absent. Non-target Sea Cucumbers were more abundant outside the MPA although commercially important species were wholly absent from the survey area.
- Damaging impacts such as discarded fishing gear and anchor damage were observed in very low frequency or not observed at all. Household trash was observed at a relatively high level on a number of transects outside the MPA.
- Low abundances of commercially important species, both inside and outside the MPA, is indicative of unsustainable fishing pressure and poaching inside the MPA.

Based on the findings of the surveys, CCC made the following recommendations:

- Increase enforcement and acceptance of the MPA through education and if necessary punishment for breaking the rules.
- Provide a guard house and equipment for Bantay Dagats and have them present at all times.
- Deploy MPA demarcation buoys and signage to clearly define the MPA boundaries and deter illegal fishing.
- Consider ways to improve trash disposal on land to prevent it entering the marine environment. This may include more waste and recycling bins.
- The management of the MPA should be assessed using the MPA MEAT to determine successes and highlight areas for improvement (Philippines CTI NCC, 2011).

2.2.3. MPA Assessment at Napantao, San Francisco

Surveys were conducted in the MPA at Napantao in April 2013. Key findings of the surveys were as follows:

- Overall fish abundance was not significantly higher inside the MPA than outside, though grouper species were significantly more abundant inside the MPA.
- Average size of groupers (lapu lapu) recorded was higher inside the MPA than outside the MPA.
- Total invertebrate abundance was not significantly different between inside and outside the MPA.
- *Drupella* sp. were observed in significantly higher abundance inside the MPA than outside.
- Percentage hard coral cover was significantly higher inside the MPA, though hard coral was the most abundant substrate both inside and outside the MPA, with rock also common inside and sand common outside.
- Commercially important species, such as groupers (lapu lapu), sweetlips (lipti), giant clams, Triton's trumpet shells and species of sea cucumber were observed in low numbers or were entirely absent.
- Damaging impacts such as household trash, discarded fishing gear and anchor damage were observed in very low frequency or not observed at all. Furthermore coral disease and predation were low both inside and outside the MPA.



Based on the findings of the survey CCC made the following recommendations:

- Maintain the currently excellent levels of enforcement of the MPA rules (even a few violations can undo years of recovery).
- Keep monitoring the reefs to see how they change, if they are facing new threats and if management is working.
- Keep monitoring the number of tourists visiting and their impact on the reef to make sure that the tourism is sustainable.
- Evaluate the effectiveness of the management of the MPA using the MPA MEAT to determine successes and highlight areas for improvement (Philippines CTI NCC, 2011).

Additional surveys were carried out in Napantao MPA in August and September 2013. It is our aim to survey this MPA twice each year, once in March/April and once in August/September in order to characterise ecological changes in the MPA over time and between seasons. This detailed level of monitoring is not possible in all locations as it is very labour intensive but is possible at Napantao because surveying is logistically straightforward from CCC's base there.

2.2.4. Proposed MPA Assessment at Santa Paz Norte, San Francisco

Surveys were conducted in an area proposed as an MPA near the Barangay of Santa Paz Norte, known as Ghost Town, between June and August 2013. Key findings of the surveys were as follows:

- Abundance and diversity of fish families and species varied significantly between survey sites. Overall fish abundance was significantly greater at 12m than at 6m.
- Abundance and diversity of invertebrates varied significantly between survey sites. The abundance of invertebrates was significantly greater at 12m than at 6m.
- Rock was the most commonly recorded substrate across the survey area followed by hard coral and then rubble. Generally hard coral cover was significantly higher on sites towards the southern end of the surveys area.
- Commercially important fish families including barracuda, emperors (katambak) and sweetlips (lipti) were entirely absent from the surveys. Others including grouper (lapu lapu) and snapper (maya maya) were only recorded in low numbers and individuals were all generally small in size.



The Ornate Ghost Pipefish (Solenostomus paradoxus) - inspiration for the name 'Ghost Town'

- Instances of damaging impacts such as trash, discarded fishing gear and boat damage were generally recorded in low abundance. Instances of coral damage from predation were classed as 'high' but are well within natural levels.
- The reef at Ghost Town is home to a wide array of marine life that are attractive to tourist divers.
- The reef wall and 'muck' diving areas towards the southern end of the survey have great potential as dive sites for tourists.

Based on the findings of the survey CCC made the following recommendations:

- Based purely on scientific data the best location for an MPA would be in the area close to the northern end of the village near the river mouth and extending north west up the coast (see Figure 7).
- Consultation should start between all members of the community regarding the creation of an MPA. This should include the local fisher-folk, Barangay Council, Municipal and Provincial Government and CCC.
- Try to secure funding to help in the establishment of an MPA. Demarcation buoys and signage are useful tools for enforcement.
- Increase promotion of the area as a dive site to increase dive tourism and raise local income.

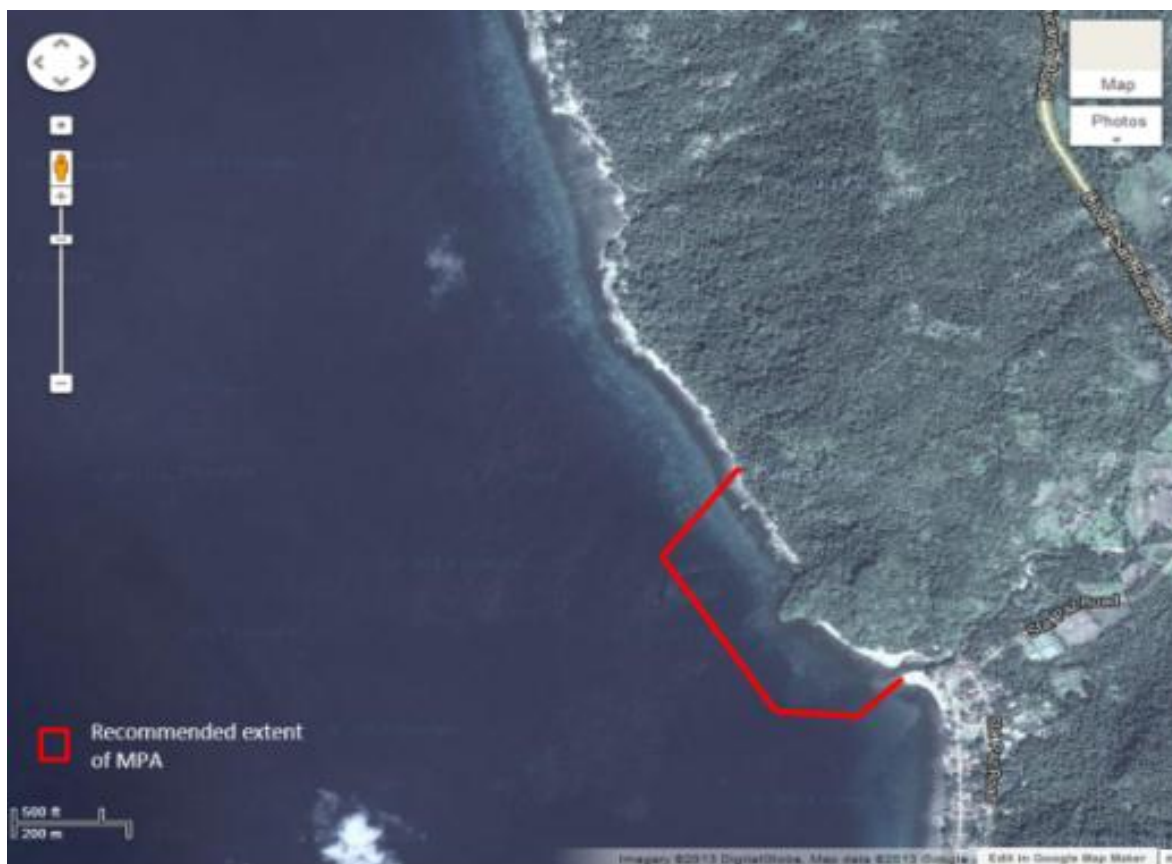


Figure 7 - Recommended MPA site at Santa Paz Norte. Image copyright Google.

2.2.5. CoTS Assessment at Magallanes, Limasawa and Napantao, San Francisco

The crown of thorns seastar (CoTS) is a voracious predator of Scleractinian corals and poses one of the most significant threats to coral reef ecosystems (Pratchett, 2005). An adult CoTS can consume vast quantities of coral per year and when populations of these corallivorous animals reach outbreak levels, significant and lasting damage can be caused to reef communities. Several outbreaks of CoTS have occurred throughout Sogod Bay in recent years and therefore



Crown of thorns seastar (Acanthaster planci)

monitoring of CoTS communities is a high priority for marine management. CCC are able to assist with CoTS monitoring and extraction when requested. Using a modified version of the Reef Check method, teams of divers count the number of CoTS encountered along 20m x 5m belt transects to give an indication of CoTS population levels in the area. Where populations are found to be at outbreak levels an extraction programme may be instigated, involving either manual removal of individuals or destruction using 'CoTS guns' (where available) which inject a solution of vinegar and seawater.

In April 2013, CCC conducted a CoTS assessment in an area proposed as a site for an MPA associated with the barangay of Magallanes (Figure 8). The area assessed had suffered from a CoTS outbreak in recent years but was showing signs of recovery. CoTS were recorded in relatively low numbers (0.38 ± 0.39 individuals per 100m^2 inside the proposed MPA and 0.75 ± 0.16 per 100m^2 outside the proposed MPA) indicating that the population was not currently at outbreak levels. It was recommended that regular monitoring should continue in order to provide early warning of any future outbreaks and allow a rapid response to minimise future damage. While not the primary purpose of the study, it was also noted that the area would be a good candidate for an MPA as an effectively managed MPA would increase the resilience of the reef to future CoTS outbreaks.

In May and June 2013, CCC conducted a CoTS assessment of Napantao MPA. CoTS numbers were found to be within acceptable levels (1.19 ± 0.46 individuals per 100m^2 inside the MPA and 0.86 ± 0.27 individuals per 100m^2 outside the MPA). Hard coral recorded within the MPA was generally healthy and did not show signs of heavy predation. High abundance of *Acropora* corals, fast growing species preferentially preyed upon by CoTS, was seen as good anecdotal evidence that the CoTS population was in balance with the reef ecosystem. Continued monitoring to pick up early signs of future outbreaks was strongly advised.

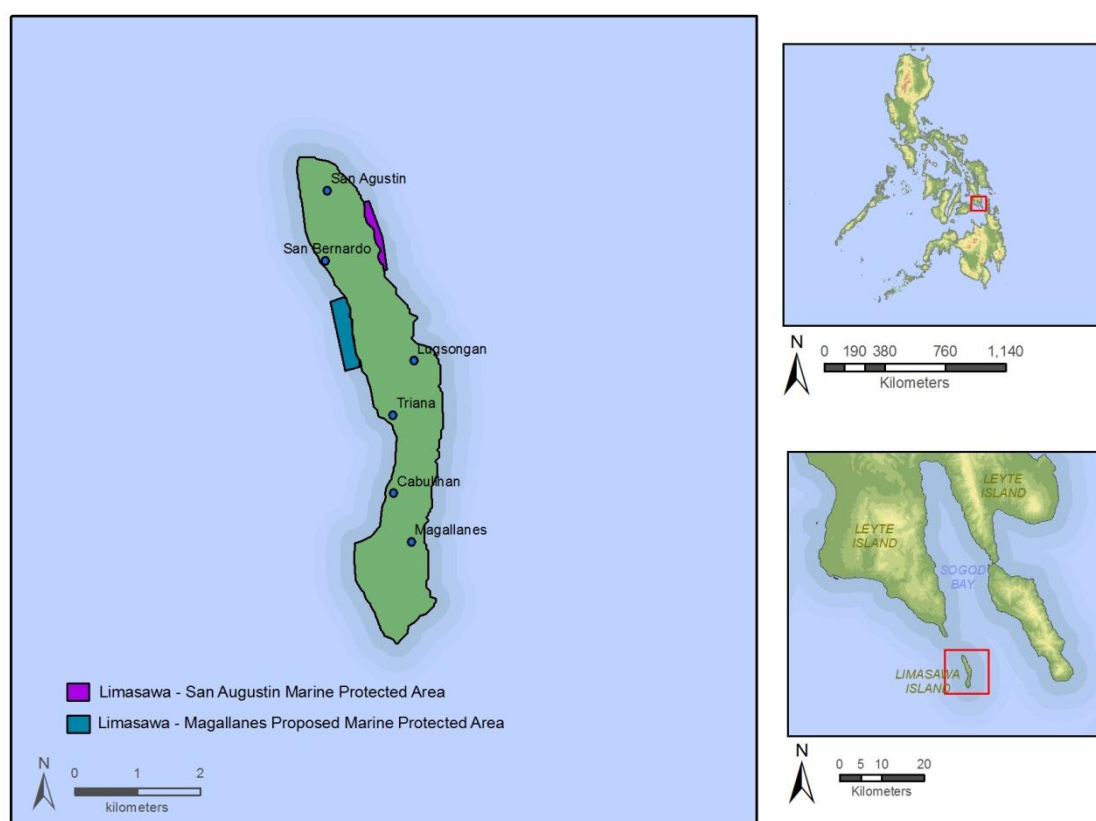


Figure 8 – Map of Limasawa showing location of CoTS assessment in the Magallanes Proposed Marine Protected Area

2.3. Technical and Scientific Meetings

Throughout 2013 CCC has both attended and hosted a variety of technical and scientific meetings to present our work, share knowledge and to learn about other projects from across Southern Leyte and the Philippines (Table 1). Within Sogod Bay we are pleased to be an associate member of the Sogod Bay Sustainable Marine Management Alliance (SBSMMA). The Technical Working Group (TWG) for the Alliance meets monthly to discuss matters concerning the management of marine resources in the bay. CCC provides technical support to the SBSMMA in matters concerning reef ecology and marine surveys.

Table 1 – Technical and scientific meetings attended by CCC in 2013

Month	Activity	Location
March 2013	SBSMMA TWG meeting – First year anniversary celebration. CCC presented our new MPA survey methodology and preliminary results of Santa Paz Sur MPA assessment.	Liloan
March 2013	Conference on the MPA Management Effectiveness Assessment Tool (MPA MEAT)	Cebu
April 2013	SBSMMA TWG meeting	Libagon
May 2013	SBSMMA TWG meeting – CCC presented findings from San Agustin-Lugsongan MPA assessment	Magallanes, Limasawa

June 2013	MPA Managers Summit – CCC presented findings from Santa Paz Sur and San Agustin-Lugsongan MPA assessments	Sogod
June 2013	SBSMMA TWG meeting	Malitbog
June 2013	Presentation of Santa Paz Sur MPA assessment findings to Municipal officials	Municipal Legislative building, San Francisco
July 2013	SBSMMA TWG and board members meeting. Election of board members for the coming year.	Macrohon
August 2013	SBSMMA TWG meeting	Macrohon
September 2013	SBSMMA TWG meeting	Padre Burgos
October 2013	National Symposium on Marine Science hosted by the Philippine Association of Marine Scientists (PAMS)	UPV Tacloban College, Tacloban City
October 2013	Meeting between Napantao Community Association (NACOA) and representatives of the Provincial and Municipal Tourism Departments	Napantao Barangay Hall
November 2013	Presentation of Napantao MPA assessment results to Municipal officials	Municipal Legislative building, San Francisco

2.4. Survey Work Initiated in 2013

In October 2013, at the request of the Municipal Agriculturalist of Liloan, CCC initiated an MPA assessment survey of Tabugon MPA, Liloan. Additionally, CCC was requested to conduct a proposed MPA assessment for the barangay of Molopolo in Liloan. Unfortunately, before these surveys could be completed the project was closed and surveying stopped. Given the amount of time that has passed since the surveys began and the potential impacts of Typhoon Yolanda on the marine environment, data collected in 2013 will not be comparable with any further data collected since the re-opening of the project. As such, these surveys will be re-initiated in 2014.

3. Capacity Building Work

3.1. Scholarship Scheme

CCC's Scholarship Scheme provides opportunities for any Filipino national to join the expedition team in Napantao and receive training to enable them to carry out marine surveys. A full four week training course includes the following:

- PADI dive training to Advanced Open Water level
- Introduction to coral reef ecology and biology
- Fish, coral and invertebrate species identification
- Ecological survey techniques
- Data handling skills
- Hands on conservation experience
- Reef Check Ecodiver certification

"...Personally, in terms of advocacy to preserve marine life especially the coral reefs, Coral Cay has made me want to fight harder for our reefs and to push for the establishment of more MPAs all over the country. Armed with what I have seen and what I have learned in Coral Cay, it is no longer a pipe dream but a very tangible possibility..."

- Leo Quilab, CCC Scholar

Scholars are invited from across the Philippines, with priority for placements given to residents of Southern Leyte. In 2013, CCC welcomed 10 scholars (Table 2) who all successfully completed the training programme. One scholar, Jerome Napala, returned to CCC's site to undertake his PADI Divemaster qualification having previously completed a full scholarship in 2011 (see case study below).

Table 2 – CCC Scholars 2013

Month	Scholar Name	Information
February 2013	Jem Baldesimo	An environmental consultant from Manila
April 2013	Marlon Managa	A marine biology student at SLSU Bontoc
April 2013	Leo Quilab	A biology student from Manila
May 2013	Jerome Napala	CCC Scholar in 2011, returned to complete his Divemaster qualification. Works on the Padre Burgos Reef Restoration Project.
July 2013	Danica Lopez	Working for a conservation NGO in Palawan
July 2013	Lourdes Tan	Developing corporate and social responsibility for her family's fishing business in General Santos City, Mindanao
August 2013	Ciara Juan	From Manila
September 2013	Beth Santillan	Working with Ocean-Action Resource Center in Silago
October 2013	Excalibur Setera	An MPA manager from San Joaquin, Iloilo Province, Panay
October 2013	Vanessa Rivera-Celis	From the Provincial Tourism Office of Iloilo Province, Panay

In 2014, CCC is eager to increase the number of Southern Leyteños participating in the scholarship scheme. Consultation with the PGSL has highlighted some barriers to participation, especially that the commitment of one month full-time participation is unfeasible for those in full-time

employment. In collaboration with the PGSL and local marine managers, CCC has developed a modular scheme requiring a commitment of only 1-2 days per week which will be available in 2014 (see Appendix C). Additionally, CCC will be offering the opportunity for extensions to the scheme to allow participants to complete their PADI Divemaster course where these skills will be relevant to their area of work.

"...My stay in CCC is something that I will certainly cherish. I found the activities in CCC to be demanding yet fulfilling. Demanding, in terms of needing to accomplish expected skill sets in a limited amount of time. Physical and knowledge competencies were developed from lectures, diving, snorkelling and surveying...I left CCC feeling confident and eager to establish baseline data for the MPA in my hometown. CCC definitely went beyond my expectations...."

Lourdes Tan, CCC Scholar

CASE STUDY – JEROME NAPALA, CCC SCHOLAR

Jerome Napala hails from the barangay of San Antonio in Malitbog, Southern Leyte. He joined CCC as a Scholar in 2011 while studying marine biology at Southern Leyte State University. He successfully completed his scholarship, during which he attained his PADI Open Water and Advanced Open Water certifications, as well as passing CCC's intensive Skills Development Programme and providing vital assistance on coral reef surveys in Sogod Bay. Of his experience with CCC, Jerome said "Coral Cay experience was really a fantastic experience, it change my perspective in life and open new path for conservation of Sogod Bay".

In 2012, now working on a government project called "The Filipinovation on Coral Reef Restoration Project 7: Pilot Technology Demonstration on Coral Reef Restoration" and studying for a Masters in marine biology, Jerome contacted CCC to seek additional training. In May 2013, Jerome returned to Napantao to complete his PADI Divemaster course and gain additional experience of coral reef surveys. He also took the opportunity to get to know a new group of CCC volunteers and to share his experiences in marine conservation in Southern Leyte with CCC's team.

Inspired by his experiences of the amazing natural environment of the Philippines, Jerome began to look at additional ways he could help. "The idea of making an NGO started when I finished my scholarship at Coral Cay last 2011" he said, and in 2013 'GREEN' (Grassroots Responsiveness thru Education on Environmental Needs) was born. Still in its early stages, GREEN aims to support reef surveys, coral restoration and environmental awareness raising in Southern Leyte, with a view to expanding to terrestrial projects in the future.



3.2. Other Training and Capacity Building Activities

In addition to providing full scholarships, CCC also delivers a range of short training schemes for MPA managers, teachers, students and other interested parties throughout Southern Leyte. Table 3 lists the training and capacity building activities carried out by CCC in 2013.

Table 3 – Training and capacity building activities conducted by CCC during 2013

Month	Activity	Participants
January 2013	Installation of MPA marker buoys at Santa Paz MPA	Santa Paz MPA managers
May 2013	Coastal Resource Management Workshop	6 staff and students from Southern Leyte State University (SLSU)
July 2013	Threats to the Marine Resource Workshop for National Disaster Consciousness Month	Over 500 students from Caasai Private School Over 200 students from Santa Paz High School Over 200 students from Marayag High School
July 2013	Assisted the Tourism Department of Liloan Municipality by conducting underwater photography dives of the reefs in Barangay Gudan (see case study below)	Municipal Tourism and Agricultural officials, Liloan
August 2013	Teacher training event ‘MPA for Teachers’ – 8 lesson module for Grades 5-8. In collaboration with Ocean-Action Resource Center (ORC) and SLSU Bontoc Campus.	25 elementary and secondary school teachers & Department of Education Officials
August 2013	Assisted the Tourism Department of Liloan Municipality by conducting underwater photography dives of the reefs in Barangay Molopolo.	Municipal Tourism and Agricultural officials, Liloan
August 2013	Donated ten copies of the textbook ‘Corals of the World’ to SLSU Marine Sciences Department	SLSU
September 2013	Coastal Resource Management Workshop	13 students and staff from SLSU BSED Livelihood Technology Education course
October 2013	Teacher training module development meeting	ORC

A key development this year was the production of a teacher training scheme for an eight lesson marine biology module in collaboration with Ocean-Action Resource Center (see case study below). 2014 will see further development of this module and delivery of training to teachers from across Southern Leyte.

In 2013 CCC has also been developing a training scheme for Bantay Dagats (MPA wardens) which aims to equip them with the skills to effectively guard an MPA and to carry out day-to-day management activities (see Appendix D). 2014 will see the delivery of this scheme in Barangays around Southern Leyte.

CASE STUDY – TEACHER TRAINING EVENT

In August 2013, CCC collaborated with local NGO, Ocean-Action Resource Center (ORC), to provide classroom resources and guidance for teachers wishing to include marine science lessons in their curriculum. In combination with ORC, CCC worked to provide an eight-lesson module, suitable for grades 5 through 8, which uses MPAs as the basis to illustrate key ecological principles and environmental concerns. The module, called 'MPA for teachers', begins with an overview of tropical marine ecosystems, covering the importance of sea grass beds, mangroves and coral reefs. It then focuses on MPAs, explaining the concept behind this conservation technique and conveying its benefits. The MPA is then used as a venue to explore the interactions and relationships associated with marine ecology. Competition, predation and the food chain are explored, as is the fascinating topic of symbiosis.

Created by Grace Quiton, a previous CCC volunteer and Scholar, the lesson plans include collaborative activities and interactive games to engage students and stimulate discussion about the marine environment in the Philippines. Designed to enhance the learner's appreciation of marine ecosystems and cultivate a sense of curiosity and discovery, the ultimate goal of the module is that the understanding of this environment will promote protection of it.

Our pilot 'MPA for teachers' training workshop was held at Southern Leyte State University (SLSU), Bontoc campus, and attended by 25 elementary and secondary school teachers and Dept. of Education officials. CCC's Education Officer covered the course content, explained the philosophy behind the module and incited enthusiasm by demonstrating the effectiveness of the included educational activities.



Workshop participants practice an educational game exploring the interactions between organisms on a coral reef

CASE STUDY – TOURISM PHOTO DIVES

In August 2013, CCC was approached by the Tourism and Agricultural Offices of Liloan Municipality to assist with a project to produce materials to promote tourist attractions within the municipality. CCC conducted a number of SCUBA dives on the reefs of Barangay Gudan in order to take photos and video of the reef to be used for promotion. Below is a selection of the best photos.



4. Education and Outreach Work

4.1. Teaching in Schools

As part of CCC's wider environmental education programme our enthusiastic staff are out and about year round providing lessons on environmental issues to local schools. In 2013 our Education Officers visited 41 schools in San Francisco and the nearby Municipalities of Liloan, Pintuyan and Limasawa (Table 4) to present lessons on coral reef ecology and biology. The lessons provide students with an understanding of what coral reefs are, where they are found and how they work. In addition students gain an understanding of the importance of reefs, how they are threatened and what can be done to protect them. Educational efforts were focused in areas where survey work was being carried out in order to raise awareness of the importance of the local MPA and its current status.



Children at San Isidro Elementary, creating colourful playground artwork of the beautiful coral reef

Table 4 – Schools receiving lessons from CCC's education staff in 2013

Month	Municipality	School Name
January 2013	San Francisco	Santa Paz Elementary School
January 2013	San Francisco	Santa Paz National High School
January 2013	San Francisco	Bong Bong Elementary School
January 2013	Liloan	New Malangza Elementary School
January 2013	Lilaon	San Roque Elementary School
February 2013	San Francisco	Sudmon Elementary School
February 2013	Pintuyan	Pintuyan Central School
February 2013	Pintuyan	Punod Central School
February 2013	Pintuyan	Dan-an Elementary School
February 2013	Pintuyan	Catbawan Elementary School
March 2013	San Francisco	Marayag National High School
March 2013	San Francisco	Marayag Elementary School
March 2013	Pintuyan	Nueva Estrella Elementary School
April 2013	Limasawa	Triana Elementary School
April 2013	Limasawa	Magallanes Elementary School
April 2013	Limasawa	Lugsongan Elementary School

April 2013	Limasawa	San Agustin Elementary School
June 2013	Liloan	Calian Elementary School
June 2013	Liolan	Himayangan Elementary School
June 2013	Liloan	Himayangan High School
June 2013	Liloan	Ilag Elementary School
June 2013	Liloan	Liloan Central School
June 2013	Liloan	Magaupas Elementary School
June 2013	Liloan	Molopolo Elementary School
June 2013	Liloan	President Roxas Elementary School
June 2013	Liloan	San Isidro Elementary School
June 2013	Pintuyan	Manglit Elementary School
June 2013	Pintuyan	Son-ok Elementary School
July 2013	San Francisco	Santa Paz National High School
August 2013	Liloan	Anilao Elementary School
August 2013	Liloan	Candayuman Elementary School
August 2013	Liloan	Catig Elementary School
August 2013	Liloan	Estela Elementary School
August 2013	Liloan	Estela National High School
August 2013	Liloan	Guintolan Elementary School
August 2013	Liloan	San Roque Elementary School
September 2013	Liloan	Caligangan Elementary School
September	Liloan	Tabugon Elementary School
October 2013	San Francisco	Napantao Elementary School
October 2013	Liloan	New Malangza Elementary School
November 2013	San Francisco	Napantao Elementary School
November 2013	San Francisco	Bongawisan Elementary School

In October 2013 CCC launched the Seastars Environmental Award Scheme (SEAS) for local schools. The aim of SEAS is to develop sustainable partnerships between CCC and local schools and to build an environmentally aware culture among the young people of the Barangay. The scheme has three levels (Figure 9), each building a higher level of environmental awareness and engagement in the students of the school. SEAS was initially launched in Estela and Himayangan High Schools in Liloan Municipality, with both schools quickly attaining Bronze level. Both schools were on track to achieve Gold Seaster level by December 2013 but the scheme was unfortunately put on hold following the closure of CCC's site in November 2013.

In 2014 CCC aims to complete this scheme with Himayangan and Estela High Schools and initiate it in San Francisco and Santa Paz High Schools. Further schemes will be developed for schools in areas close to CCC's survey locations.



Figure 9 – CCC’s Seastars Environmental Award Scheme (SEAS) setup

4.2. Other Educational and Outreach Activities

In addition to teaching in schools, CCC has delivered a range of educational and outreach programmes to a wider cross section of the local community (Table 4). In 2013, key outreach events were targeted to locations where CCC surveying activities were conducted, specifically: Santa Paz Sur (see case study below), Limasawa, Napantao, Santa Paz Norte and Liloan.

Table 4 – Educational and outreach activities conducted by CCC in 2013

Month	Activity	Location
March 2013	Coral reef awareness day – MPA talk, survey results presentation, puppet show, trash can painting, beach clean-up	Santa Paz Sur, San Francisco
March 2013	Educational open day – MPA talk, coral reef games, mural painting	Triana, Limasawa
April 2013	Educational open days – MPA talks, coral reef games, mural painting	Magallanes, Lugsongan and San Agustin, Limasawa
April 2013	Reef Rangers training and activity day for 12 students from Marayag National High School, San Francisco	CCC base, Napantao, San Francisco
April 2013	Production of an educational poster and distribution in schools (see Appendix E)	N/A
May 2013	Reef Rangers training and activity day for 12 students from Santa Paz National High School, San Francisco	CCC Base, Napantao, San Francisco

May 2013	Children and youth environmental camp – climate change and coastal resources presentation, beach clean-up, puppet show, film screening	Liloan
July 2013	Beach clean-up in collaboration with Napantao Barangay Council	Napantao, San Francisco
July 2013	Reef Rangers training and activity day for 12 students from Himay-Angan High School, Liloan	CCC Base, Napantao, San Francisco
August 2013	Coral reef awareness day – beach clean-up, MPA talk, trash can painting, puppet show	Santa Paz Norte, San Francisco
September 2013	Reef Rangers training and activity day for 15 students from Himay-Angan High School, Liloan	CCC Base, Napantao, San Francisco
September 2013	Ocean Conservancy International Coastal Clean-up Day beach clean-up in collaboration with Napantao Barangay Council	Napantao, San Francisco
October 2013	Reef Rangers training and activity day for 7 students from Estela High School, Liloan	CCC Base, Napantao, San Francisco
October 2013	Presentation of Napantao MPA assessment survey results and waste management talk for Barangay Council members and community	Napantao, San Francisco

CCC's Reef Rangers scheme is a key element of our education and outreach programme, which complements and builds on our educational work in schools. Through the programme, students who show a particular interest in environmental issues have the opportunity to develop their understanding of the marine environment and experience it first hand through supervised snorkelling sessions. In addition, participants have the opportunity to engage with CCC's international team, learning more about marine ecosystems and what draws visitors to the Philippines through structured interviews. Reef Rangers is open to school students, usually aged between 14 and 16 years and is a great introduction to the marine environment for enthusiastic individuals who are not yet old enough to participate in our Scholarship Scheme.



Reef Rangers conduct an interview with a CCC volunteer as part of their training programme

Through all of this on-going engagement work CCC has successfully raised awareness of coral reef conservation and marine resource management issues within communities that depend on the reef resource.

CASE STUDY – COMMUNITY AWARENESS DAY SANTA PAZ SUR

On Saturday 2nd March, CCC organised a day full of activities in the Barangay of Sta. Paz Sur. This day was aimed at raising awareness about coral reefs, marine conservation and to inform the people about the status of their local MPA.

For the adults and older children we put on a lecture about how MPAs work. We also shared our preliminary findings from the local MPA which were accompanied by a slide show that featured pictures and a video of the reef inside their MPA. If people wanted a first-hand reef experience they could make use of masks and snorkels provided by CCC.

For the children we organised games and other activities that taught them about the reefs and MPAs in a playful manner. Our Education Officer had taught most of these children in January and they were able to use what they had learned in those lessons during our games. Our Fred the Fish puppet show was also presented and it was, as always, a great success with the children. The CCC staff and volunteers were joined by local residents in a beach clean. In one hour we filled twenty rice sacks with mainly plastic and glass collected from the area and the Barangay multi-purpose building.

The awareness day was attended by many people from the Barangay and the lectures and games were well received by all. If people had questions about coral reef ecology, MPAs, or other issues such as crown of thorns seastars, CCC staff and volunteers were standing by to answer them.



Activities at the Santa Paz Sur community awareness day

5. Conclusion and the Future of the SLCRCP

2013 saw the successful delivery of a range of exciting work programmes in Southern Leyte, through CCC's on-going collaboration with the Provincial Government of Southern Leyte and local stakeholders. The successful introduction of an MPA assessment methodology opens exciting prospects for future work within the Bay. In 2014 and beyond, CCC aims to continue to support local marine resource management by providing comprehensive ecological MPA assessments on request. In 2014 survey targets include:

1. Re-initiate and complete full ecological assessment of Tabugon MPA, Liloan.
2. Re-initiate and complete assessment of area proposed for MPA status by Barangay Molopolo, Liloan.
3. Conduct full assessment of Napantao MPA in March/April and August/September to build on temporal datasets.
4. Conduct at least four other requested MPA assessments as directed by PGSL and local government units.
5. Conduct CoTs assessments as and when requested.

2013 saw successful integration of survey efforts with capacity building and outreach work. In 2014, CCC plans to continue offering scholarships to all interested Filipino nationals, with preference given to candidates from Southern Leyte. In order to facilitate this, modular scholarship options will be available to Southern Leyteños in the coming year. CCC will continue to liaise with project partners to develop training options best suited to their needs. Additionally, 2014 will see the launch of CCC's Bantay Dagat training scheme in barangays in San Francisco and the development of the teacher training scheme, in collaboration with ORC. Education on marine conservation issues through teaching in schools, Reef Rangers programmes, community open days and other events will continue throughout Southern Leyte, particularly in areas where MPA surveying is being conducted.

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Appendix A – Target Species on Surveys

SUBSTRATES

Soft Coral	Sponge	Recently killed coral
Rock	Silt/mud	Rubble
Sand	Nutrient indicator algae	Other*
Hard Coral Lifeforms**:		
<i>Acropora</i> branching	<i>Acropora</i> encrusting	<i>Acropora</i> submassive
<i>Acropora</i> digitate	<i>Acropora</i> tabulate	Non- <i>Acropora</i> branching
Non- <i>Acropora</i> encrusting	Non- <i>Acropora</i> foliose	Non- <i>Acropora</i> submassive
Non- <i>Acropora</i> mushroom	<i>Heliopora</i> (blue coral)	<i>Millepora</i> (fire coral)
<i>Tubipora</i> (organ-pipe coral)		
*Other:		
Anemone	Corallimorph	Halimeda
Tunicate	Zoanthid	Gorgonian
Hydroids		

** If hard coral, also record target species

TARGET HARD CORALS

Brain small	Brain medium	Brain large
<i>Ctenactis echinata</i>	<i>Diploastrea heliopora</i>	<i>Echinopora</i>
<i>Euphyllia</i>	<i>Favia</i>	<i>Favites</i>
Foliose <i>Montipora</i>	<i>Galaxea</i>	<i>Goniopora/Alveopora</i>
<i>Herpolitha limax</i>	<i>Hydnophora</i>	<i>Lobophyllia</i>
Massive <i>Porites</i>	<i>Montipora digitata</i>	<i>Mycedium elephantotus</i>
<i>Pachyseris rugosa</i>	<i>Pachyseris speciosa</i>	<i>Pavona clavus</i>
<i>Pectinia lactuca</i>	<i>Plerogyra</i>	<i>Pocillopora</i> small
<i>Pocillopora</i> medium	<i>Pocillopora</i> large	<i>Polyphyllia talpina</i>
<i>Porites cylindrica</i>	<i>Porites nigrescens</i>	<i>Porites rus</i>
<i>Seriatopora hystrix</i>	<i>Tubastrea micrantha</i>	<i>Turbinaria</i>
Upside-down Bowl		

TARGET INVERTEBRATES

Feather duster worms	Christmas tree worms	Flatworms
Crabs	Shrimps	Banded coral shrimp
Lobsters	Nudibranch	Abalone
Conch	Cowrie	Triton's trumpet
Cone shell	Drupella	Top shell
Other gastropod	Giant clam	Octopus
Cuttlefish	Squid	<i>Acanthaster planci</i>

<i>Linkia laevigata</i>	<i>Culcita novaeguineae</i>	<i>Protoreaster nodosus</i>
<i>Choriaster granulatus</i>	Feather star	Brittle star
Long spine sea urchin	Pencil urchin	Collector urchin
Prickly redfish	Pinkfish	Greenfish
Other sea cucumber	Giant Clam	

TARGET FISH

Common Name	Latin Name	Visayan Name
Angelfish	Pomacanthidae	Adlo
Barracuda	Sphyraenidae	
Blenny	Blenniidae	
Butterflyfish*	Chaetodontidae	Alibangbang
Cardinalfish	Apogonidae	
(Damsel fish)	(Pomacentridae)	
Anemonefish	<i>Amphiprion</i> sp.	
Sergeant Damsel fish	Pomacentridae	
Emperor	Lethrinidae	Katambak
Filefish	Monacanthidae	Ilak
Fusilier	Caesionidae	Dalagang bukid
Goatfish	Mullidae	Timbongan
Goby	Gobiidae	
Groupers	Serranidae	Lapu-lapu
Flagtail Grouper	<i>Cephalopholis urodeta</i>	
Honeycomb Grouper	<i>Epinephelus</i> sp.	
Humpback Grouper	<i>Cromileptes altivelis</i>	
Lyretail Grouper	<i>Variola louti</i>	
Peacock Grouper	<i>Cephalopholis argus</i>	
Jack/Trevally	Carangidae	Talakitok
Lionfish	Scorpaenidae	
Lizardfish	Synodontidae	
Moorish Idol	<i>Zanclus cornutus</i>	Sanggowanding
Moral Eel	Muraenidae	
Parrotfish	Scaridae	Mulmul
Pipefish	Syngnathidae	
Porcupinefish	Diodontidae	
Pufferfish	Tetraodontidae	
Rabbitfish	Siganidae	Kitong
Virgate rabbitfish	<i>Siganus virgatus</i>	
Ray	Rajiformes	
Sandperch	Pinguipedidae	
Scorpionfish/Stonefish	Scorpaenidae	
Snapper	Lutjanidae	Maya-maya
Black and White Snapper	<i>Macolor macularis</i>	

Checkered Snapper	<i>Lutjanus decussatus</i>	
Two Spot Snapper	<i>Lutjanus biguttatus</i>	
Spade/Batfish	Ephippidae	
Spinecheeks	Nemipteridae	Silay
Twoline Spinecheek	<i>Scolopsis bilineatus</i>	
Squirrelfish/Soldierfish	Holocentridae	
Surgeonfish	Acanthuridae	Indangan
Unicornfish	<i>Naso</i> sp.	
Sweeper	Pempheridae	
Sweetlips	Haemulidae	Lipti
Toby	Tetraodontidae	
Triggerfish	Balistidae	Pakol
Trunk/Box/Cowfish	Ostraciidae	
(Wrasse)	(Labridae)	
Crescent Wrasse	<i>Thalassoma lunare</i>	
Humphead Wrasse	<i>Cheilinus undulatus</i>	
Red Breasted Wrasse	<i>Cheilinus fasciatus</i>	

*Target Butterflyfish

Vagabond Butterflyfish	Spot-Banded Butterflyfish	Merten's Butterflyfish
Klein's Butterflyfish	Dot and Dash Butterflyfish	Chevroned Butterflyfish
Latticed butterflyfish	Singular Bannerfish	Threadfin Butterflyfish
Eastern Triangle Butterflyfish	Longfin Bannerfish	Teardrop Butterflyfish
Redfin Butterflyfish	Masked Bannerfish	Spot-Nape Butterflyfish
Pyramid Butterflyfish	Pennant Bannerfish	Lined Butterflyfish
(Big) Long-Nosed Butterflyfish	Racoon Butterflyfish	Yellow-Dotted Butterflyfish
Copper-Banded Butterflyfish	Dotted Butterflyfish	Black-Backed Butterflyfish
Orange-Banded Butterflyfish	Ovalspot/Mirror Butterflyfish	Spot-Tail Butterflyfish
Humphead Bannerfish	Bennett's/Eclipse Butterflyfish	Panda Butterflyfish
Asian Butterflyfish	Bluespot Butterflyfish	Eight-Banded Butterflyfish
Burgess' Butterflyfish	Highfin Coralfish	Reticulated Butterflyfish
Ornate Butterflyfish	Two-Eyed Coralfish	Saddled Butterflyfish
Meyer's Butterflyfish	Brown Banded Butterflyfish	Spotted Butterflyfish
Speckled Butterflyfish	Ocellate Coralfish	Yellowtail Butterflyfish
Pacific Double-Saddle Butterflyfish		

Appendix B – Summary Reports for CCC Survey Work



- ▶ CCC CARRIED OUT AN ASSESSMENT OF THE REEFS IN AND AROUND THE SAN AGUSTIN-LUGSONGAN MPA, LIMASAWA BETWEEN MARCH AND APRIL 2013
- ▶ THE REEF IS IN GOOD HEALTH GENERALLY WITH A MIX OF HABITATS. THERE ARE HOWEVER SOME SIGNS OF OVERFISHING IN THE AREA.
- ▶ ELECTRONIC COPIES OF THE FULL TECHNICAL REPORT ARE AVAILABLE FROM OUR PROJECT SCIENTIST

A REPORT BY CORAL CAY CONSERVATION

CORAL CAY CONSERVATION

Expeditions

San Agustin-Lugsongan

MPA

AMPINGAN TA ANG KABTANGAN SA KADAGATAN ALANG SA ATONG UMAABOT NGA PANGINABUHI

The San Agustin-Lugsongan MPA, Limasawa was established in 2008 and is one of the largest MPAs in Southern Leyte, covering an area of 45 hectares.

The current status of San Agustin-Lugsongan MPA

Surveys conducted by CCC found that overall numbers of fish and invertebrates were not higher inside the MPA. However, there were more *Alibangbang* inside the MPA.

Hard coral was more common inside the MPA. Outside, the reef was mostly sand and rubble with patches of hard coral.

Many commercially important species of invertebrates and fish, such as giant clams and *lapu-lapu* were uncommon and small in size. Non-target sea cucumbers were more abundant

outside the MPA, but commercially important species were entirely absent.

Crown of Thorns sea stars (CoTs) were found in low numbers and do not currently pose a threat to the reefs.

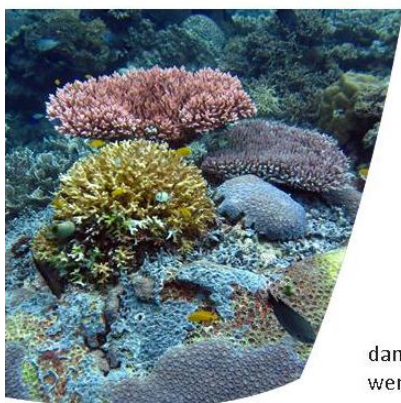
Levels of discarded fishing gear were low, however levels of household trash were relatively high outside the MPA.

Overall the reef is in quite good health but showing signs of overfishing and high levels of trash. More active enforcement is required.



Why are MPAs important?

MPAs protect areas of reefs from human impacts. Within an MPA, fish are protected and can grow larger, producing more offspring. This leads to 'overspill', increasing fish numbers outside the MPA. In the Philippines many very successful MPAs have been created including the famous Apo Island MPA. Not only do these well managed MPAs help to enhance fish stocks, they also provide income from tourism and other benefits such as protection of coastal habitats from storms.



CCC's Assessment of San Agustin-Lugsongan

The potential for ecosystem protection, dive tourism and key recommendations for management

Human pressure on reef ecosystems can have a big impact. The lack of large fish such as lapu-lapu and other important animals like giant clams both inside and outside the MPA suggest that fishing is very common in the area.

The removal of these important or 'keystone' species can affect the balance of reef ecosystems.

Fishing inside and close to the MPA was observed during the surveys. Any positive effects of the MPA can be quickly destroyed if poaching is permitted.

Other human impacts such as discarded fishing nets, anchor

damage and blast fishing were very low in the area.

However, household trash outside the MPA was in some areas very common. Trash such as plastic and polystyrene can have harmful effects on reef creatures.

Many animals such as turtles mistake trash for food. If they eat the trash it can kill them. Plastic can also smother corals which will cause them to die.

Key Recommendations:

- Increase enforcement and acceptance of the MPA through education and if necessary punishment for breaking the rules.

- Provide a guard house and equipment for Bantay Dagats and have them present at all times.
- Deploy MPA demarcation buoys and signage to clearly define the MPA boundaries and deter illegal fishing.
- Consider ways to improve trash disposal on land to prevent it entering the marine environment. This may include more waste and recycling bins.
- Use the MPA Management Effectiveness Assessment Tool to highlight management successes and areas for improvement.

Religious statue placed in Magallanes

In April 2013 CCC was pleased to assist with a community project in the town of Magallanes. The project aimed to place a religious statue underwater, offshore from the shrine of the First Mass. At the request of Father Esquibel, our team was asked to locate a suitable site for the placement of the statue. It was important that the site was deep enough to avoid collisions from fishing boats but also shallow enough to be visible to visitors snorkelling at the surface. After a short search a suitable sand patch was located and marked ready for the placement of the statue.



Father Esquibel with Project Scientists Casper van de Geer and Alex Ferguson

CROWN-OF-THORNS ASSESSMENT

Magallanes, Limasawa



In addition to the San Agustin-Lugsongan MPA survey CCC also conducted a Crown-of-Thorns assessment in an area proposed as a potential new MPA, close to the town of Magallanes.

Crown-of-Thorns (CoTs) are predators of coral. In low numbers they are an important part of the reef. However when there are too many in one area they can cause a lot of damage and kill a lot of coral.

Our assessment indicates that there are very low levels of CoTs in the area proposed as an MPA and so the threat of an outbreak is low at present.

We recommend that there is continued monitoring of the area for signs of future outbreaks. This will help prevent large scale damage to the reefs.



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With Special Thanks to:
The Municipal Government
of Limasawa

In Partnership With:
The Provincial Government
of Southern Leyte,
Philippines





► CCC CARRIED OUT AN ASSESSMENT OF THE REEFS IN AND AROUND SANTA PAZ SUR MPA BETWEEN JANUARY AND MARCH 2013



► THE MPA IS IN GOOD HEALTH GENERALLY BUT IS SHOWING SIGNS OF OVERFISHING



► ELECTRONIC COPIES OF THE FULL TECHNICAL REPORT ARE AVAILABLE FROM OUR PROJECT SCIENTIST

A REPORT BY CORAL CAY CONSERVATION

CORAL CAY CONSERVATION



Santa Paz Sur MPA

AMPINGAN TA ANG KABTANGAN SA KADAGATAN ALANG SA ATONG UMAABOT NGA PANGINABUHI

Santa Paz Sur MPA, also known as Anna's Garden, was established in 2009 and covers 4.4 hectares. Recently buoys were deployed to mark the boundaries of the MPA so that everyone can see where it is.

The current status of Santa Paz Sur MPA

Surveys conducted by CCC found that overall numbers of fish were not higher inside the MPA. However, there were higher numbers of invertebrates inside the MPA compared to outside.

Crown of thorns sea stars (CoTs) were only present in low numbers except in one place, outside the MPA to the south.

Hard coral was more abundant outside the MPA and sand was more abundant inside the MPA.

Many species of fish including lapu-lapu and lipti were only seen in very low numbers. Other commercially important species such as giant clams and sea cucumbers were also uncommon.

Levels of trash and discarded fishing gear on the reef were low.

Overall the reef is in good health but showing signs of overfishing. Fishing continues to take place within the MPA, so more enforcement is needed.



Why are MPAs important?

MPAs protect areas of reefs from human impacts. Within an MPA, fish are protected and can grow larger, producing more offspring. This leads to 'overspill', increasing fish numbers outside the MPA. In the Philippines many very successful MPAs have been created including the famous Apo Island MPA. Not only do these well managed MPAs help to enhance fish stocks, they also provide income from tourism and other benefits such as protection of coastal habitats from storms.



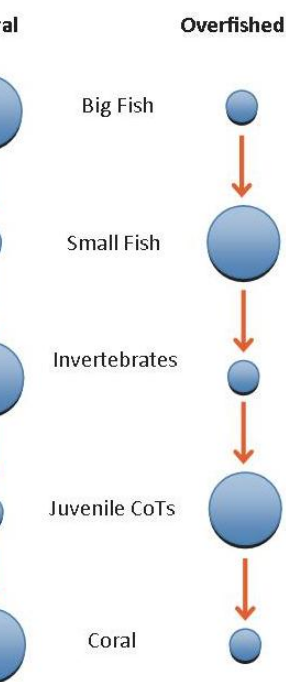
CCC's Assessment of Santa Paz Sur MPA

How does overfishing impact on the coral reef ecosystem?

means there are lots and a smaller circle means there are few.

When big fish, like lapu lapu, are removed the whole ecosystem is affected. This is because the big fish eat smaller fish which in turn eat small invertebrates and so on down the food chain. If the big fish are removed the smaller fish increase in number because they are not being eaten and the whole system becomes unbalanced.

There are lots of food chains like this which occur on the reef because there are lots of different animals living there. These individual chains are all connected into a complex web. This means that something that affects



one group of animals (like fishing) can have important and often unexpected effects on other, seemingly unrelated, groups.

Impacts from humans on the reef (such as anchor damage to coral and trash) are relatively low in Santa Paz MPA but many types of fish and invertebrate that are good to eat (such as lapu lapu, lipiti, giant clams and sea cucumbers) are only present in very low numbers or not there at all.

Many of these animals are what is known as 'keystone species'. This means that they play a vital role in the ecosystem as a whole and their loss can seriously affect the stability of the entire reef ecosystem.

The diagram on the right shows an example of this. The circles represent the relative abundance of each type of animal, so a big circle

CROWN OF THORNS:

Are they a problem in Santa Paz Sur MPA?



Crown of thorns sea stars (CoTs) are a natural part of the reef ecosystem. They feed on coral, just like many other of the creatures on the reef. Usually this is not a problem but sometimes CoTs can reproduce rapidly, and occur on the reef in very large numbers. When this happens there can be a serious impact on the reef as large amounts of coral is eaten.

In Santa Paz Sur MPA CoTs were not recorded in high numbers. However, at one site outside the MPA to the south, several CoTs were found in a small area. This may be due to changes to the local environment as a result of heavy rains increasing water input from a nearby river.

This outbreak is relatively small and localised and is unlikely to pose a threat to the reef. However, it should be monitored to make sure that it doesn't get worse. The site is relatively shallow at 6m and should therefore be easy to monitor while snorkeling.



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&
The Municipal Government of
San Francisco





- ▶ CCC CARRIED OUT AN ASSESSMENT OF THE REEFS IN AND AROUND NAPANTAO MPA BETWEEN MARCH AND APRIL 2013



- ▶ THE MPA IS IN GOOD HEALTH GENERALLY AND THERE ARE GOOD SIGNS THAT IT IS ACHIEVING ITS CONSERVATION GOALS



- ▶ ELECTRONIC COPIES OF THE FULL TECHNICAL REPORT ARE AVAILABLE FROM OUR PROJECT SCIENTIST

A REPORT BY CORAL CAY CONSERVATION



Napantao MPA

AMPINGAN TA ANG KABTANGAN SA KADAGATAN ALANG SA ATONG UMAABOT NGA PANGINABUHI

Napantao MPA was established in 1996 and covers 5 hectares. It is one of the premier dive sites in the Philippines attracting international tourists who wish to experience the beauty and diversity of coral reefs.

The current status of Napantao MPA

Surveys conducted by CCC found that overall numbers of fish were not higher inside the MPA. However, there were higher numbers lapu-lapu inside the MPA and these were also bigger than those found outside the MPA.

Crown of thorns sea stars (CoTs) were only present in low numbers and do not currently pose a threat to the reefs.

Hard coral was more abundant inside the MPA and more target species of

coral were recorded inside the MPA than outside the MPA.

Many commercially important species of invertebrates such as giant clams and sea cucumbers were uncommon.

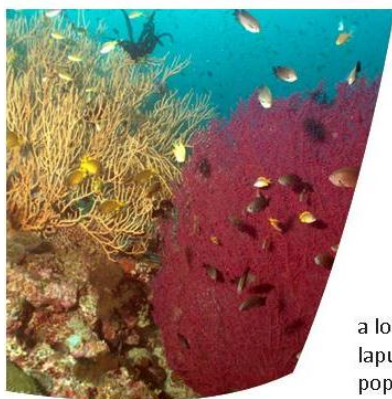
Levels of trash and discarded fishing gear on the reef were low.

Overall the reef is in good health and is showing some signs of recovery from overfishing. Enforcement of the MPA rules is good.



Why are MPAs important?

MPAs protect areas of reefs from human impacts. Within an MPA, fish are protected and can grow larger, producing more offspring. This leads to 'overspill', increasing fish numbers outside the MPA. In the Philippines many very successful MPAs have been created including the famous Apo Island MPA. Not only do these well managed MPAs help to enhance fish stocks, they also provide income from tourism and other benefits such as protection of coastal habitats from storms.



CCC's Assessment of Napantao MPA

The recovery of lapu lapu numbers and key recommendations for management

A key finding of CCC's surveys in Napantao MPA was that the numbers of lapu lapu were higher inside the MPA than outside. Lapu lapu inside the MPA were also bigger.

Lapu lapu grow very slowly and can live for as long as 40 years. This means it takes them a long time to reach sexual maturity. Also as lapu lapu get bigger they produce more offspring.

This means that when big lapu lapu are removed by fishing not only does it take

a long time for other lapu lapu to grow as big but the population can't produce as many offspring so recovery is slow.

Finding that there are more lapu lapu inside the MPA and that they are also bigger than the those outside the MPA indicates that, protected from fishing, the lapu lapu populations are beginning to recover.

The lapu lapu inside the MPA are still not very big compared to what they can be, but with continued protection they will keep getting bigger and producing more offspring.

Key Recommendations:

- Maintain the currently excellent level of enforcement of the MPA rules (even a few violations can undo years of recovery).
- Keep monitoring the reefs to see how they change, if they are facing new threats and if management is working.
- Keep monitoring the numbers of tourists visiting and their impact on the reef to make sure that the tourism is sustainable.
- Evaluate the effectiveness of the management of the MPA using the MPA Management Effectiveness Assessment Tool (MPA MEAT).



LIFE UNDER THE WAVES...

What lives in Napantao MPA?



The reefs of the Philippines are famous for being home to huge numbers of fascinating and beautiful creatures. It is this rich diversity of life that is so appealing to tourists and other visitors who come to experience the marine environment.

The MPA at Napantao, with a particularly diverse and beautiful reef, has a lot to offer visitors.

Not only can you see big, eye-catching creatures like whale sharks and turtles, you can also experience wonder and beauty on the smallest of scales.

The pictures on this page were all taken inside the MPA at Napantao.

*Clockwise from top left:
Oliver's squat lobster;
Psychedelic batwing sea slug;
Tree soft coral; Warty frogfish;
Reef inside the MPA with
Tubastrea coral, Anthias and
Moorish idols.*



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- ▶ CCC CARRIED OUT AN ASSESSMENT OF THE REEFS IN THE COASTAL WATERS OF SANTA PAZ NORTE BETWEEN JUNE AND AUGUST 2013



- ▶ THE REEF IS IN GOOD HEALTH GENERALLY AND THERE IS GREAT POTENTIAL FOR THE CREATION OF AN MPA AND DEVELOPING THE SITE FOR DIVE TOURISM



- ▶ ELECTRONIC COPIES OF THE FULL TECHNICAL REPORT ARE AVAILABLE FROM OUR PROJECT SCIENTIST

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Santa Paz Norte

AMPINGAN TA ANG KABTANGAN SA KADAGATAN ALANG SA ATONG UMAABOT NGA PANGINABUHI

The coastal waters of Santa Paz Norte are home to a wide range of beautiful species and contain a diverse array of interesting reef structures. Known as 'Ghost Town' the area is already a popular location for dive tourists who wish to experience rare and beautiful marine creatures.

The current status of Santa Paz Norte reefs

Surveys conducted by CCC found that overall numbers of fish and invertebrates varied between different areas of the reef. There were also more fish and invertebrates at 12m than at 6m.

Crown of thorns sea stars (CoTs) were only present in low numbers and do not currently pose a threat to the reefs.

Hard coral was generally abundant across all of the area that was surveyed.

Many commercially important species

of invertebrates and fish, such as giant clams and Lapu-lapu were uncommon and small in size.

Generally levels of trash and discarded fishing gear on the reef were low.

A number of areas such as the reef wall and 'muck' slope are prime sites for dive tourists

Overall the reef is in quite good health. It is an ideal site for protection and has the potential for good income generation from tourism.



Why are MPAs important?

MPAs protect areas of reefs from human impacts. Within an MPA, fish are protected and can grow larger, producing more offspring. This leads to 'overspill', increasing fish numbers outside the MPA. In the Philippines many very successful MPAs have been created including the famous Apo Island MPA. Not only do these well managed MPAs help to enhance fish stocks, they also provide income from tourism and other benefits such as protection of coastal habitats from storms.



CCC's Assessment of Santa Paz Norte

The potential for ecosystem protection, dive tourism and key recommendations for management

The reef along the entire survey area is generally in good health. However the lack of large fish like Lapu lapu suggests that fishing in the area is common.

Many species of fish grow slowly and take a long time to reach sexual maturity. In addition, larger fish produce more offspring. Removing lots of large fish means that fewer babies are produced and the population cannot recover.

If part of the area were protected then there would be a safe area for fish to live where they could grow and produce more offspring.

Another key finding of the survey was that there is very good potential for dive tourism. The interesting reef structure and rare species such as the Ornate Ghost Pipefish are very attractive for divers.

Divers will pay to dive in a well-managed MPA, and so bring income into the community of Santa Paz Norte.

Key Recommendations:

- Based purely on the findings from this study CCC suggest that the best location for a MPA would be in the area close to the northern end of the village near the river mouth
- and extending north west up the coast (see map).
- Consultation should start between all members of the community regarding the creation of a MPA. This should include the local fisher-folk, Barangay Council, Municipal and Provincial Government and CCC.
- Try to secure funding to help in the establishment of a MPA. Demarcation buoys and signage are useful tools for enforcement.
- Increase promotion of the area as a dive site to increase dive tourism and raise local income.

LIFE UNDER THE WAVES...

The spooky creatures of Ghost Town!



The area known as Ghost Town in the waters of Santa Paz Norte is a very special dive site. Famed as a 'muck' dive this section of the reef has little coral and is instead almost entirely silt, washed into the sea from the nearby river.

This type of habitat is home to a range of many rare and bizarre creatures that are highly prized viewing for tourist divers. Of particular interest are the Mimic Octopus that can change the shape and texture of its body to fool predators and the Ornate Ghost Pipefish, the namesake for the site.

All of the pictures on this page were taken on the Santa Paz Norte site.

Clockwise from top left:: Mimic Octopus,; Ornate Ghost Pipefish; Broadclub Cuttlefish; Painted Frogfish; Golden Fire Worm



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Appendix C – CCC Modular Scholarship Scheme

One of Coral Cay Conservation's (CCC's) primary objectives is to facilitate the training and development of Filipino Scholars to conduct underwater marine surveys. The long term aim is to provide the province of Southern Leyte and the Philippines as a whole with individuals capable of continuing the survey work that CCC currently conducts. This training usually consists of a one month residential programme on CCC's base in Napantao, San Francisco. During the first week individuals are trained to PADI Advanced Open Water level. Following this they undertake an intensive two week science training course designed to teach them skills in marine species identification and survey techniques required to undertake marine assessments.

Following consultation with the Provincial Government of Southern Leyte (PGSL) and Municipal Marine Resource Managers it has been identified that there is a need to expand the spectrum of participants on the programme. These include but are not limited to, full-time employees of the Government and local Municipalities, private interested parties and related NGOs. One major limiting factor of the current programme is the time commitment of one month. Many individuals have expressed an interest in the programme but cite this as a problem, expressing that they would be unable to be absent from their work commitments for such an extended period. To address this issue the following proposed plans have been designed to provide the same level of training given in the one month programme, but over an extended timescale and with a weekly commitment of just one or two days.

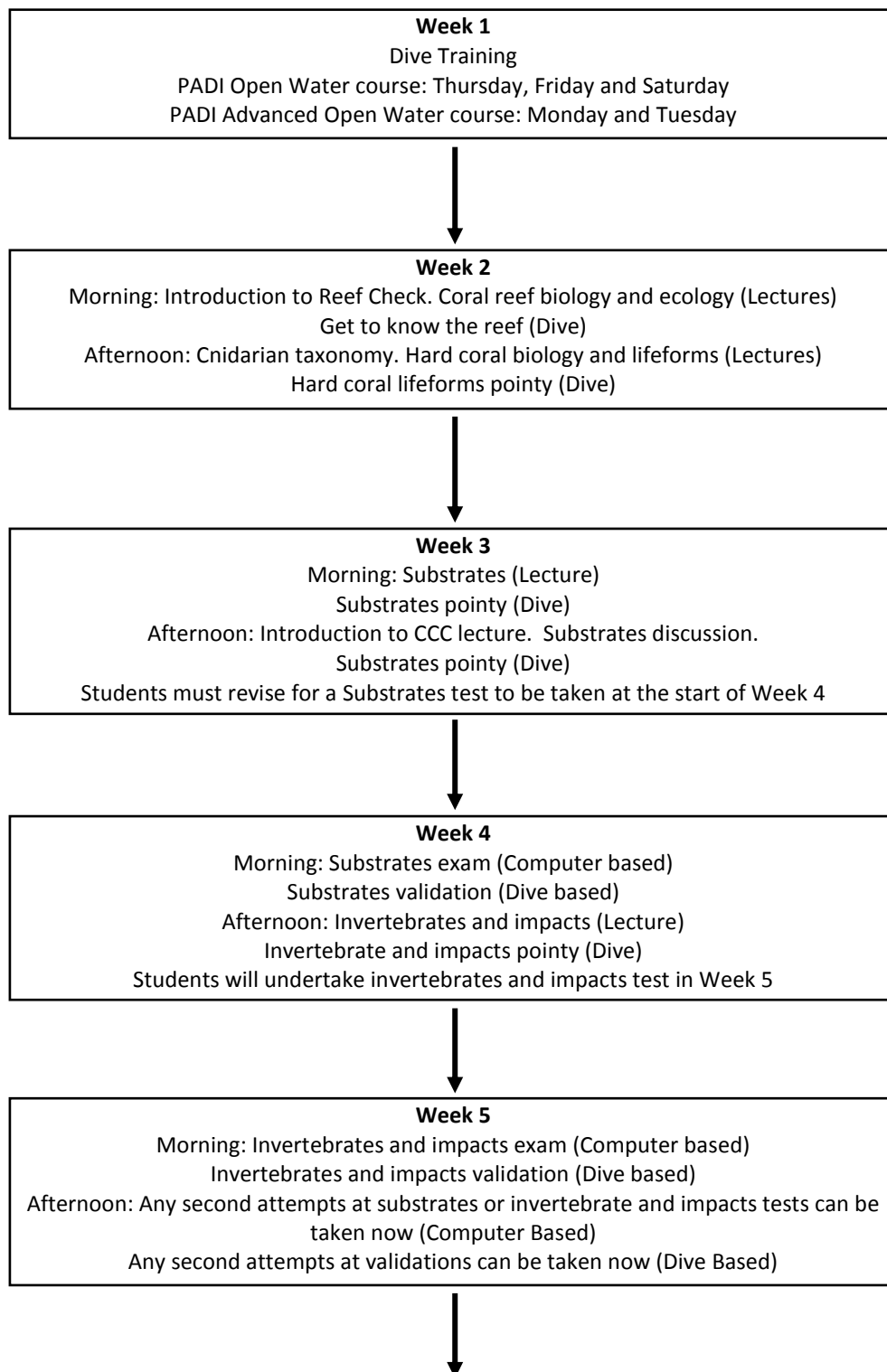
The plans cover three possible timetables that can be undertaken depending on the availability and level of species identification required by the participant. Currently all participants on the one month placement undertake CCC's full Skills Development Programme (SDP) which incorporates an enhanced version of the Reef Check methodology. This worldwide recognised technique for assessing the state of coral reefs using indicator species has been adapted and enhanced by CCC to incorporate more species and provide a more detailed assessment of reef health. The proposed timetables are based around either the standard Reef Check protocol or CCC's enhanced SDP. Both courses will enable participants to conduct marine surveys but with the latter providing more in depth knowledge and species identification skills.

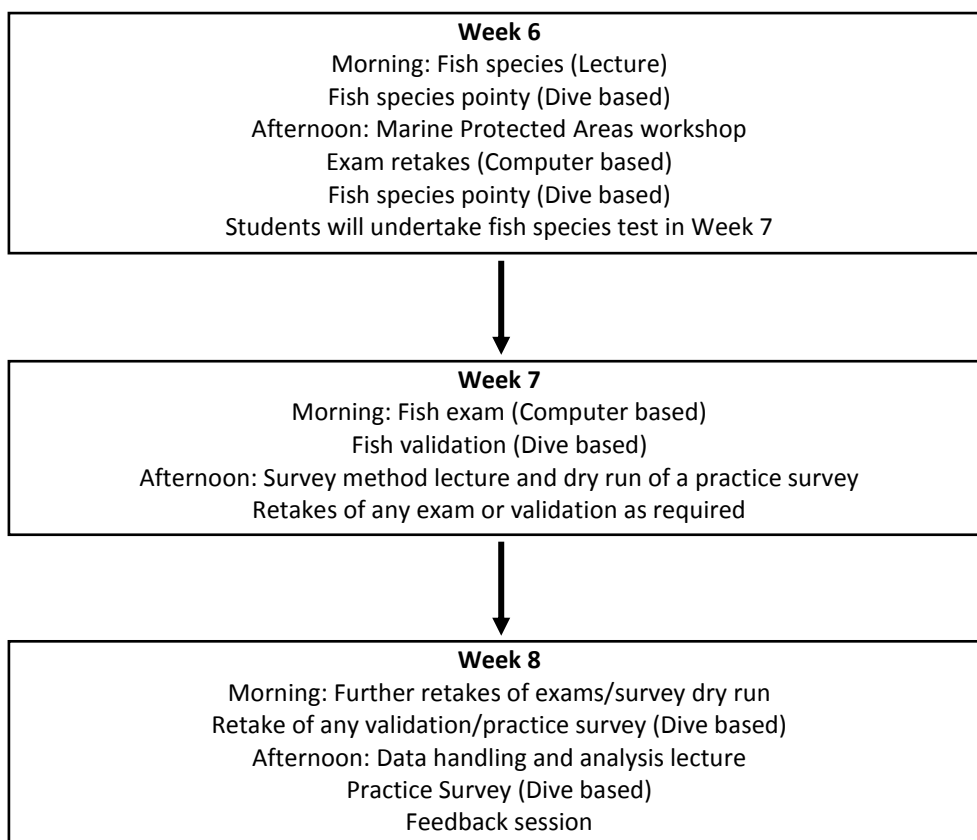
The PADI dive training will be conducted by one of CCC's trained PADI instructors. If necessary this can be facilitated in both English and Visayan. Lectures will be conducted by members of the CCC science team and thus will be in English.

Following the timetable set by Coral Cay Conservation a "Week" starts on a Thursday. Additional to this, all dive training must be completed on "Week 1" running Thursday thru Saturday then again on Monday and Tuesday. This has been designed to allow participants to progress through this essential and time consuming initial training quickly but also only requires them to miss four days of the working week total.

Timetable 1

- Incorporating the Reef Check identification and survey methodology. Lectures held one day per week (provisionally Friday).

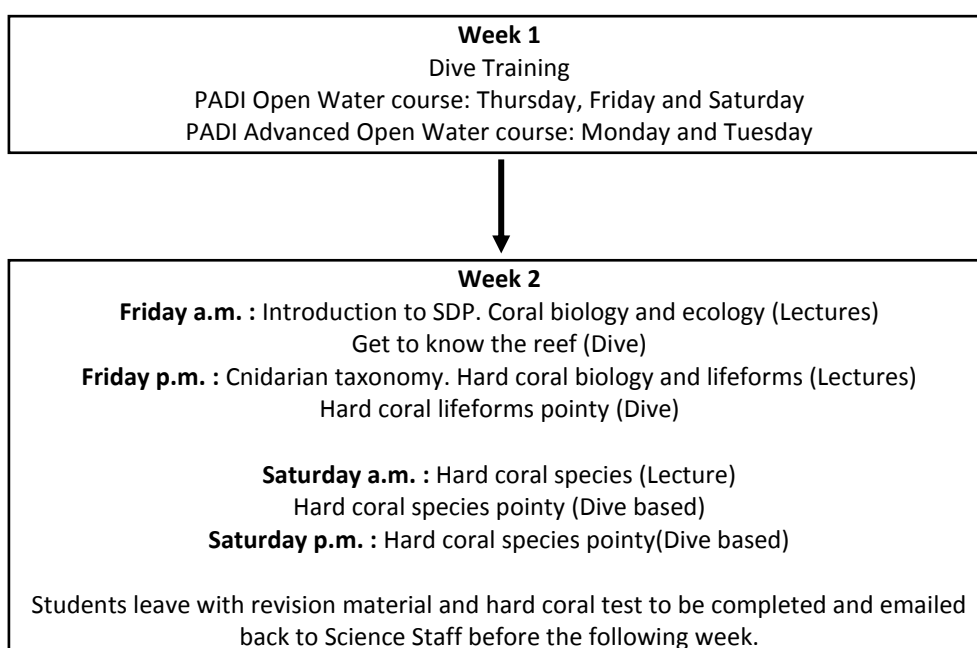


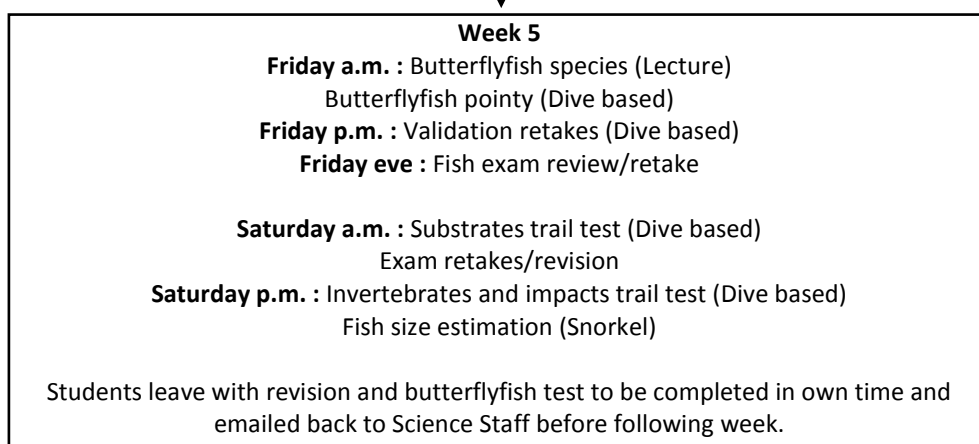
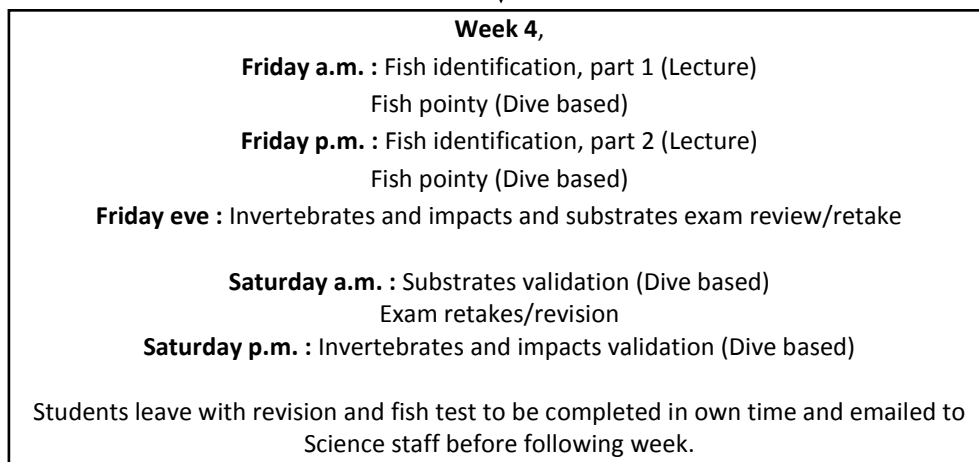
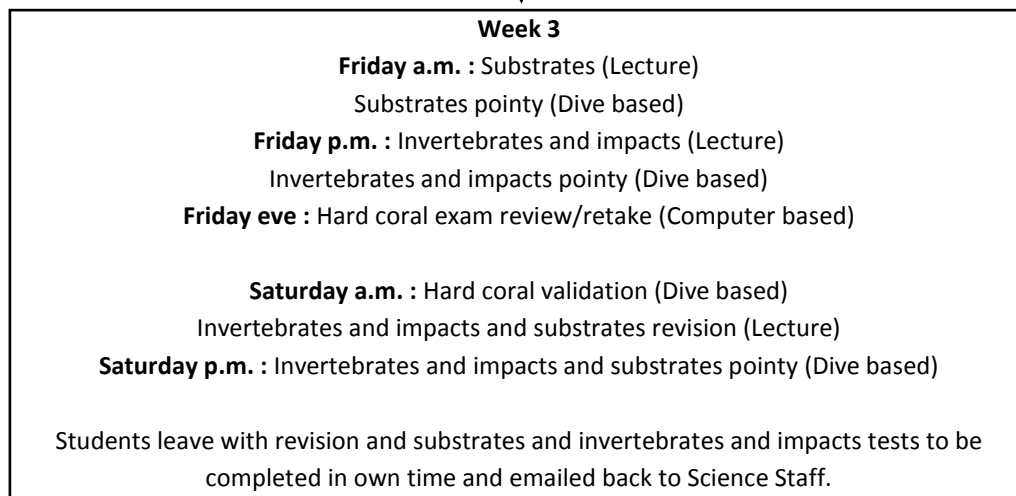


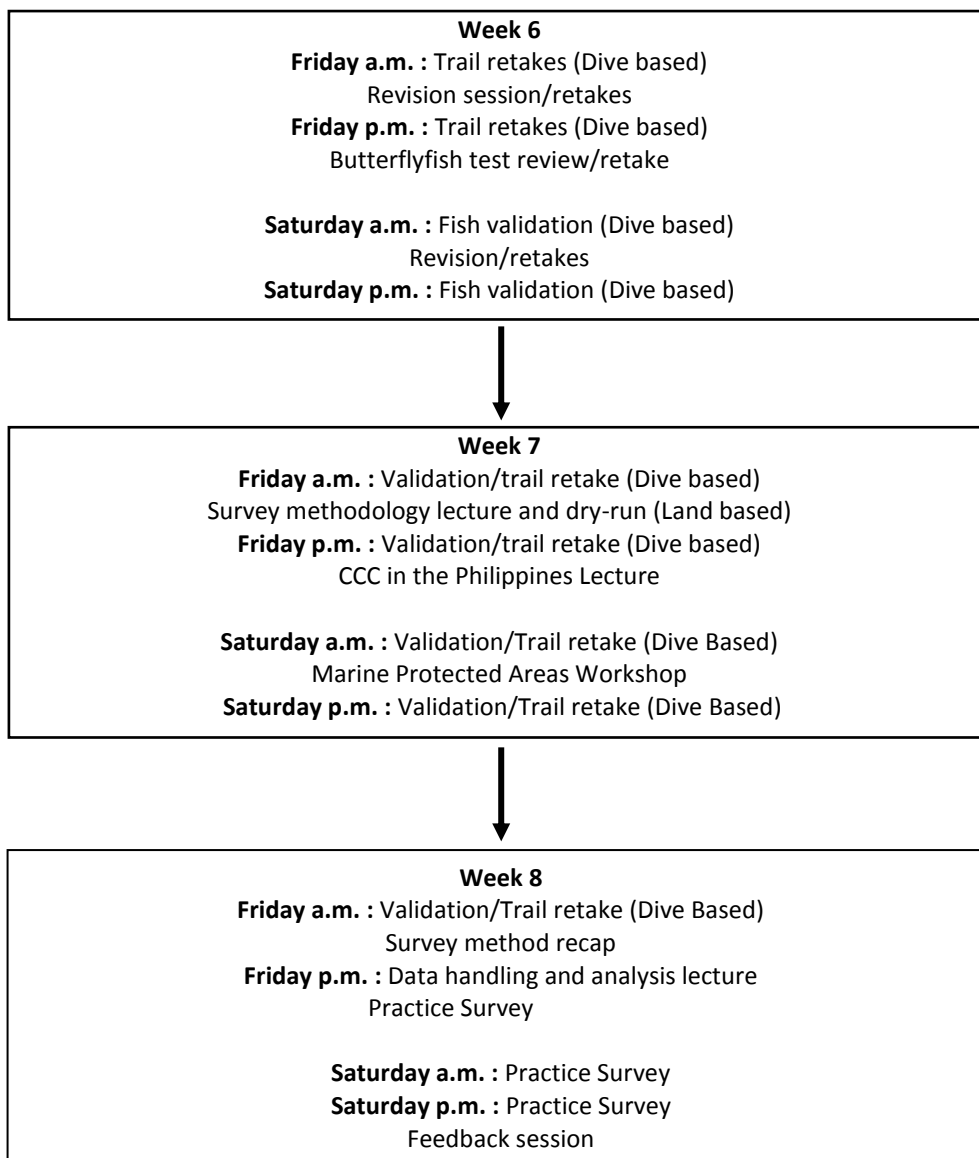
By the end of this 8 week course participants will be fully certified to PADI Advanced Open Water and also as Reef Check EcoDiver surveyors.

Timetable 2

- Incorporating Coral Cay Conservation's full Skills Development Programme (SDP) and Survey Methodology. Lectures held two days per week (provisionally Friday and Saturday).



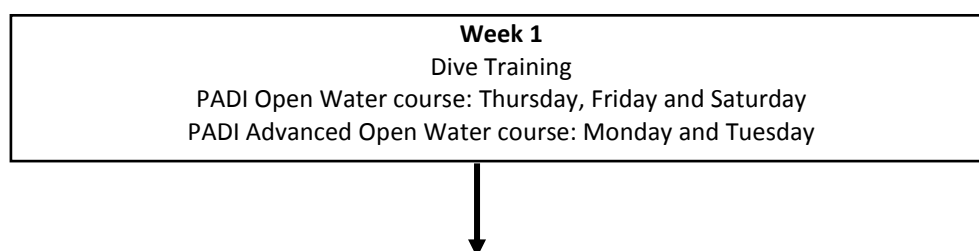


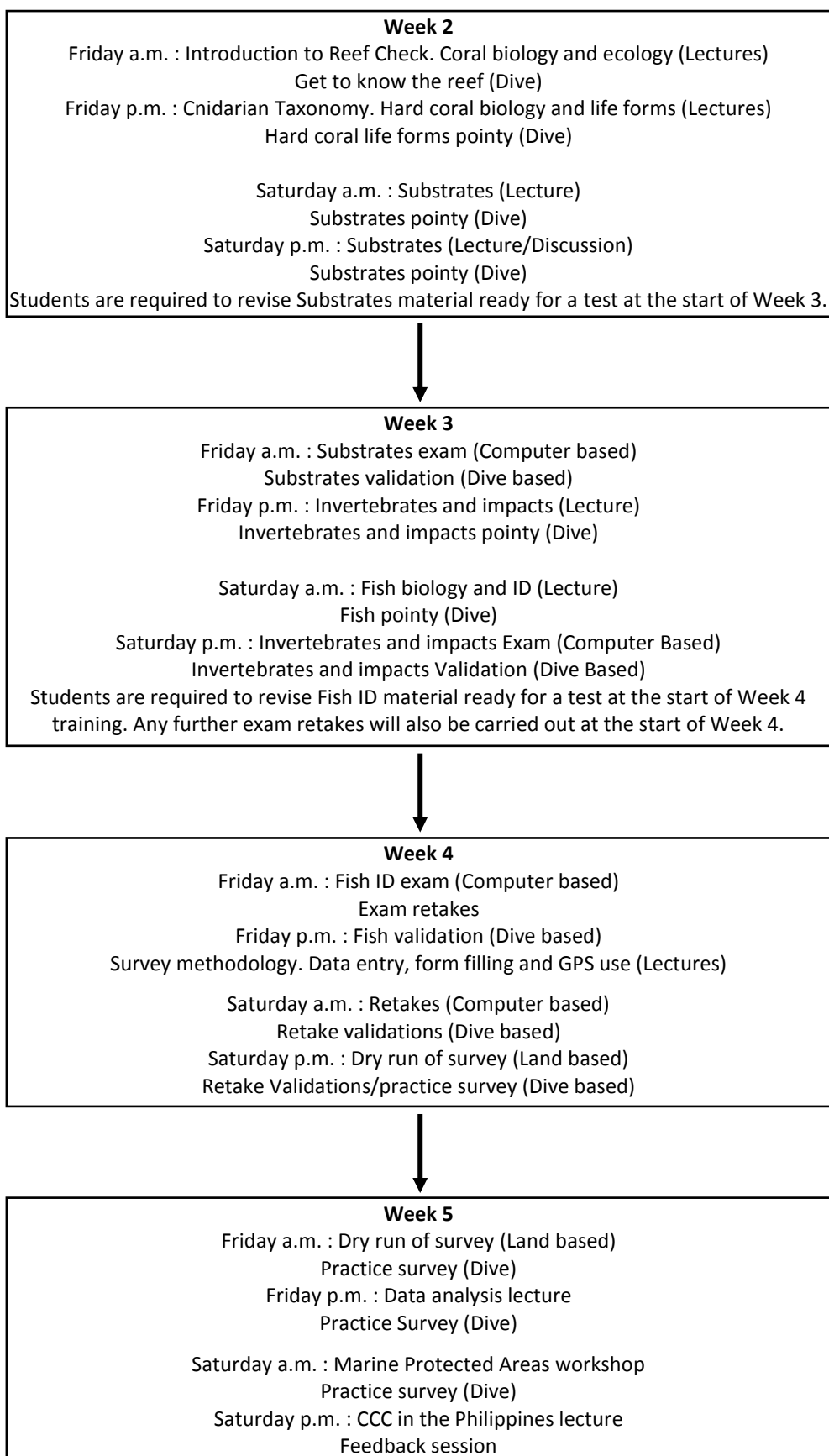


At the conclusion of this course participants will be trained to PADI Advanced Open Water level as well as to CCC's survey level allowing them to survey to either the Reef Check Protocol or the more in depth CCC survey protocol.

Timetable 3

- Incorporating the Reef Check identification and survey methodology. Lectures held two days per week.





At the conclusion of this course participants would be fully certified PADI Advanced Open Water Divers as well as Reef Check EcoDivers able to survey using the Reef Check Protocol.

Summary

The timetables detailed above are just outlines and should be viewed as a guide to what it is possible to achieve. The logistical practicalities for both participants and CCC will need to be discussed in greater depth and likely on a case by case basis. Furthermore, the timetables may need to be reviewed and adapted depending on the progress of participants through the respective courses. Timetable 2 relies on the participants being able to conduct self-study outside of their time at the CCC base. In addition they are required to complete tests and email the answers back to Science Staff at CCC. If this is not possible there are alternative options with the tests being conducted on site. However due to the high work load of this timetable it would be easier and more efficient if participants could complete the tests in their own time.

For the two day timetables outlined it may be possible to accommodate participants on the CCC site overnight. Alternatively, accommodation nearby may also be available. The logistics of this will depend on volunteer numbers on site and also the personal preferences of participants.

Appendix D - Bantay Dagat Training Programme

CCC will provide training to MPA wardens (Bantay Dagats) to enable them to carry out their roles effectively. This training provides the skills to guard the MPA and carry out day-to-day management tasks, but will not equip participants to monitor the ecological status of the reef.

Timeframe and Outline

The programme will consist of 3 parts:

- MPA Training (1 day)
- Science Training (1 day)
- Dive Training
 - PADI Open Water (4 days)
 - PADI Advanced Open Water (3 days)

The programme will be given at the CCC base at the Napantao Dive Resort. CCC staff member Jesse Lou Tinapay will be the main instructor.

The programme will be set up to tailor to the availability of the Bantay Dagats. Dive theory and lectures can be given in the evenings or as half days. Dive training, however, will require the participants to be on site in Napantao for full days.

1. MPA Training

These lectures will provide an overview of the concept of an MPA, including costs and benefits.

Topics covered will include:

- What an MPA does
 - concepts of spillover and larval recruitment
 - fishing grounds sustained for future generations
 - income through tourism
- Challenges in MPA management
 - poaching
 - MPA demarcation
 - continued presence in MPA guardhouse
 - collecting diver fees
- Use of case studies to illustrate successes and failures
- The rules of your MPA

2. Science Training

These lectures will provide a basic understanding of the coral reef ecosystem and instill a sense of pride and ownership for the Bantay Dagat's own reef.

Topics covered will include:

- What is a coral?
- Reef geography (zonation on a coral reef)

- Coral reefs worldwide and the importance of the Philippines coral reefs to global biodiversity
- Interaction between corals, fish and invertebrates
- Crown of thorns, levels of occurrence: from “healthy” to “outbreak”
- Crown of thorns extraction training

3. Dive Training

In order for the Bantay Dagats to effectively maintain their MPA, they will be trained to PADI Advanced Open Water level. This will allow them to safely dive to 30 meters, which may be necessary to place MPA marker buoys.

To consider

- Dive insurance is necessary when doing dive training. Can the relevant Municipality provide this insurance?
- CCC requires a dive medical check to be conducted before dive training can commence. Can the relevant Municipality subsidise these medical checks?
- Although CCC can provide dive gear, items such as fins, mask and snorkel would ideally be provided by the Bantay Dagats themselves. Can the relevant Municipality provide this equipment?
- When full days are spent training in Napantao Dive Resort, CCC will provide food and accommodation (when available)
- CCC will provide PADI course manuals
- The participants are expected to attend all the science lectures

